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THE

ELECTRICAL REVIEW.

Vol. LXXXIV.

JANUARY 3 — JUNE 27, 1919.

LONDON:

THE ELECTRICAL REVIEW, LTD.,

4, LUDGATE HILL, E.C. 4.

London:
Published by the Proprietors,
a 4, Ludgate Hill, E.C. 4.

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Printed by Wm. Cate, Ltd., 147-150, Gt. Saffron Hill, E.C. and Published by the Proprietors. The Electrical Review Ltd. 4 Ludgate Hill, E.C. 4.

THE
ELECTRICAL REVIEW.

Vol. LXXXIV. JANUARY 3, 1919. No. 2,145.

ELECTRICAL REVIEW.

Vol. LXXXIV.] CONTENTS: January 3, 1919. [No. 2,145.

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THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY

OFFICE 1–4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "Ageekay, Cent., London." Code, A B C
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to The Electrical Review, and crossed "London City and Midland Bank Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

1919—THE NEW ORDER.

We stand on the threshold of a new era. The war is over, for practical purposes: peace will be restored in a few months, and we look forward to a period of intense activity in the electrical industries. Are we ready for it ?

Great changes are in progress in the organisation of some of our principal manufacturing concerns; huge combinations are being formed, with immense capital at their command, which will enable them to deal with the great undertakings which are confidently expected to be launched in the near future: there will be abundance of work to be done both at home and abroad—but other nations will be seeking orders, too, and we must be prepared to meet their competition in the open markets of the world with the three weapons: high quality, low price, and quick delivery. Now, British manufacture is the hall mark of good quality, and we trust that our excellent records of the past in this respect will be maintained and excelled in the future; but low price and quick delivery depend not upon design, workmanship, and material so much as upon efficient organisation—first of the individual workshop, and, secondly, of the whole industry.

The war has taught us many lessons, the gist of which has been impressed upon our memories by arduous effort and prolonged—sometimes painful—experience. One of the most significant of these is the fact that we, as a nation, can do anything that any other nation can do—and do it better—when we realise the necessity of its accomplishment. We have also learnt—what we well knew before, though we did not appreciate it at its true value and importance—that rapid and economical production depends upon quantity production; what we could do when we applied this precept to practice was demonstrated by our astonishing output of munitions of war, a performance which amazed the world. That output was produced, in the first instance, regardless of expense, for the cost was a minor matter, when rapidity of production was a matter of life and death to the nation; but later, when the emergency had passed, our output was also cheapened, in spite of war wages and scarcity of material. But above all, the fact stands out that our factories throughout the land were organised to work co-operatively. Thus we won the war—and we won it largely by efficiency of organisation and collective operation.

Precisely the same principles will govern the result of the industrial conflict which is now about to open. Production in quantity, efficient organisation, and "team work" on the largest scale are the essentials to success in the world-competition that lies before us. *Are we ready?*

The great combines to which we have alluded will be mainly concerned with the manufacture of heavy and costly apparatus, and with the execution of large contracts which can only be successfully handled by concerns equipped with almost limitless resources and personnel; of the necessity for such qualifications, in order to compete with the huge organisations of the United States and Germany, the past history of our electrical industry affords abundant evidence. But it is neither necessary nor desirable that smaller firms should endeavour to emulate the example of their big brothers, and to make "everything electrical": nor is it necessary that the big concerns should trouble themselves with the production of apparatus that are manufactured on a repetition basis, and can therefore be turned out in quantity by the smaller ones with equal economy and efficiency. Let us not forget the lessons of the war.

For 20 years, like a voice crying in the wilderness, we have urged our manufacturers to co-operate—to collaborate

—to lay aside petty jealousies and help one another—in a word, to *organise* the industry, which means in a large measure to specialise: four years of war have but confirmed the wisdom of our preaching—but do we see any symptoms of real conversion amongst our manufacturing friends? We gravely fear that Peace is bringing with it but a renewal of the old individualism which, whatever its merits in the past, *will not serve in the future*. It is not yet too late to mend our ways; now, indeed, is the very time, whilst we are changing over to peace production, when our industries could be most easily organised for victory in the trade war. We are not speaking merely to the great combines, but to the smaller firms also—to those who, having built up thriving businesses in certain lines, cling to them with the just pride and affection of the creator. It is, perhaps, at once the pride and the misfortune of the electrical industry that it is as yet so young that the originators of designs which have attained high reputation still retain personal control over their creations, and carry on their businesses rather as a hobby than as a source of revenue. But the interests of the nation should prevail over the inclinations of the individual, and it is the patriotic duty of every man to ask himself whether by sinking his individuality to some extent he can promote the national welfare. We repeat, in conclusion, that organisation and specialisation on the part of electrical manufacturers is the key to success in the trade war—and we see no evidence as yet that that key is going to be used.

Sheffield's War Activities.

In presenting to our readers to-day an account of the electrical developments in Sheffield during the war, we may with advantage draw attention to the splendid record of the city as one of the principal factors in winning the war. Of the world-wide reputation of Sheffield as one of our most important steel-producing centres, we need not speak; the city was also noted for its manufactured products based on steel as the raw material, and for its electro-plated goods. During the war the industries of the city underwent a complete transformation, and it became a huge manufactory of munitions, employing over 120,000 workers on this class of production, of whom some 30,000 were new to the life of the workshop. The output of the city was doubled, and the railway traffic during the year ending June last was 35,000,000 tons. Innumerable new works were built and existing works extended on a large scale, new steel furnaces were started, and electric steel furnaces to the number of about 60 were constructed. The great steel firms were reorganised and brought together, and combinations were formed to secure control of all the raw materials necessary to the increase of output and to the cheapening of production. Since the armistice unemployment has not overtaken the industrial population; on the contrary, the city is up to the neck in work, with orders in hand for many months to come. Sheffield, in fact, not only played a leading part in the war, but is going to do so also in peace time, and may be depended upon to hold her own with all comers.

The phenomenal progress of the electricity supply department, under the management of Mr. S. E. Fedden, has already been commented on in these columns; between 1914 and 1918 the revenue increased five times and the output seven times, the capital expenditure was doubled and the net profit increased ten times. When the present and prospective extensions have been completed, the plant capacity will have been increased from 23,000 KW. in 1914 to 146,000 KW., making it one of the four largest undertakings in the Kingdom.

In the face of these striking advances in the industrial fortunes of Sheffield, it is interesting to reflect that the city contains hundreds of small manufacturing firms, each in pre-war times confining its attention to a very restricted range of products, and that an intensely conservative spirit reigned in the community. The fact that changes so vital and fundamental have been effected in so short a time is striking evidence of the inherent adaptability and capacity of the British character, and augurs well for the future of the country in the difficult times that lie ahead.

Sheffield first became a steel centre because of its many small water powers, which provided the necessary power to forge swords and bayonets; gradually extending its scope, the city began to make steel for itself, and then to manufacture from its steel many other products besides military weapons. It is curious to observe how by a return to its primitive occupation the spirit of the city has been revivified and its energies have been aroused. Well has Sheffield "done its bit!" May its prosperity never wane.

Our Consuls and Trade Development.

Discussion has been renewed in the Press on the question of the qualifications of British Consuls. The Government Department concerned with these appointments did not feel able to fill the offices while so many excellent men were away with the Forces. Now that specially required men are being released, we presume there need be no further delay; certainly few things in connection with trade are of greater importance now that the war is ended. We observe that special plans are on foot for ensuring that men selected for such posts shall have suitable experience in touch with our industries, and the business world will be eager to know the details, so that they may judge the likelihood of their being able to rely upon, and co-operate with, the new officials in making their efforts for British trade expansion throughout the world. In the course of speeches that have been delivered lately by critics of the past Consular Service, one speaker mentions Consuls whom he has known who had no knowledge of the weights and measures of the country to which they were sent; another instances Consular appointments in Russia given to men who knew nothing of the Russian language. No doubt the Government, which is pledged to establish the Consular Service upon a new basis which will ensure its efficiency, will see that these, and the many other defects of the past, are not continued. From what we can gather, there is no probability of any undue haste being shown in connection with this important matter. To secure that a sufficient number of adequately trained men of the right type are available at their appointed posts will necessarily take some time, but we hope that those responsible will not let the grass grow under their feet. We ought soon to be having a series of official reports from the different markets if the business world is to be adequately assisted in strengthening our export trade connections, but manufacturers will be unwise if they fail to make very energetic efforts on their own behalf. They will not need much official assistance in reviving connections which, unfortunately, have in too many cases been allowed to lapse under war conditions. No doubt they are using the foreign postal service pretty freely just now, and are arranging tours for their travelling representatives, as well as preparing printed literature regarding their manufactures for the use of their agents on the spot and for sending direct to likely purchasers. Happily trade organs which have maintained their efficiency against great odds during the past four years have been available for Colonial and foreign trade publicity right along, and during the coming months, before Consuls or foreign representatives can be at their posts, or new catalogues and publicity literature can be ready, these organs will fill more actively than ever before the *rôle* of business-getter. They are sometimes criticised by those who have an axe of their own to grind or who are incapable of understanding other people's war-time difficulties and who imagine that the paper situation has been equally serious in all countries. But we believe that speaking generally the British manufacturer and trader will make the fullest possible use of all tried available facilities in these days when thousands of potential purchasers abroad want to know what we are going to do out of our increased productive capacity to help to satisfy their crying needs.

We observe that the British Trade Commissioner who has completed a tour of Eastern Ontario finds strong sentiments in favour of British goods, but he points to a lack of British publicity effort such as is necessary if we are to face the aggressive selling methods which may be expected to characterise the foreign competition that is coming.

ELECTRICITY SUPPLY IN SHEFFIELD.

We have on previous occasions recorded the progress of the electricity supply department of the Corporation of Sheffield,* and have pointed out the vast scope for the development of this branch of the Corporation's activities that was afforded by the great industries of the rapidly-growing city; but no one, we should think, could ever have foreseen the extraordinary increase in the importance of the department which has taken place during the war. In 1912, when we last described the works of the undertaking, the output was under 17 million units per annum; in the year ending March 25th, 1918, it was no less than 172½ millions—an increase of over 900 per cent. Up to the outbreak of war, the progress of the undertaking was normal and steady, the output for the year ending March, 1914, being 26½ million units; during the war, therefore, the output has increased by nearly seven times, while the annual income has reached the amount of £639,667, the balance of profit alone being larger than the total revenue in 1914. Naturally, this rapid expansion has not been accomplished without imposing a vast amount of work upon the staff, and it is interesting to observe that the whole of the extensions of plant and mains have been carried out "according to plan" by the department, on the lines laid down by the general manager and engineer, Mr. S. E. Fedden, M.Inst.C.E., as long ago as 1904. This could not have been accomplished without effective organisation; but, fortunately, Mr. Fedden had so organised the undertaking, and so trained his staff, that when war broke out, and the demand began to advance by leaps and bounds, all that was necessary was to carry out the plan of campaign already outlined, each head of a department being in a position to perform his own section of the work under the general supervision of the chief. In a word, the organisation of the whole undertaking was such that it was capable of expansion even to ten times its pre-war capacity without a hitch—provided that the necessary plant could be obtained at short notice.

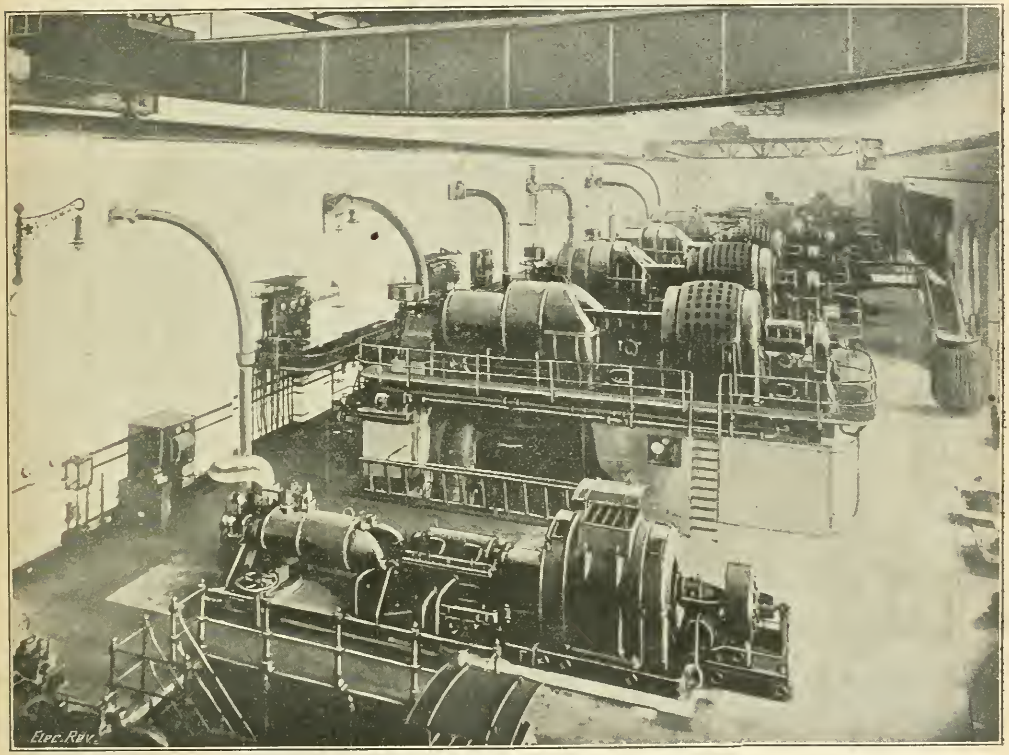

Fig. 1.—Neepsend Power Station: Interior of Turbine Room.

At the outbreak of war in August, 1914, the department was preparing to meet the normal increased output, and a new 8,500-kw. turbo-alternator was in course of erection at Neepsend, while the contracts for building extensions and the installation of the necessary boilers and auxiliary works were in progress. The first effect of the declaration of war was a heavy drop in the demand for electric power; the output fell off by one-third of the normal demand during the first week and one-fourth during the second, but in the third week the normal output was regained, and from that time onwards rapid and continuous progress was made. Applications for supply began to pour in at an unprecedented rate, and it soon became evident that additional plant would be required to cope with the growing demand. The installation of the plant above mentioned was pushed on as quickly as possible; but owing to the dislocation caused by the mobilisation of the Army, and the resulting difficulties in obtaining materials, it was not until March, 1915, that the new set was able to run on load. In the meantime, in November, 1914, preparations were made to install a second 8,500-kw. set, with the corresponding boiler plant, to meet the 1916 demand, and orders were placed for the necessary plant.

To add to the difficulties of the situation, two of the largest generating sets at Neepsend broke down just before Christmas, 1914, when the heaviest load of the year fell due. Continuity of supply was interrupted only for a few

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* Electrical Review, July 15th, 1904, and August 30th and September 6th, 1912.

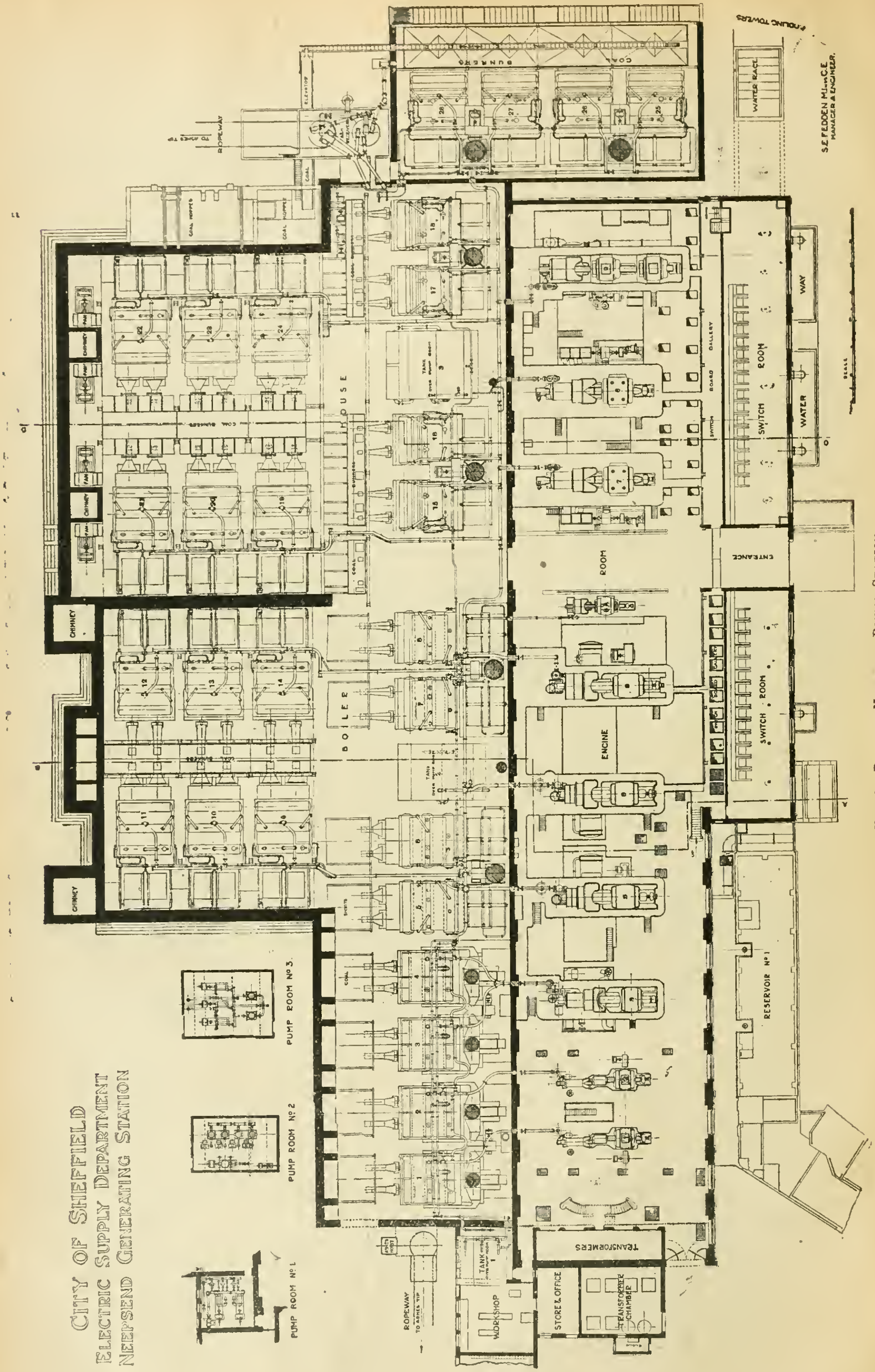


FIG. 2.—PLAN OF NEEPSEND POWER STATION.

minutes, and by bringing into use the whole of the available plant in all three generating stations, the general supply of the city was fully maintained: much of the plant had been lying idle for years, but it had been maintained in excellent condition, so that it could be brought into use at a moment's notice. The rush of applications for electricity supply continued, and in June, 1915, it became necessary either to decline further applications, or to install additional generating plant immediately. A 2,000-kw. turbo-alternator, intended for a Russian colliery, which was practically ready at the maker's works, was commandeered by the Ministry of Munitions, and afforded temporary relief, but this was obviously inadequate to cope with the increased demand, and steps were taken to ascertain what further plant was obtainable: it was found that a 9,000-kw. set was in course of construction for a South American railway, and this also was commandeered by the Ministry, which also provided the capital required to pay for this set and the additional boilers and other apparatus necessary to its operation. At the same time the buildings were being extended to practically double the size of the existing station, as rapidly as possible, the work being carried on without cessation. Large arc lamps were used to illuminate the site at night, in spite of the lighting restrictions then in force, and in frosty weather coke fires were lighted every few yards near all concrete and brickwork, to prevent delay in the work. The large extensions in progress necessitated the handling of heavy structural steelwork at great heights, and the interworking of cranes, light railways, and moving machinery in an area congested by the working gangs of some 20 contracting firms, but no serious accidents occurred to life or property, except one on the railway siding, when a train of about 40 trucks of coal broke a coupling and ran the full length of the siding, crashing into the steel framework of the new boiler house; this accident entailed a delay of six weeks in repairing the damage done to the steel work.

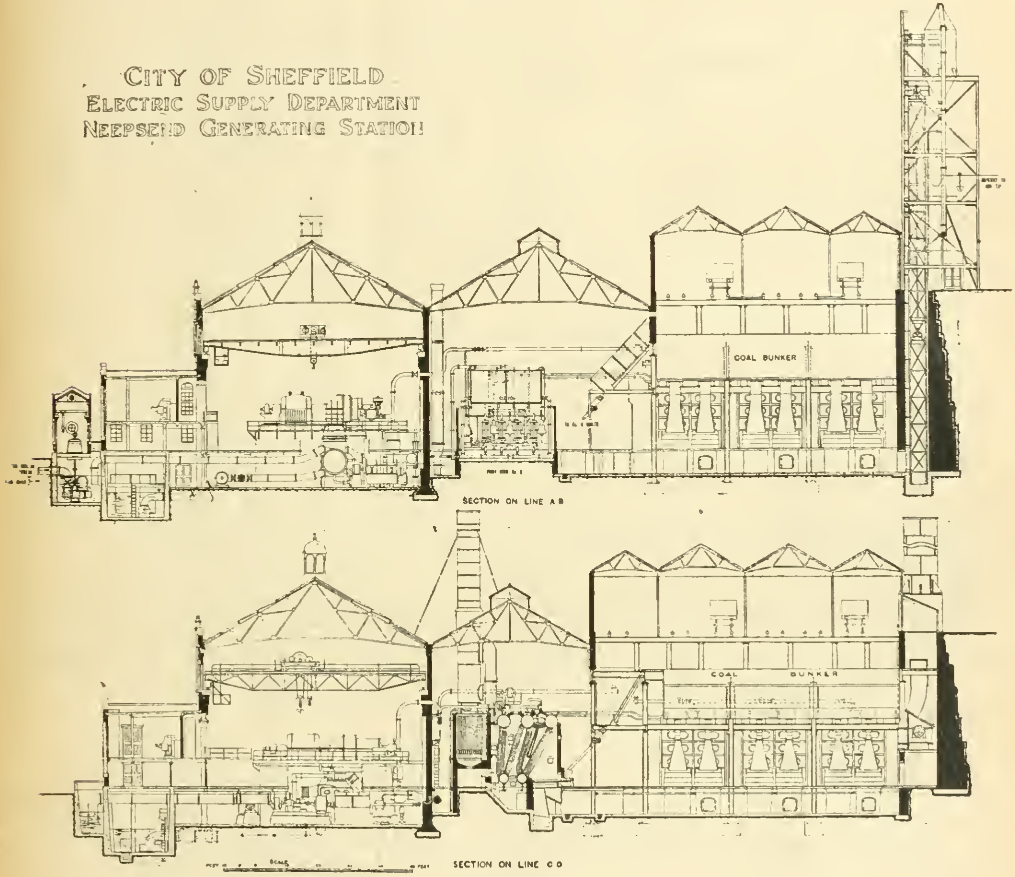


Fig. 3.—Sectional Elevations of Neepsend Power Station.

The load on the station continued to increase, and new applications to pour in, and it was seen that even with the new plant then on order the capacity of the stations would be unequal to the demand, so at the beginning of January, 1916, orders were placed for another 8,500-kw. turbo-alternator and the corresponding boilers, at an estimated cost of £137,000, which was raised by the Ministry of Munitions for the purpose. At this time the existing plant was working continuously on overload to cope with the demand: no time was available for overhauling and inspecting the plant, and it was not surprising that in March two generating sets broke down, necessitating the restriction of supply to certain large consumers to night work whilst repairs were in progress. The strain on the staff during these trying times may be imagined; but everyone loyally worked "all out" to overcome all difficulties and to maintain continuity of supply in face of the ever-mounting demand of the City's munition factories. The rate of progress is well illustrated by the following table:—

12 months ended March 25th—	1914.	1915.	1916.	1917.	1918.
Capacity of plant ..	23,225	31,725	42,225	59,725	68,225
Units sold	26,546,718	44,873,342	77,868,027	126,476 858	172,451,007
Coal consumed, tons	44,187	70,541	131,123	194,101	244,342
Cost of coal ..	£17,820	£35,005	£85,437	£146,356	£228,777

The relative positions of the four generating stations belonging to the Sheffield Corporation are indicated on the accompanying sketch-plan (fig. 4); it will be seen that the original station at Sheaf Street, and the tramway power station at Kelham Island, are situated at the centre of the city, but when the necessity of erecting a large installation became evident, it was decided to make use of the natural advantages of the site at Neepsend, on the north-west of the city, and about two miles from the central area. It was then anticipated that the future industrial load, which was confidently expected, would develop in that direction: as it turned out, the demand for power and heating arose chiefly in the north-east, and it is in that quarter that the new station is being erected at Blackburn Meadows. The distance of transmission from Neepsend, however, is not great—about 3½ miles to the industrial area—and the excellent facilities afforded by the site for the supply of water and coal, and the disposal of ashes, amply compensate for this slight drawback. The station is built close to the river Don, on the flank of a hill, which enables the trains of coal trucks to be run in above the boilers, thus dispensing with costly machinery and labour for handling the coal. Ample space is available in the adjoining valleys for dumping ashes, and a large yard is provided for storing coal. The station is built on rock foundations; the clay excavated from the site, being of excellent quality, was made into bricks on the spot, and utilised for building the station.

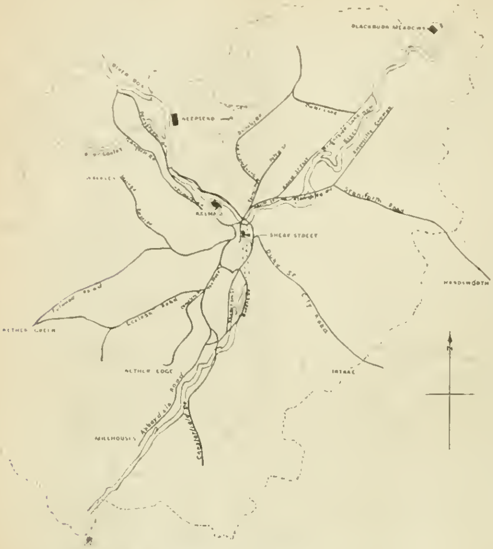


Fig 4.—Plan of Sheffield, showing positions of Generating Stations.

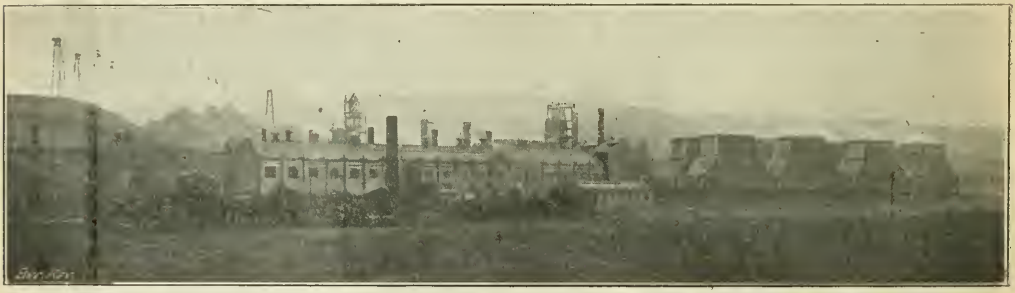


Fig. 5.—Exterior of Neepsend Power Station.

The lay-out of the buildings is shown on the accompanying plan (fig. 2): it will be noticed that in the first instance the boilers were arranged alongside of the turbine room, and this arrangement was satisfactory so long as the generating sets were of comparatively small output, but the installation of larger sets in the newer part of the station necessitated the provision of additional boiler houses teed off from the main range, and in the completed station the steam-raising plant covers a far larger area than the turbine room. The latter consists of one long room divided near the centre by a passage extending also through the boiler house, and the whole of the plant and switchgear is so laid out that the building and its contents can readily be divided into two independent stations, in order to afford protection against breakdown which might otherwise affect the whole of the plant. At present, however, the station is run *en bloc*.

The power-station building, in its completed form, covers an area of about 2½ acres; the turbine room is 384 ft. in length and 76 ft. wide; and the boiler houses, as shown in the plan of the station, are arranged along one side and one end of the engine room. The great length of the building is, perhaps, best illustrated by our view of the exterior (fig. 5), which also shows the eight cooling towers at the south end of the site, and the ash heaps beyond the station towards the north and east. Adjoining the main buildings are the pump room for the cooling towers, stores, mess rooms, &c. At the south end of the site, behind the cooling towers, the hill-side has been levelled and made into a yard for storing coal in the open; this is served by a self-propelling steam crane, which stacks the coal with the aid of a two-ton grab, and also delivers it to the hoppers when required (a second crane is about to be provided). Our illustration (fig. 6) shows part of the coal yard and the crane, together with the end of the station buildings and of the covered sidings and coal bunkers. The sidings are fed by a branch from the Great Central Railway, and provide ample accommodation for storing full and empty trucks, which are handled by means of nine reversible capstans, each driven by an 18-h.p. motor; the coal is weighed in

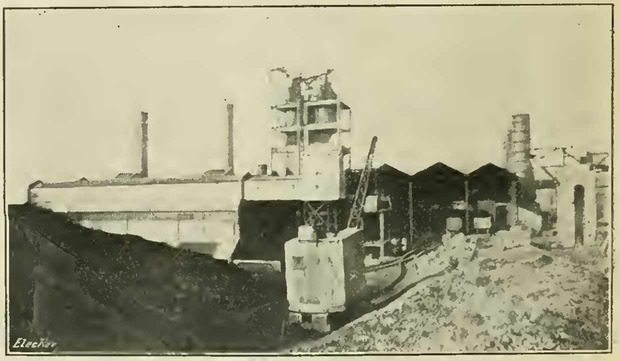


Fig. 6.—South End of Power Station and Coal Yard.

the trucks on a weigh-bridge before entering the coal store, and is measured into the hoppers of the mechanical stokers. Normally four or five train-loads arrive at the station daily, and are dumped either into the bunkers through iron gratings, which prevent large pieces of coal from passing to the shoots, or into the hoppers which feed most of the boilers directly. In order to handle the trucks across the five tracks, two traversers, each driven by a 9-H.P. motor, are provided; each traverser is equipped with a capstan driven by the same motor and capable of hauling in either direction, and traverses the coal shed from one side to the other. The trucks are hauled up ramps on to the traverser, and the control is so arranged that it is impossible to carry out any operation in the wrong way. No accident has ever happened in connection with these traversers, although they are used by unskilled labour, male or female, and they have given great satisfaction. They were made by Messrs. Ransomes & Rapier, of Ipswich, and one of them is illustrated in fig. 9.

The hoppers are arranged as shown in the plan and sectional elevations, from which it will be seen that the coal is delivered from the railway trucks to the stokers without any handling; from the hoppers it passes into measuring chambers and through breeches pipes to the stoker hoppers, and the operation of the coal valves automatically records the quantity of coal fed to the grates, by volume; the record is found to agree closely with the measured weight. The bunkers of the first eight boilers had inclined floors, so that they could be completely emptied by gravity; in the later extensions the bunkers were made rectangular in vertical section, to increase their capacity, the coal being trimmed into the shoots when the stock is low. The coal stored in the main bunkers is similarly trimmed by hand when it is necessary to draw upon the reserve. The last extension of the boiler house is situated at a higher level, across the end of the turbine house, and to supply it with coal an elevator has been installed, together with a tray conveyor running the length of this boiler house; the housing of this conveyor, which was supplied by Messrs. Babcock & Wilcox, is seen in fig. 6.

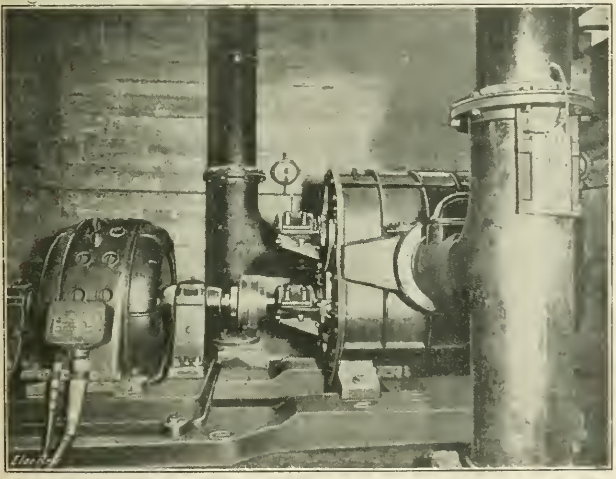


Fig. 7.—Roots Blower for Ash-handling Plant.

To remove the ashes from the basement of the boiler houses, a hand-operated tramway is provided, and the loaded trucks are pushed on to a lift which elevates them to a hopper, into which the ashes are tipped; after the truck has been put on the lift and locked in position, the whole of the operation is automatic, until the empty truck is returned. A pneumatic ash suction plant has also been installed, which carries off the ashes and discharges them into receivers above the ash hoppers; the air is exhausted by Roots blowers, one of which is shown in fig. 7; the blower is driven by a motor, and gives a suction of 4-in. to 5-in. water gauge. The air is drawn from the top of the receiver, while the ashes are delivered into the latter below a water spray, which damps down the dust; an air washer is provided in the suction pipe. The Roots blower is capable of handling 20 tons of ashes per hour. There are two sets of blowers and ash receivers; one set has two receivers, either of which can be brought into use, and the system is so arranged that a duplicate service is provided for all parts of the boiler house. The pneumatic system is in regular use, the tramway being held in reserve.

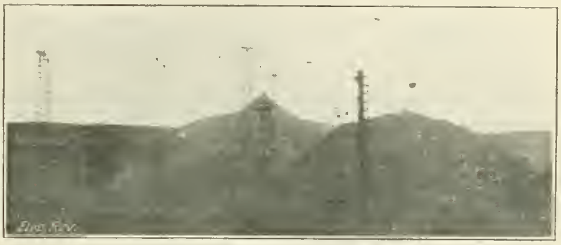


Fig. 8.—Ropeways and Ash Tips.

From the receiver the ashes fall into the same hopper as the ash trucks discharge into, and thence they are fed into skips on aerial rope-ways, made by Messrs. R. White and Sons, of Widnes, which were fully described in our issue of April 9th, 1915. There are in all three of these rope-ways, leaving the station at either end and at the middle of its length; in the later installations the operation of the rope-way is largely automatic, the loaded skips being pushed on to an inclined railway, down which they gravitate to the cable-way, automatically gripping the hauling rope, which carries them out to the dumping ground. After depositing their loads at a spot where the tripping gear is fixed, they return to the station, and are automatically freed from the hauling rope.

The system of aerial rope-ways is a striking feature of the landscape at the rear of the station buildings: still more remarkable are the veritable mountains of ash which have already been built up in the adjoining valleys, and which can be seen in figs. 5 and 8. When it is borne in mind that the coal from which the ash was derived must have occupied a bulk from 6 to 10 times that of the ash, some idea can be formed of the immense quantities of fuel that are consumed by a large power station.

Two of the rope-ways leave the east side of the building and cross the Great Central Railway over safety bridges; one of them is the most intricate of its kind in existence, at one point turning an angle of 140°. These rope-ways can each handle 20 tons per hour. The third leaves the north end of the station, and can deal with 10 tons per hour. In some places the tip is already 100 ft. deep by ¼ mile long. The tipping ground covers an area of 40 acres.

An 18-in. culvert has been provided at the bottom of the valley to drain the land, and manholes in connection therewith are being carried up to the top of the tip, 140 ft. from the soil. Test shafts are provided in the mass of the ash heaps, being built up as the deposit grows, to enable the temperature of the dump to be measured.

The tipping is regulated so that eventually the whole of the area will be uniformly filled, and the surface will be levelled by explosives, or otherwise, when that stage is reached. The light iron towers which carry the rope-ways are, of course, gradually buried under the pile.

Make-up water for the boiler feed is derived from the town mains, and is of a very soft quality, the total hardness being 1 to 2°. Make-up water for the cooling towers is obtained from the River Don, and averages about 12° of hardness. In the winter months sufficient cooling water is derived from the Don without the use of cooling towers. The large quantities of water dealt with give considerable importance to the equipment provided for this purpose. The intake from the river is close to the north end of the power-station buildings; the main channel is 14 ft. wide, and the depth of water is 9 ft. Nearer the station the channel is 20 ft. wide, and the water passes first through raking screens, which stop the larger leaves, twigs, &c., and afterwards through a revolving disk screen, made by Messrs. F. W. Brackett & Co., Ltd., of Colchester. In addition, there is a Brackett duplex revolving band screen for use at times of flood. From the cleaning apparatus the water passes into a large reservoir, 20 ft. wide and 18 ft. 6 in. deep, running the whole length of the building beneath the switch rooms, and divided into three sections, which can be shut off from one another by sluice gates. No. 1 section is nearest the river: No. 2 is provided with a by-pass from the river—a 3-ft. pipe, which derives a supply from a separate inlet, through a leaf comb, by Messrs. Whitehead & Poole, of Radcliffe, and a Brackett revolving band screen. The third section is at present without separate connection with the river. Sediment rapidly accumulates in the reservoir (which is primarily a settling tank), and therefore it is necessary to lay off the sections in turns, on Sundays, to clean them out. A weir crosses the river below the intake, and trouble was experienced through the bed of the river silting up, but this was overcome by providing a sluice gate: this is opened at flood time, and the resulting current effectually scours the basin.

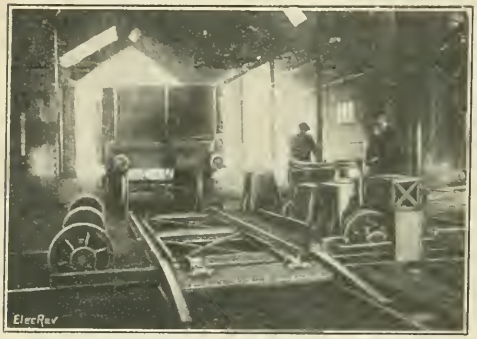


Fig. 9.—Electric Traverser.

The far end of the reservoir receives the cooled water from the towers, which forms a torrent of imposing dimensions when the station is working at full load in the summer, twice as much water passing over the towers as is consumed in the whole of Sheffield in the same time.

The hot water from the condensers is discharged into channels which run alongside of the building, the pipes being carried down beneath the water surface to secure the benefit of the siphon action. From these channels the four pumps derive their supply; they are situated in a roomy building at a level below that of the channels, so that they are self-priming, and are of the Worthington centrifugal type, each capable of lifting 660,000 gallons per hour; they are driven by two Crompton and two Fuller motors of 250 H.P. each, controlled by Reyrolle switchgear and liquid starters. The interior of the pump room is shown in fig. 10.

The cooling towers were built by Messrs. Bradshaw and Co., of Manchester, after the outbreak of war; seven of them are capable of dealing with 330,000 gallons per hour each, while the eighth is rated at 375,000 gallons. Each pump serves two of the towers. The average amount of cooling is about 18° F., and the loss of water by evaporation is not more than 2 per cent. The circulating water is periodically changed by discharging it from the cooling towers to the river through a 4-ft. pipe.

In addition to the four pumps above-mentioned, there was provided in connection with the earlier section of the power station a Worthington pump rated at 770,000 gallons per hour, which is driven by a Lancashire Dynamo Co.'s motor with vertical shaft.

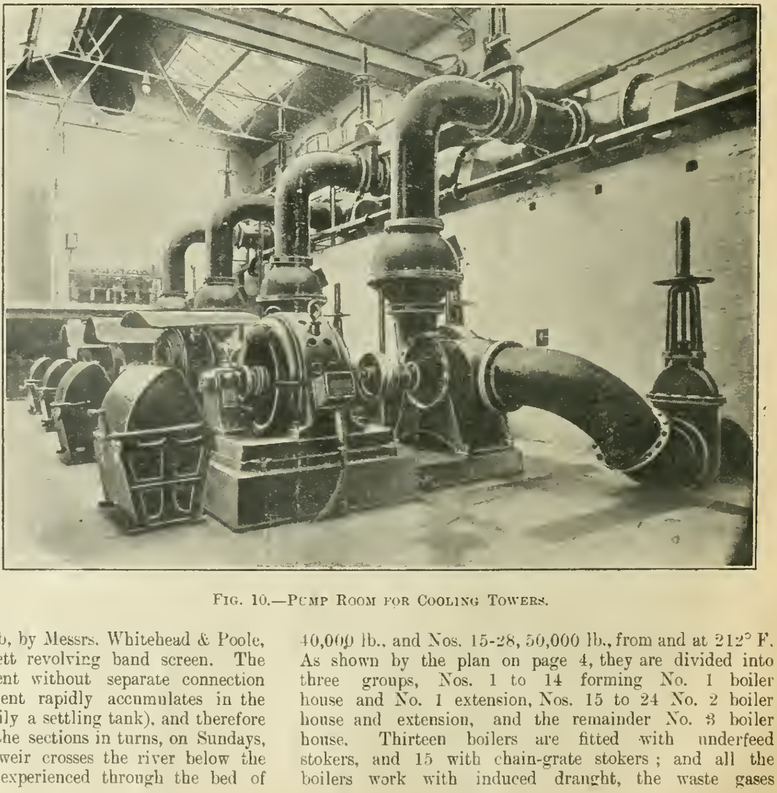


Fig. 10.—Pump Room for Cooling Towers.

The boilers are all of the Stirling five-drum type, with internal superheaters and (with the exception of the first four) Green economisers; they are of four sizes—Nos. 1—4, 32,000 lb. per hour; Nos. 5—8, 38,000 lb.; Nos. 9—14, 40,000 lb., and Nos. 15-28, 50,000 lb., from and at 212° F. As shown by the plan on page 4, they are divided into three groups, Nos. 1 to 14 forming No. 1 boiler house and No. 1 extension, Nos. 15 to 24 No. 2 boiler house and extension, and the remainder No. 3 boiler house. Thirteen boilers are fitted with underfeed stokers, and 15 with chain-grate stokers; and all the boilers work with induced draught, the waste gases being discharged into steel chimneys. Steam is generated at 200 lb. per sq. in., and superheated about 150° F., the temperature at the stop valves being about 540° F.

The fans are in duplicate, two to each chimney; either suffices for three boilers on light load, or two on overload. They are of the "Sirocco" type, made by Messrs. Davidson and Son, Ltd., of Belfast. The induced draught is maintained at about ⅝ in. water gauge at the back bank of tubes; the pressure of the forced draught on the underfed furnaces is 2 in.

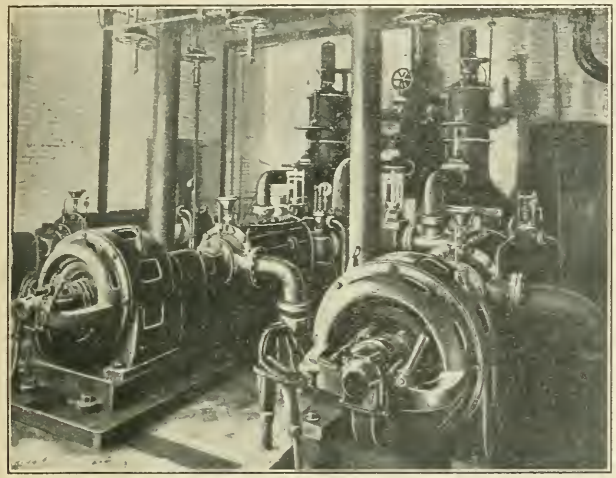


Fig. 11.—Interior of No. 3 Pump Room.

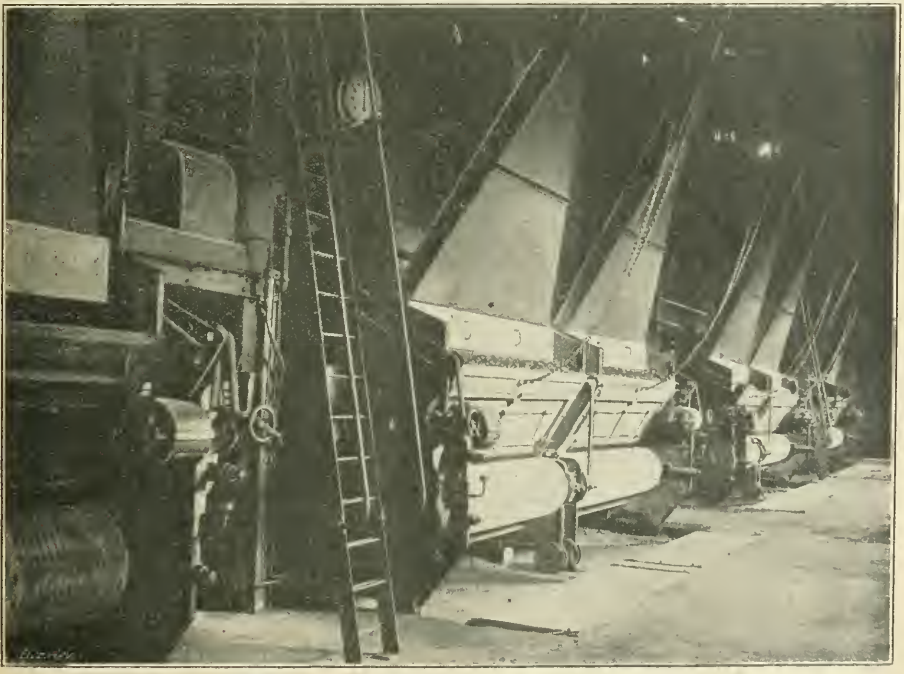


Fig. 12.—No. 3 Boiler House, Neepsend.

The whole of the boilers are connected to a main steam header 12 in. in diameter, but can be divided into two sections, if desired. The chief contractors for the pipe work were Messrs. Aiton & Co., Ltd., of Derby; portions were provided by the Stirling Boiler Co., Ltd., and Messrs. John Spencer, Ltd. The pipes are mainly of riveted steel.

Feed water is supplied by four pump rooms; No. 1 pump room, at the north end, contains one Hall steam-driven pump, capable of delivering 10,000 gallons per hour, and two motor-driven turbine pumps, made by the British Electric Plant Co., Ltd., each capable of supplying 20,000 gallons per hour. No. 2 room is near the middle of the boiler house, and contains four Hall steam pumps and one B.E.P. pump. No. 3 is in No. 2 boiler house, and contains three B.E.P. pumps; and No. 4 pump room, at the south end of the station, contains two B.E.P. pumps. We give a view of No. 3 pump room (fig. 11), which is a pattern of orderly arrangement and accessibility. Duplicate feed piping is provided, direct to the boilers and through the economisers, with a by-pass round the latter. The southern section of the station, with its boilers, pumps, &c., can be run as a separate station, entirely independent of the rest of the plant. The turbine pumps are driven by two-phase motors of 100 h.p. each.

The working of the boiler house and condensing plant at Neepsend is of exceptional interest, as every effort is exerted to secure and maintain the highest possible efficiency and economy. A strict watch is kept over every item in the boiler house. Every week the stock of coal in hand is checked, and samples of the coal are taken daily, samples of the ashes every watch; the works chemist has a well-equipped laboratory under the switch rooms, and carries out complete tests of the calorific value and composition of the coal and ashes from each boiler house; each foreman stoker is held personally responsible for keeping his results up to the standard level. The temperatures of the feed water and flue gases at both ends of the economisers and in the uptakes, the temperatures of the furnaces, and of the circulating water entering and leaving the towers, &c., are all recorded, and the flue gases are analysed daily. Samples of the boiler, feed water and the circulating water are taken and analysed daily, and the draught-gauge readings are recorded.

The economisers are fitted with National circulators, and a by-pass is provided from the hot to the cool end, to ensure that the water at the cool end shall never be below 120° F.; live-steam heating is also provided for the same purpose. All the boilers from No. 1 to No. 14 are fitted with Venturi meters; the latter could not be obtained during the war for the boilers installed later. Ten of the new boilers are fitted with feed regulators supplied by the Crosby Feed Regulator Co., which are said to have proved very reliable and efficient.

A weighing machine is provided in the boiler house for accurate fuel-consumption tests.

Practically a continuous "heat balance" is maintained, and for 12 months past the efficiency of the steam-raising plant has been kept above 70 per cent. all the time.

The condenser leakage is tested three times a day; for this operation the Dionic tester is to be adopted.

Each turbo-generator is provided with a Lea recorder and an indicating wattmeter, so that a consumption test can be taken literally at any moment. Several times, by means of this continuous test, incipient trouble in the turbines has been detected, and prevented from developing into a serious fault. The average consumption of the whole station is 15 or 16 lb. of water per KW.-hour generated.

Besides the foregoing tests, the laboratory is equipped for testing fire bricks and other refractories, the flash point and viscosity of oil, &c.

The running data, coal and steam consumption, &c., are worked out daily, and are reported to the station superintendent and the general manager the first thing in the morning, and if any departure from the normal high standard of efficiency is noted, an immediate investigation follows.

(To be continued.)

AMERICA'S ELECTRICAL TRADE.

By MALCOLM CHALMERS.

Writing in the Electrical Review of November 2nd, 1917, I showed how the war's effect on the British and German electrical industries had given a great impetus to the American industry, and that the exports of electrical goods from the United States had gone up by leaps and bounds, more than doubling themselves in three years. The figures for the year ended June 30th, 1918, however, show that this wonderful improvement has not been maintained, the exports during that year, in spite of the general increase in prices which had taken place, being only about 4 per cent. larger than in the previous year. The following figures show the development since the outbreak of war, as compared with the last pre-war year:—

Year ended June 30th, 1914	£5,312,000
" " " " 1915	4,187,000
" " " " 1916	6,399,000
" " " " 1917	10,931,000
" " " " 1918	11,393,000

The increase last year over the previous year was thus only £462,000, whilst the 1916-17 trade was £4,532,000 in advance of that for 1915-16. Taking into consideration the fact that prices have risen considerably in the year, it is almost certain that the volume of trade during last year was really less than during the previous year. The reason, of course, is not far to seek. The entry of America into the war made large demands on the electrical industry in common with other American industries, and a rigorous supervision was kept on the export trade by the Government, in order that ample supplies might not be lacking both for the American and the Allied Armies.

Turning to the detailed figures, we find that the tendency has not been uniform throughout the industry, increases in some items being counterbalanced by considerable decreases in others. Thus, whilst there were apparently largely increased exports of metal filament lamps, transformers, meters, telephone instruments, and motors, there was a considerable decline in the exports of insulated wire and cables and electric locomotives, and smaller ones in the case of telegraph apparatus and arc and carbon filament lamps, whilst batteries and dynamos, having in view changes in prices, were probably shipped to about the same extent as in 1916-17. Certain items appear in the list for the first time, the exports, if any, in earlier years being included under the general heading, "other electrical goods." Among these a fair export trade was done in carbons, heating and cooking apparatus, magnetos and sparking plugs, and switches and accessories. In the following table the details for 1917-18 are given as compared with 1916-17:—

	1916-17.	1917-18.	*Inc. or dec.*
Batteries	£627,000	£698,000	+ £71,000
Carbons	*	318,000	—
Dynamos & generators...	532,000	560,000	+ 28,000
Fans	101,000	171,000	+ 70,000
Heating and cooking apparatus	*	111,000	—
Insulated wire & cables ...	1,498,000	1,191,000	− 307,000
Interior wiring supplies (inc. fixtures)	234,000	319,000	+ 85,000
Lamps: Arc	3,300	2,700	− 600
Lamps: Incandescent, carbon filament ...	33,000	30,000	− 3,000
Lamps: Metal filament	446,000	663,000	+ 217,000
Magnetos, sparking plugs, &c.	*	660,000	—
Meters and measuring instruments	216,000	332,000	+ 116,000
Motors	1,228,000	1,375,000	+ 147,000
Rheostats and controllers	*	44,000	—
Switches and accessories	*	464,000	—
Telegraph apparatus (inc. wireless apparatus) ...	112,000	61,000	− 51,000
Telephone instruments ...	407,000	535,000	+ 128,000
Transformers	263,000	466,000	+ 203,000
Electric locomotives ...	117,000	34,000	− 83,000
Other electrical goods ...	5,112,000	3,359,000	−1,753,000†

* Included under "Other Electrical Goods" in this year.

† Allowing for the value of goods included under this heading in 1916-17, but, shown separately in 1917-18, there was an actual decline of £156,000.

It is, unfortunately, not possible to estimate the full effect of price fluctuations on these figures, as quantities are only shown in a few cases. Of these arc lamps, carbon-filament lamps and electric locomotives were exported to a considerably less extent, but in the case of fans and metal-filament lamps there were actual increases in the export figures over the figures of the previous year. The average prices, however, had risen during the year. Thus the number of fans exported last year were 54,022, at an average price of £3 3s. each compared with 38,396, at £2 11s. each in the previous year, and 32,816 at £2 15s. in the last pre-war year; 14,865,899 metal-filament lamps were exported last year, with an average value of 10½d. each, as compared with 10,703,531 in 1916-17, valued at 10d. each, and 849,261 at 1s. 1d. each prior to the war. Carbon-filament lamps were 35 per cent. dearer and arc lamps 96 per cent. dearer than in 1916-17.

As regards markets for America's electrical goods, Canada is easily first, that country taking no less than £2,112,000, or nearly 20 per cent. of America's total exports in 1916-17, and although similar particulars for 1917-18 are not available there is little doubt that this figure was well maintained. Chief among the classes of goods sent to Canada were batteries, dynamos, fans, lamps, motors, transformers, and telephones. Another good group of markets was Latin America, which in the aggregate took more than Canada—namely, £2,653,000—the principal countries contributing to this total being Argentina, Brazil, and Cuba. America has also improved her position in Australia and New Zealand, China, and Japan; whilst the United Kingdom, France, Italy, Spain, and India are other good markets for American electrical goods.

In spite of the comparative slump last year, the figures quoted above are sufficient to demonstrate the strong position that the American electrical industry has built up for itself in the world's markets since 1914. It must not be forgotten, moreover, that the home market is a very large one, and, thanks to a highly protective tariff, it is almost entirely supplied by home products. The import trade is practically confined to a few lamps which were imported to the extent of about £136,000 in the last pre-war year, whilst last year the figure was less than £18,000.

Some idea of the size of the American electrical industry may be gathered from the fact that in 1914, the date of the last census of manufacturers, there were 1,030 concerns in the United States manufacturing electrical goods, with a combined capital of over £74,000,000 and employing some 118,000 persons. The value of the output of these concerns was about £70,000,000 in 1914, being an increase of 30 per cent. over the corresponding figure for the previous census, five years earlier. Since 1914 America has practically had the world's markets to herself and, as we have seen, has more than doubled her export trade in that time. During the war, moreover, the motor-car industry has developed marvellously, the output in 1917 being nearly two million cars as compared with about half a million in 1914, and the consequent increased demand on the electrical industry for batteries, magnetos, coils, sparking plugs, starting gear, and lighting sets must have been tremendous. Altogether, it seems as if the United States will be a very serious competitor against British electrical goods in the future, not only in markets such as Canada and Central and South America, where her close proximity to the markets will give her an advantage, but also in such countries as Australia, New Zealand, and British India. The question of the possible position in our own country must also not be lost sight of, and British manufacturers will need to study the question very seriously, if they are to regain the markets lost to them on account of the restrictions on export trade rendered necessary by the war.

A TRAVELLING LIGHT.

By N. D. B. PHILLIPS, Lieut. R.E.

A convenient method for lighting a hospital operating table is illustrated in fig. 1. It consists of an ordinary counterweight fitting fixed to a block, on the upper side of which two grooved pulleys are screwed: these grooved wheels run on a taut wire of No. 10 or 12 s.w.g. This wire is fastened at one end to an eyebolt in a beam, and at the other end to an eyebolt E, the latter threaded sufficiently to allow of its being tightened up by the nut.

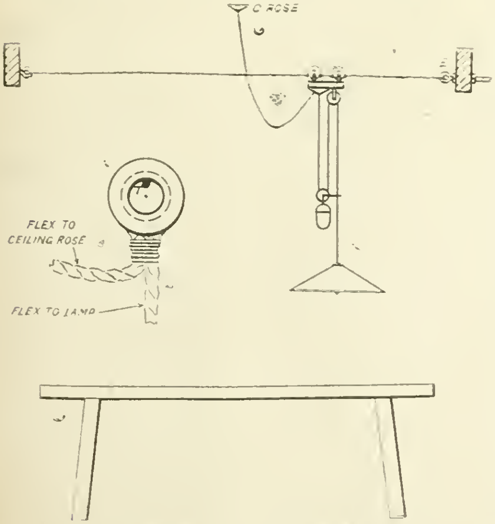


Fig. 1.—Travelling Light for Operating Table.
Fig. 2 (inset).—A Simpler Arrangement.

The flex to the counterweight fitting is suspended from a ceiling rose, leaving sufficient slack to enable the fitting to be run as far as necessary in either direction. The ceiling rose should not be placed directly over the taut wire, but to one side of it, so that the flex will not foul the fitting when in its mid position.

Fig. 2 (inset) is a simpler arrangement, convenient for lighting a drawing board, or similar purpose. It consists of a small bobbin-insulator, round which the flex from ceiling rose to lamp is bound, and sliding on a taut wire T.

These devices, although rough and ready, were found very serviceable in France, and in many instances proved economical by enabling one light to suffice where more would otherwise have been needed.

REVIEWS.

Radio Communication, Theory, and Methods. By J. Mills. Pp. 205; 120 figs. London: Hill Publishing Co., Ltd. Price 7s. 4d. net.

This book is one of peculiar interest. It is the substance of a course of lectures given by the author during the summer of 1917 to a company of the U.S. Reserve Signal Corps troops. The men concerned were, it is true, volunteers from the employés of the Western Electric Co., but the author states that they differed widely in the extent of their previous training in electrical engineering. The author claims to have adopted "a method which involved practically no mathematics except elementary algebra, and presupposed but a limited knowledge of physics." Yet in the very first chapter we find such expressions as

$$\epsilon^{j(\omega t-\frac{\pi}{2})} = -j\epsilon^{j\omega t}.$$

In two introductory pages, the author removes the inexpert reader's dread and ignorance of the vector operator *j* and the differential operator *p* in about the simplest manner we have ever seen, and as we have here the substance of lectures designed to bring men, some of whom were relatively ignorant, into fighting trim as quickly as possible, we presume that the author was equally successful in familiarising them with the other mathematical expressions introduced so swiftly to their notice. That is nothing short of a remarkable achievement. At the worst, this book is of great value to those already well grounded in mathematics, and if it is really of practical value to students not so grounded, then the treatise is of quite extraordinary utility. It is always hard for one who has mastered initial difficulties to determine whether a given treatment removes all the obstacles likely to be encountered by the beginner, but from all the circumstances associated with this volume we believe that it imparts an exceptional degree of precise knowledge with unusual rapidity and sufficient detail.

Historical matter is excluded, and so, too, is matter of purely academic and speculative interest. Similarly, no detailed descriptions and instructions are given as to the construction and operation of apparatus. Primary attention is devoted to fundamental principles and methods, but one is seized by qualms as to whether these are not too frequently presented in a fundamentally mathematical manner. Chapter I is devoted to alternating currents and, starting off with quite elementary conceptions, ends up with conjugate vectors and vector impedance. This, in 24 pages, leaves the reader rather breathless unless he has had the text amplified by a good deal of lecture work, which is doubtless the intention. Chapter II deals with the telephone receiver, its characteristics from the "wireless" point of view, and the circle diagram for motional impedance. Two and three element vacuum tubes and vacuum amplifiers are next considered, after which there is a chapter on the detection and measurement of high-frequency currents. The heterodyne receiving system is included, together with some equations (three lines long) for conjugate vectors.

The production of damped sinusoidal currents and the phenomena of resonance are dealt with in Chapter V, which is excellent, but frankly bristling with algebra. The very important Chapter VI, on undamped high-frequency currents, is in much more practical vein, and gives a very useful treatment of high-frequency alternators and the Poulsen arc. Chapter VII, on radio-telegraphy and telephony, surveys simple and complex oscillators, types of aerials, ground systems, and the general methods of wireless telegraphy and telephony. The final chapter is concerned with practical appliances and methods of radio-telegraphy and utilises its space to excellent advantage. There is an appendix on transmission over wire circuits—excellent in the masterly nature of the survey effected, but involving hyperbolic functions, and certainly demanding amplification by a tutor before it could be absorbed by the reader for whom the book is intended. A selection of graded problems concludes the volume, and these, together with the rest of the book (which is admirably produced and well up to date), form a good basis for lecture treatment.

Magnetism and Electricity for Home Study. By H. E. Penrose. Pp. 515 + xii, 225 figs. London: The Wireless Press, Ltd. (1918). Price 5s. net.

This book has been prepared primarily for the use of wireless students, and is intended to augment their knowledge of the elementary principles of magnetism and electricity. The usual methods of treatment are set aside in favour of the electron theory, upon which the author admittedly makes some severe demands, but which he regards as a satisfactory means of overcoming the genuine dislike of mathematical reasoning which he has found to exist in a large body of students. From an introduction by E. T. Fisk, of the Australian Wireless, we learn that Mr. Penrose has had a wide experience as instructor to various types of Navy, Army, and Mercantile wireless students, and that the object of the book is "that any person of any age could obtain a thorough grasp of elementary principles without previous acquaintance with the subject."

In 50 lessons the whole subject of electricity and magnetism is dealt with in a curiously discursive manner. We are led by awe-inspiring sentences up to the point at which we are bidden to "regard the universe as floating in an infinitely great ether ocean," and then, without warning, are commanded to "suspend a bar magnet from some convenient point in such a manner that it is free to turn," and merely arrive at the fact that unlike poles attract!

Some of the chapters are useful and straightforward to a degree, and the analogical treatment sometimes achieves a remarkable success. But on the whole the introduction of the ether would appear to muddle rather than clarify the treatment. The best chapters appear to us to be those in which the author follows more orthodox methods, and among these are the lessons on hysteresis, measurement of E.M.F. and current, D.C. generators, electrolysis, and accumulators.

We agree with the introductory statement that the lay-out of the book is unique, but, after a careful perusal, we are unable to find much virtue in this uniqueness. Rather, we are inclined to the opinion that Mr. Penrose would have done better had he been more orthodox, and we would observe that some of his heresies are entirely unforgivable. For example:—

"If two spheres A and B be subject to the same charging force (A having twice the superficial area of B), the charge produced on A must be twice the charge on B." (P. 303.)

"A point worth remembering in connection with the increase of resistance with temperature is that the resistivity is not affected." (P. 208.)

"The unit of force is that force which, acting for one second on a mass of one gramme produces an acceleration of one centimetre." (P. 500.)

While this definition of force may be merely *lapsus plumæ*, the two former errors are followed by further statements which, by re-stating and enlarging upon them, preclude the assumption that they are slips. Our suspicion that the author is something of an amateur physicist is confirmed when we read this remarkable outburst:—"Mass may be defined as the density of a unit volume of a given substance. In other words, it is the amount of substance contained per unit of volume. For instance, a 1-in. cube of beechwood does not contain so much matter as does an inch-cube of lead. The electromagnetic unit of mass is the gramme (1 oz. = 28.3495 grammes)."

We now begin to understand the cause of "the genuine dislike of mathematical reasoning" evinced by the author's students—and we fear that a wide use of this book would entangle many other students in a similar mathematical hopelessness.

While there are many good points in this book, its many shortcomings, errors and peculiarities make it impossible for us to recommend it as a suitable book for the use of electrical students.—P. H. S. K.

BUSINESS NOTES.

The "Electrical Review" Index.—As it is still necessary to effect every possible economy in paper consumption, the index to Vol. 83 of the Electrical Review, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding, or for other purposes, is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, London, E.C. 4.

Control of Metals, Machinery, and Plant, &c.—The following recapitulation of the modifications in the control of materials and machinery which have been made to date by the Ministry of Munitions since the cessation of hostilities, is issued for the guidance of manufacturers:—

Priority.—(*a*) Ordinary civil orders may now be placed and executed in Class C without priority permits or certificates. No further applications need, therefore, be made to the Priority Department of the Ministry of Munitions unless it is desired for national reasons to raise the priority of an order.

(*b*) Uncompleted contracts for the Admiralty, War Office, and Ministry of Munitions, which have been placed in Classes A or B, need no longer be given the priority attaching to them under the Order of Priority of March 8th, 1917, except in cases where the contractor is notified in writing or by official notice in the Press that a particular classification is still required to be given to any particular contract.

Metals.—(*a*) *Modification of Control.*—1. Iron, steel, and non-ferrous metal may be ordered, supplied, and used for Class C orders without priority classification or reference number from the Ministry of Munitions: and stocks purchased and held by Government contractors may be used for any class of work.

2. No permit is now required for the manufacture or sale of iron and steel wire or wire rope for home trade, and until further notice manufacturers of forgings, stampings, and castings in iron, steel, or malleable iron are at liberty to accept orders for priority below Class B.

3. The Control Orders forbidding dealing in non-ferrous metals without a licence, are suspended in the case of tin, copper, brass (including swarf and scrap), cupro-nickel, scrap, spelter, lead, platinum, chrome ore and type metals.

4. All restrictions as to the sale or purchase of calcium carbide have been removed, subject to a maximum price to consumers of £40 per ton for quantities of 1 cwt., and over.

(*b*) *Export Licences.* 1. Manufacturers must still continue, as hitherto, to obtain licences for export for articles made of steel and non-ferrous metals covered by the various schedules of the War Trade Department, but every effort will be made to grant these licences as freely as possible.

(*c*) *Prices.*—1. The maximum prices of steel for home trade are to continue at their present level until February 1st, 1919, when the direct subsidies paid by the Government on steel will cease, and a corresponding increase in price take place. A schedule of the prices to come into force on February 1st can be obtained on application to the Ministry of Munitions (C.I.S.P., Room 104, 8, Northumberland Avenue, S.W. 1). The present maximum prices of pig iron are to remain unchanged until April 30th, 1919, but post-war conditions are not yet sufficiently stable to warrant a fixing of prices after that date.

2. A schedule of fixed report prices for pig iron and steel, to take effect from November 18th, 1918, has been issued, and can be obtained on application to the Ministry of Munitions, as above. The prices, which are based upon the existing home prices, plus the subsidies paid by the Government, will remain in force until further notice. Upon all exports of pig iron, unmanufactured steel, and certain classes of semi-manufactured steel, a drawback will be collected by the Board of Customs and Excise, equivalent to the amount of the subsidy already paid by the Government on the articles in question. The items on which the drawback is chargeable are those whose prices are controlled and included in the schedules referred to in the preceding paragraph. Application for the schedule showing the amount of the drawback to be collected should be made to the Board of Customs and Excise, Lower Thames Street, London, E.C.

3. The following is a schedule of the present prices of non-ferrous metals from holdings of the Ministry:—

	Per ton, buyers.	Delivered, works.
Copper, electrolytic	£125	—
Brass ingot to Government specification	93	do.
Spelter, G.O.B.	57	do.
Refined, 99·9 per cent.	61	do.
Aluminium	200	do.
Soft pig-lead	40	ex steamer or ex store.
(The existing schedule in relation to manufacture in lead is abolished.)		
Nickel	£195	ex works or warehouse.
Antimony	55	do.

These prices are subject to usual extras for small parcels.

Plant and Machinery.—Restrictions as to dealing in, and prices of, new and second-hand machinery and treadle lathes have been withdrawn; but purchases of new machinery can only be made from firms holding trading permits from the Ministry of Munitions.

Contractors in possession of plant and machinery owned by the Ministry of Munitions are at liberty to use it for civil work, provided they notify the Superintendent Engineer in their area within one week from the date on which it was first used. If the contractor does not ultimately wish to purchase the machinery he will be required to pay a reasonable hire not to exceed the rate of 20 per cent. per annum on the cost price of the machine.

The Crane Order, prohibiting the sale or supply of any cranes except under permit, and the Motor Engines and Vehicles Order prohibiting the manufacture except under permit, are revoked.

Owners of steam-driven lorries and trailers are no longer required to make returns of charges of ownership.

Lighting Restrictions.—The B. of T. gives notice that the Lighting, Heating and Power Order, 1918, restrictions, have been removed as from December 23rd, 1918.

Refractory Materials Order Revoked.—The Minister of Munitions has revoked the Refractory Materials (Maximum Prices) Order, 1917, as from December 31st.

Export Prohibitions Relaxed.—A further list of relaxations in export restrictions appears in the *London Gazette* for December 27th, 1918.

Non-Ferrous Metal Industry Act.—The *London Gazette* for December 24th contains a further list of licences granted under this Act.

Cable Codes and Overseas Trade.—A communication from the Army Council to the Comptroller-General, Department of Overseas Trade, states that it is not possible to relax the restrictions relating to the use of telegraphic codes without the concurrence of the principal Allied Powers who have co-operated in the censorship during the war. The Army Council recognise the importance to the commercial community of allowing greater latitude in the use of cable codes, and the question of relaxation is now being discussed with the various Allied authorities.—*Board of Trade Journal.*

Aluminium Order Suspended.—The Minister of Munitions has suspended until further notice the Aluminium (Returns) Order, 1917, and the Aluminium (Scrap and Swarf) Order, 1917, as from December 24th.

Resumption of Trade with Belgium.—The Board of Trade calls attention in its *Journal* to the fact that the restrictions imposed by the Trading with the Enemy (Occupied Territory) Proclamation no longer apply to trading with Belgium, and that consequently the obligations to obtain a special licence under that proclamation, as well as the requirement to pay the purchase price for goods imported from Belgium into a blocked account in this country, are now dispensed with. Imports from Belgium into this country must, however, be accompanied by certificates of origin and interest issued in the usual form by a British Consular officer. Imports into, and exports from, Belgium are further controlled by the requirement of a licence issued by the Belgian authorities, particulars with regard to which can be obtained from the branch of the Department des Affaires Economiques which has been opened at 110, Cannon Street, London, E.C.4.

Sites for New Factories at Pietermaritzburg.—The recent expansion of industrial activity in the Union of South Africa has, amongst other results, induced certain municipalities and similar public bodies to offer specially favourable terms to manufacturers in the way of water and power rates as well as sites for the establishment of industries. The Trade Commissioner for the Union has been notified that the Pietermaritzburg Corporation is prepared to offer suitable sites on very reasonable terms, and to submit plans with additional information as to supply of labour, raw materials, railway communications, &c. The water rate varies from 1s. 6d. per 1,000 gallons for a monthly consumption of 250,000 gallons to 9d. per gallon up to 12,000,000 gallons. Electricity can be supplied on a graduated basis of from 3d. to ·84d. per unit, and for industries of a kind not already established a reduction will be made of 33⅓ per cent. off these charges.

Christmas Wishes and Social Functions.—A Christmas staff and works function, arranged by the Social Committee of the Automatic Telephone Manufacturing Co., Ltd., and held at the Britannia Rooms, Cunard Buildings, Pier Head, Liverpool, on Friday, December 20th, from 6.30 to 10.30 p.m., took the form of a dance and whist drive. The function was a complete success. Some 300 guests attended.

The St. Helens Cable and Rubber Co., Ltd., of Warrington, issued their Christmas wishes to "Our Fighters at Home and Abroad" in the form of a pamphlet containing a list of the names of 24 of their men who have made the supreme sacrifice in the war, and of 170 others who are "still going strong." Particulars of the work done in connection with the Works' Comfort Fund are followed by a number of appropriate messages from the different departments to the men still with the fighting Forces.

British-Italian Trade and Industry.—The *Bulletin* of the British Chamber of Commerce for July (Inc.) which has come to hand contains a number of appropriate "Victory" messages. It is recognised that Britain and Italy should now fight side by side in Peace as they have done in war, and in this connection we make the following extracts from an article which immediately follows the messages referred to :—

"During the war many industries in Italy have undergone considerable development. . . . The principal engineering industries, production of motor cars, aeroplanes, &c., have made great strides. In fact, Italy now claims to possess the largest automobile industry in Europe. Among other industries which may be singled out as having received a great impetus from the war, and which were practically non-existant in Italy up to 1915, may be mentioned the manufacture of fire-bricks, &c., in connection with the metallurgical furnaces, the production of scientific and optical instruments, electric reflectors, and ignition magnets for automobiles. The manufacture of certain chemicals has made progress, and there are several new schemes under consideration more or less connected therewith, *e.g.* :—

1. The institution of a big bank to favour electrical undertakings and hydro-electric plants after the war, the building of electric machinery to be specially aided.
2. The formation of a military technical corps of 3,000 engineers.
3. Various schemes *re* the electrolytic zinc industry.
4. The nomination of a Special Committee to foster the development of nitrate products.
5. Scheme to discipline the rationing of electric power and to encourage building plants.
6. The creation of an Invention and Research Office and an Office for War Chemicals.

The enterprise of Italians will lead to the development of industries on a large scale, and much of the machinery and raw material required will be imported. Among the developments expected, the following will probably be taken in hand first :—

1. Enlargement of ports and construction of wharves, &c., necessary to relieve congestion, so as to provide for proper development of shipping.
2. Overhaul of the railway system, and the electrification of lines.
3. Utilisation of further water power for the creation of electric energy, and the building of requisite reservoirs.
4. Fuller cultivation of the land, and the reclamation of wastes for agricultural purposes.
5. Adaptation of factories used for munition making for industrial purposes.

In connection therewith, a large demand is certain to arise for machinery and engineering plant, constructional iron and steel and building materials, agricultural machinery and implements, rolling stock, mill and factory furnishings, &c.

Not only commercially, but also financially, intellectually, and politically, relations between Britain and Italy should be much closer, more intimate and efficient than in the past. On both sides, Government and Parliament corporate bodies, associations of every sort ; scientific, literary, sporting ; steamship companies, industrial and commercial firms and private individuals should, as far as lies in their power, favour, promote, support, foster, and encourage relations of every kind, and especially financial, economical, and commercial, between the two countries.

Although the British Empire itself offers such an immense field to British manufacturers, it should be in their own interest to devote much more attention to Italy before the Teutons are in a position to recommence their work of "peaceful penetration" as far as new conditions will allow, recollecting that Italians are more than ever anxious to develop their commercial relations preferentially with the British Empire, to which Italy is tied by traditional sympathy. British firms should not fail to :—

1. Send out commercial travellers, or appoint agents, in order to see buyers on the spot and find out exactly what kinds of goods they, the customers, want.
2. Supply agents, when necessary and expedient, with a certain stock of goods from which to execute small orders promptly and supply part of large orders in order to retain clients.
3. Correspond in Italian, have catalogues printed in that language, and quote prices in the currency, weights, and measures of the country.

Italy is one of the most important countries with which Britain may hope to develop business on a much larger scale than in the past. The British Empire has goods Italians want, and Italy has commodities that the Empire needs. Economically Italy is growing by leaps and bounds, and her strides during the war in some respects have been prodigious ; this, with the economic education which war brings to the peasant soldier, will have its favourable reaction on the Italian market, benefiting both her and her customers and clients."

Letters from the Forces.—In a recent letter from a correspondent with the R.A.F. abroad, the writer says :—"Many thanks for the Reviews, which have always reached me most regularly. I am shortly on my way to 'Blighty,' and I take this opportunity of thanking you, on behalf of my chums and myself, for your generosity, which has not only been a help to us and to the Forces in which we are proud to serve, but has been the means of enlightening us regarding the numerous changes in the electrical industry and the conditions of home, so that we shall not be total strangers in our Homeland when we return."

New Italian Industries During the War.—According to the most exact recent news obtainable, about 2,500 millions of lire (100 millions sterling) of new capital have been invested in Italian industries during the war, approximately as follows :—Transports, land and sea, 545 millions ; siderurgical industries, 432 millions ; electrical industries, 405 millions ; banking, 278 millions ; mechanical engineering, 267 millions ; chemical and electrochemical industries, 217 millions ; mining industries, 173 millions ; automobile industry, 100 millions ; textile industries, 80 millions. This only goes as far as June, 1918, while it is well known that since then many limited companies have greatly increased their share capital (one company by as much as lire 400,000,000), and does not take into account at all other private companies and partnerships. The true sum total is, therefore, more likely to be 3,500 million lire, say, 140 millions sterling.—*Bulletin* of the British Chamber of Commerce for Italy.

Scrap Copper from the Fields of Battle.—A question which is now occupying the minds of experts is how much of the precious metal can be salved on the battlefields of three continents. It is asserted that something like 3,000,000 tons of copper lie on the battlefields of Belgium and France, not to mention the thousands of tons in Russia, Serbia, the Balkans, Italy, Bulgaria, Rumania, Palestine, Egypt, Mesopotamia, and other places where the dogs of war were let loose by the ex-Kaiser. It is said that of the scrap copper in France and Belgium, at least 1,000,000 tons can be recovered, or about equal to one year's output of the United States. It is now known that for five years prior to the war Germany purchased at least 200,000 tons per annum for herself and her Allies, and her purchases were so skilfully camouflaged that the destinations of the copper were seldom suspected. Germany is now practically denuded of copper, and the Peace Conference will probably see that she gets none of the battlefield scrap.

Irish Coal Output in 1917.—A White Paper just issued shows that in 1917 the output of the coal in Ireland was 95,646 tons, and the value £87,164. Of this, 80,301 tons were anthracite, mainly from the Kilkenny mines, the figures for Kilkenny being 61,742 tons ; Queen's County, 14,156 tons ; and Tipperary, 4,403. The Roscommon mines produced 12,487 tons, for which £1 per ton was paid at the pit head. In coke, 395,368 tons of coal were used, producing 188,704 tons of coke. Iron ore was produced to the extent of 54,533 tons, valued at £14,266. The average of iron obtained was 38·44 per cent., and the quantity of pig iron 20,972 tons. In Sligo, 16 tons of zinc ore were obtained, and 5 tons of zinc obtained by smelting. The figures of the coal output in the year just closed will be considerably in advance of those of 1917, the efforts to meet the shortage having considerably increased the output in the east and west, and at present some coal is being got from the Tyrone field at Dungannon. The shortage of coal in Ireland is being severely felt, the greater part of the imported fuel being obtained from Scottish mines.

Demobilisation.—The War Office announces that officers and men cannot at present be demobilised from certain corps in the Army, as they are essential to the work of demobilisation. The fact that employment awaits an individual will be recorded with a view to his being demobilised as early as possible. The corps in question are :—Royal Army Service Corps, Ordnance Corps, Veterinary Corps, Remount Corps, Army Pay Corps, Directorate of Military Railways, France.

Iron and Steel Prices.—The Minister of Munitions has issued certain information supplementing the notices which have already appeared with regard to home and export prices of iron and steel.

Country of Origin.—A Bill requiring all goods to be marked clearly with the name of the country of origin has been passed by the Australian House of Assembly, which prevents German goods, after passing the Customs, from being labelled "Made in Australia."—*The Times*.

Another Accumulator Trade Combination.—An important amalgamation of interests has just been effected in the accumulator manufacturing business by the combination of the New Peto & Radford Accumulator Co. with the Pritchett and Gold and Electrical Power Storage Co., Ltd. The first of these concerns has been identified with the production of portable accumulators for motor-cars since the early days of motoring. The Pritchett & Gold concern, which has been employed on work of a heavier character, is itself a war-time amalgamation of the old Pritchett & Gold Co. and the Electrical Power Storage Co., the co-operation of interests being arranged as a step towards economy of production and the establishment of the business on a large scale. The second amalgamation is, we understand, the consequence of the recognition that the portable accumulator business is destined to become an important one, and the acquisition of the Peto & Radford business was considered to afford an opportunity of starting in, and so specialising in, this class of trade. The proprietary name of Peto & Radford is not to disappear, as the portable accumulators will continue to be produced under that name and under the supervision of Mr. William Peto and Mr. G. R. N. Minchin, though eventually the manufacture will be transferred to the large works at Dagenham, Essex, where building extensions are already in hand.

The Requirements of France.—It is stated that priority is now allowed in France to the importation of steel, copper, zinc, lead, aluminium, machinery, tools, electrical appliances, &c., required for the liberated regions.

British Malaya: Warning.—Prospective rubber planters are cautioned against proceeding to Malaya without first securing definite appointments. It is also necessary to remember that the cost of living has advanced there, as elsewhere.

Tramcar Driver Fined.—For driving a Corporation tramcar to the danger of the public, Walter Wilson was fined 20s. at Barrow last week. It was stated that, instead of going to the points at the terminus, and crossing on to the other line, he returned at an excessive speed along the same line, passing another car going in the same direction.

Trade Announcement.—Mr. F. Young has commenced business as an electrical engineer at 43, Roebuck Road, Rochester.

For Sale.—Oldham Corporation Electricity Works has for disposal four Willans-Siemens 140-kW. sets, eight dryback marine type boilers with underfeed stokers and superheaters. For particulars see our advertisement pages to-day.

Munition Workers' Carol Party.—The Musical Society, which is run by the staff and employés of the Osram-Robertson Lamp Works, Ltd., of Brook Green, completed just prior to the Christmas holidays a very successful carol-singing campaign on behalf of St. Dunstan's Hostel. The amount collected in five nights was £110, which is probably one of the largest collections ever made by a carol party in so short a period. The party consisted entirely of munition workers.

Liquidations.—Electric Lighting & Engineering Co., Ltd. Meeting, January 24th, 1919, at 43, Castle Street, Liverpool, to hear an account of the winding up from the liquidator, Mr. R. T. Langdon.

Expanded Metal Co., Ltd.—Meeting of creditors, York Mansion, S.W. 1, on January 7th.

Bankruptcy Proceedings.—A. F. Hawdon, electrical engineer, Gosforth.—Application for debtor's discharge to be heard at Newcastle, January 16th.

Book Notices.—The Christmas number of *The M. & C. Apprentices' Magazine* contains so much that is interesting and entertaining, that it is difficult to pick out items for notice; as a matter of fact, it takes up too much of our time, and we shall have to review it from the table of contents in future! Mr. Sam Mavor writes of Baku, Mr. Bousfield of Alsace-Lorraine, Mr. Davies of "Iron," Ald. Duncan Watson of his apprenticeship, and Mr. P. Black of the education of skilled craftsmen; and there are numerous short articles and notes, and spirited illustrations. The interesting announcement is made that Messrs. Mavor & Coulson will give a gold medal next Christmas to the best fifth-year apprentice, to be selected by the apprentices themselves.

"Electricity and Magnetism for Engineers." Part 1: Electric and Magnetic Circuits. By Harold Pender. Pp. xi + 380; 98 figs. London: Hill Publishing Co., Ltd. 1918. Price $3 net.

"*Journal* of the Institution of Electrical Engineers." Vol. 57. No. 277. December, 1918. London: E. & F. N. Spon, Ltd. Price 7s.—This issue contains a paper on "Dynamical Theory of Electric Engines" (Tenth Kelvin Lecture), by Ll. B. Atkinson, and the Chairmen's addresses at the following centres: Irish (Mr. J. P. Tierney); Western (Mr. H. I. Rogers); North-Eastern (Mr. A. P. Pyne); North-Western (Mr. A. P. M. Fleming); Scottish (Mr. J. F. Nielson); and North-Midland (Mr. R. H. Campion).

Calendars and Diaries.—Messrs. Peckham, Ducamp and Co., of 4 and 5, New Compton Street, Charing Cross Road, London, W.C. 2, have prepared for 1919 one of their useful desk reminders with daily memoranda space, which is ample for ordinary business purposes.

The Anglo-Mexican Petroleum Co., Ltd., of 16, Finsbury Circus, London, E.C. 2, have issued a wall calendar with monthly date slips, below a reproduction in fac-simile of a drawing of the Mexican Eagle Oil Co.'s famous gusher Potrero No. 4, which has just ceased to yield. Beneath the date slips there is a picture of a British squadron, and a quotation from Lord Fisher on the value of an oil fired fleet.

From the Hart Accumulator Co., Ltd., of Marshgate Lane, Stratford, London, we have received, as in previous years, a desk blotting pad. Each sheet bears at the left and right hand sides a complete calendar for 1919.

Catalogue.—The Hoffmann Manufacturing Co., Ltd., Chelmsford.—Abridged edition (36 pages) of their catalogue of Hoffmann steel balls and rollers and ball and roller bearings. There is a thumb index to sections. Sizes, prices, and code-words are set forth clearly in table form. Copies of the list can be obtained on application.

The "English Electric" Amalgamation.—The amalgamation arrangements foreshadowed by the chairman at Dick, Kerr and Co.'s annual meeting have now been completed, and circulars have been issued to the shareholders giving details. A new company has been formed, named the English Electric Co., Ltd., which has already acquired all the shares of the Coventry Ordnance Works, Ltd., and the Phœnix Dynamo Manufacturing Co., Ltd., both of which are private concerns; and an offer is now made to Dick, Kerr's shareholders to exchange their shares on terms which are strongly recommended by the directors, who are backing their opinion by accepting the offer themselves.

The English Electric Co., Ltd., concerning which we gave some particulars in our "New Companies Registered," last week, has a registered capital of £5,000,000, of which less than £2,000,000 will have been issued when the proposed exchange with Dick, Kerr shareholders is completed, so that it is evident that the directors have the intention of considerable further expansion. As it is, the company will be one of the principal electrical manufacturing concerns in this country. The Board is a strong one, and representative of the leading engineering industrials. As a matter of fact, the directors themselves can through their other connections materially support the company with orders. It is interesting to note that three of our main-line railways are represented on the Board, by Sir Charles Ellis for the Great Eastern Railway, Mr. Hichens for the London and North-Western, and Mr. Bernard Firth for the Great Northern. Equally important is the representation of our shipbuilding and owning interests, with Mr. John Sampson as a director of Harland & Wolff, and Sir Alexander Gracie of the Fairfield Shipbuilding and Engineering Co., together with the chairman and Mr Hichens representing respectively John Brown & Co and Cammell, Laird & Co.

We announced, a week or two ago, that Mr. Evan Parry had resigned his post of Chief Government Electrician in New Zealand. The reason for this resignation is now apparent, for Mr. Parry has been appointed engineer-in-chief of the English Electric Co., Ltd. That he will be heartily welcomed home to Old England again by his many electrical friends, goes without saying.

D.K. Operatic Society.—The employés of Messrs. Dick, Kerr & Co., Ltd., Preston have formed an amateur operatic society, and last week the members gave a series of very successful performances of "H.M.S. Pinafore" in the Empire Theatre, Preston.

LIGHTING AND POWER NOTES.

Ascot.—Proposed Price Increase.—The Electricity Co. has applied to the B. of T. for an order to increase the maximum price of electricity from 11s. 8d. up to 20 units, and 7d. per unit beyond, to 12s., and 1s. per unit.

Batley.—Price Increase.—The electricity charges are to be increased by a further 20 per cent. from February 1st, thus raising the charge for lighting to 55 per cent. above the pre-war rate, and that for power and heating to 75 per cent.

Bolton.—Proposed Linking-up.—The Corporation has decided to apply to the L.G.B. for sanction to a loan of £7,500, for the purpose of connecting its electricity supply system with that of the Lancashire Electric Power Co.; it is proposed to enter into a mutual working arrangement for 10 years.

Bournemouth.—Price Increase.—The E.S. Co. has notified its intention to increase the price of electricity to 8½d. per unit, a total war-time advance of 33⅓ per cent.

Canada.—Water Power.—A company has sought authorisation from the Quebec Government to proceed with a hydro-electric development on the Riviere des Prairies, Island of Montreal. The preliminary plans provide for a development of 40,000 h.p. Federal sanction has already been obtained, subject to modifications of the original plan, and provincial authority is required for the use of the bed of the stream. The power house will be on the south shore of Jesus Island, and the preliminary plans provide for nine units. The project will raise the water level some 15 ft., and will interfere with the sewer outlets of Montreal.

Continental.—Spain.—A concession has been granted for the utilisation of the River Guadalpeo (Izbor), near Meleges, for the generation of electricity.

Egham.—Street Lighting.—The U.D.C. has decided to enter into a 10 years' contract with the Egham and Staines Electricity Co., for street lighting.

Falkirk.—Proposed Joint Supply.—Representatives of the Burghs of Stirling, Alloa, Grangemouth, Bo'ness, Linlithgow, Denny, Bathgate, and Armadale, and the County Council of Stirlingshire have been asked to confer with the Falkirk T.C. regarding the provision of joint electrical plant.

Ilford.—Proposed Extensions.—The electrical engineer has been instructed to report to the Corporation upon the alterations and additions required in connection with the plant

Ipswich. Year's Working.—There was a surplus of £2,175 on the working of the Corporation Electricity Department for the year ended March 31st last, of which £1,588 was credited to the reserve fund, and £474 to the liquidation of the adverse balance on the previous year's working. The income was £55,720, compared with £39,580 in the preceding year, and the working expenses were £40,301, against £26,825 : capital charges absorbed £12,848. Units sold increased from 4,836,171 to 6,797,374, of which 843,227 were for lighting, against 730,821 ; 5,245,494, against 3,444,886, for power ; and 708,653, against 660,464, for tramways. The capacity of the undertaking was 3,511 kw., and the maximum load recorded was 3,113 kw. The generation cost was 1·14d. per unit, and the total cost (excluding capital charges) was 1·423d. The average price per unit, excluding meter rents, &c., was 1·772d. The year's operation of the electric vehicle garage showed a surplus of £44. 65 per cent. of the energy sold for power purposes was consumed by controlled munition factories. In his report, the electrical engineer (Mr. F. Ayton) states that the coal cost per unit sold was ·828d., against ·678d., due almost entirely to the overloaded condition under which the plant was worked, and to the fact that much of the output was generated by the old reciprocating plant. There were many occasions during the year when, owing to the poor quality and poor supply of coal, the undertaking was unable to maintain sufficient steam, and had to appeal to the large power users to ease their demand. The item for "repairs and maintenance" increased from £1,756 to £3,533. 500-kw. rotary converters, with transformers and switchgear, were installed at the power station and the Duke Street sub-station for converting current for transmission to the foundry district. The plant had to be obtained in a great hurry, and the only suitable plant that could be found was of a make which had not proved reliable or satisfactory. The plant was started on May 3rd, and gave trouble from the first On July 25th it broke down, and was out of commission until October 1st , it was also out of commission from December 18th until January 29th The repairs have been carried out at the makers expense but the breakdowns involved the stopping of very important plant at the Orwell works and a consequent loss of revenue

Luton.—Loan Sanction.—The E.C. has obtained L.G.B. sanction to borrow £2,000 (repayable in 25 years) for extension of mains for providing additional supply of electricity to Thermo Electric. Ltd . and Fricker's Metal Co.

Mansfield.—Price Increase.—The T.C. has increased the charges for electricity by a further 25 per cent., making 50 per cent. over pre-war rates.

Methley.—Proposed Bulk Supply.—The U.D.C. has asked the Yorkshire E.P. Co. to submit terms for a supply of electricity in bulk.

Nelson.—Proposed Linking-up.—A joint meeting between representatives of the Nelson and Colne Corporations has been arranged to consider proposals for the interconnection of the electricity supply systems.

Newark.—Prov. Order.—The T.C. has decided to oppose an application by the Newark Gas Co. for an E.L. prov. order.

Normanton.—E.L. Scheme.—The U.D.C. has decided to push forward with the electric lighting scheme.

Oldham.—Fire.—A fire broke out in the generating station at Asia Mill, Hollinwood, last week, and considerable damage was done to the plant by the collapse of the roof.

Mill Driving.—Referring to the application from three large mills for a supply of electricity, the chairman of the Electricity Committee stated that he believed that the demand for electricity was about to develop very considerably, and the Committee should seriously consider its whole position.

United States.—Hetch Hetchy Scheme.—The Hetch Hetchy project, when completely developed, includes dams, tunnels, pipes, and aqueducts of sufficient capacity to deliver and distribute 400,000,000 gallons of water daily to the San Francisco Bay region from its mountain supply in the High Sierra situated 160 miles to the east. In addition to this, the completed project as now proposed includes the development of a number of attractive power sites. This completed project will undoubtedly represent an investment of approximately 125 to 140 millions of dollars. A description of this project as it appears to-day is given in the *Journal of Electricity* for November 15th.

In his report of March, 1916, the City Engineer of San Francisco sets forth a statement showing that an outlay of $14,147,000 will be necessary to complete the project sufficiently to deliver to San Francisco a domestic water supply of 60,000,000 gallons daily, and to erect at the Moccasin Creek power plant an initial installation of 37,500 kw. Since these estimates were made prices have advanced to such a degree that it is reasonable to expect an outlay of $60,000,000 will be necessary for this work. To acquire a distribution system such as the Spring Valley and the necessary reserve reservoirs an additional $40,000,000 will be necessary. To eventually complete the project so as to deliver the 400,000,000 gallons daily, and in addition to erect power lines and build all the other necessary appurtenances will require at least an additional $25,000,000, or even $40,000,000. That this completed project may cost between $125,000,000 and $140,000,000 does not in itself condemn the undertaking. Tersely put, the outstanding facts are these :—Some 20 cities and municipalities in the San Francisco Bay region need improved water facilities, and the need is far greater than is generally realised. While the Hetch Hetchy project has been reported on by experts, its alternative possibilities of development have never been properly weighed in careful analysis. The power phase of the situation, while attractive on the surface, has never been completely and thoroughly examined. The project, as a whole, is admittedly larger than San Francisco of itself can reasonably finance or, without supplying other municipalities, reduce to a paying investment. The urgent and dangerous situation that may arise from a season of water shortage extending over a two-year period, which may arise at any time, must not be overlooked.

TRAMWAY AND RAILWAY NOTES.

Aberdeen.—Proposed Light Railway.—The Corporation Electricity Committee has reported in favour of the construction of a light railway between the electricity works and the docks and railway station, for the conveyance of coal ; the estimated cost is £20,000.

Australia.—Strike.—The tramway employés at Perth (West Australia) have struck work for higher wages.

Blackburn.—Strike.—The employés of the Corporation tramway department, who are members of the Amalgamated Tramway Workers' Union, have refused to work with the members of the Municipal Employés' Union, and struck work on Monday last. The strikers have asked the Lancashire District Council of the Workers Union to declare a strike of tramway workers throughout the county They have also called out the men engaged on carting coal to the electricity works, thus threatening the supply for lighting and power

Brighouse.—Proposed Tramways.—A Sub-Committee has been appointed to interview the chairman of the Huddersfield Tramways Committee with regard to the proposed tramways to Rastrick.

Doncaster.—Proposed Extensions.—The T.C. has decided to carry out improvement schemes in the borough, including the extension of the tramway system ; the total cost is estimated at £600,000.

Halifax.—Track Renewals.—The Tramways Committee has given instructions for the repair of the tramway track between Hipperholme and Brighouse and between Brighouse and Bailiffe Bridge.

Huntingdonshire.—Proposed Light Railway.—The C.C. has decided to ask the Norman Cross Brick Co. to co-operate with the Council in the provision of a light railway for the district.

Ipswich.—Year's Working.—For the year ended March 31st, 1918, the revenue of the Corporation tramway department amounted to £34,817 and the expenditure to £27,071, compared with £25,567 and £21,922 respectively in the previous year. Loan redemption amounted to £2,413, against £2,340 ; interest to £3,244, against £3,315 ; and war allowances to employés to £611, against £672. The net profit was £1,478, against a loss of £2,672 on the previous year's working ; 625,224 car-miles were run, against 567,503 ; 6,069,777 passengers were carried, against 6,246,820 ; 708,653 units were used, against 660,464 ; 1·134 units were used per car-mile, against 1·164 ; the total working expenses per car-mile were 10·392d., against 9·271d. ; and the total revenue per car-mile was 13·365d., against 10·812d. Energy, obtained from the electricity department, cost £5,211, or 2d. per car-mile, against £4,300. The manager (Mr. F. Ayton) estimates that the whole of the track will require renewing, at a cost of £42,500, next year, and also recommends that certain useless or unprofitable routes be abandoned.

Ilford.—Supply of Electricity.—The Corporation electrical engineer and tramway manager has been instructed to endeavour to obtain a supply of electricity from neighbouring tramway authorities, in order to meet any emergencies which may be caused by breakdowns.

L.B. & S.C.R. Electrification.—A copy of a resolution passed by the Brighton T.C., to the effect that the Council is strongly of opinion that the electrification of the main line from London to Brighton should be proceeded with at the earliest possible moment, has been forwarded to the company.

Llandudno.—Supply of Electricity.—A new agreement, by which the U.D.C is to supply electricity to the Llandudno and Colwyn Bay Electric Railway Co. on a sliding scale based on the cost of fuel, comes into operation on January 1st.

London.—M.E.T.—The Metropolitan Electric Tramway Co. has given each employé a day's pay in celebration of the Armistice.

Fare Increase.—The London United Tramway Co. increased its fares on January 1st to 1d. for two stages, in place of three. There is no change in workmen's fares for the present. Should the change not result in the increase of revenue that is required, the matter will be further considered in two months' time.

Development Committee.—Early this year a conference of representatives of municipal tramway authorities in the Metropolitan area will be held to consider the following resolutions, which were adopted at a recent meeting of the Metropolitan Association of Tramway Managers:—(1) That the Metropolitan Association of Tramway Managers, which includes in its membership managers of both municipal and company-owned tramways, be dissolved; (2) that a new association be formed consisting of municipal authorities owning and working tramways or motor vehicles; that the municipal authorities be represented by not more than two members each and the managers of the undertakings; that the meetings of the Council be held quarterly; that meetings of the managers be held at least once a month; and that the managers act jointly in an advisory capacity to the Council on all matters which affect the common interests of the undertakings in the Metropolitan area.

Mersey Docks.—A big scheme for the electrification of the Mersey Dock Estate has been adopted, with a view to the extended introduction of electrically-worked mechanical appliances on the dock quays: the cost is estimated at £123,900.

South Africa.—Railway Electrification.—The report of the General Manager of Railways and Harbours for 1918 states that the services of a London firm of consulting engineers had been secured to report upon the proposed electrification of certain sections of the Union railways, and a representative of the firm had already been to South Africa to study local conditions and collect data.

Stirling.—It is proposed to lay a light railway from Stirling to Port of Monteith.

The Electric Vehicle Committee.—Mr. E. E. Hoadley, the engineer and manager of the Maidstone Corporation electricity supply department, has been added to the Electric Vehicle Committee as an additional representative of the Incorporated Municipal Electrical Association. Another addition to the Committee is Lieut.-Colonel Frank Garrett, of Messrs. Richard Garrett & Sons, Ltd., Leiston, Suffolk, who takes the place as a representative of electric vehicle manufacturers of Mr. Meaden, of Wolseley Motors, Ltd., Birmingham, who are no longer interested in electric vehicles.

Thornaby.—Prov. Order.—The T.C. has decided to apply for a prov. order to construct and work tramways within its area.

Thornton.—Railway Extension.—The Lancashire and Yorkshire and London and North-Western Railway Companies have notified the Council of their intention to promote a Bill for the construction of a branch railway, to be called the Cleveleys branch.

Wages.—The National Transport Workers' Federation has forwarded the following demands on behalf of its members to the Municipal Tramways Association and the Tramways and Light Railways Association:—The working week to consist of 44 hours, including signing on and off, and every employé to be guaranteed a working week of 44 hours or payment for the same; no day's work to exceed eight hours; a reduction of the working day not to entail a reduction of existing wages; no "spread-over" duty to exceed nine hours, inclusive of meal times or relief; all Sundays, national holidays, and overtime to be paid for at time-and-a-half rates: 14 days' holiday to be granted annually, with pay. The two Associations have agreed to meet representatives of the Federation early this year to discuss the proposals.

Weston-super-Mare.—Extension of Time.—The promoters of the Western Junction Light Railway Order, 1910, have applied to the B. of T. for an extension until December 31st, 1919, for the completion of the unconstructed lines authorised by the Order.

TELEGRAPH AND TELEPHONE NOTES.

Abbreviated Addresses.—The Postmaster-General announces that from January 1st the use in foreign telegrams of abbreviated addresses will be allowed. The registration of new abbreviated addresses for foreign telegrams has been sanctioned.

Australia.—As a result of the finding of the Navy Commission in connection with the purchase of a wireless station by the Australian Government, Senator Long has resigned his seat in the Senate. The Commission expressed the opinion that Senator Long received £2,400 in consideration of his political influence.—*The Times.*

Haiti.—The telephone systems of Haiti and the Dominican Republic have recently been connected. It is now possible to communicate between the principal towns of the two Republics.

United States.—The first extensive strike of telephone workers occurring since Government control of wires was assumed, which involved operators and electricians at Norfolk, Va., was settled on November 1st, upon a direct demand addressed to the strikers by Postmaster-General Burleson, who said that no strike could be recognised in the Government service. Employés had 24 hours in which to return after leaving their positions, and the management of the company involved had orders at the end of that period to fill all places left vacant with other workers, and to report the names of those leaving the service.

The P.M.G. has appointed Committees to make recommendations with a view to standardising the rate schedules of telephone and telegraph services throughout the States.

The restrictions heretofore placed on telephone extensions have been revoked.—*Telephone Engineer.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.

Melbourne.—March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

Dublin.—Electricity Committee. Erection of a fan house at Pigeon House Fort Station.

London.—Hampstead.—B.C. January 16th. Twelve months' supply of electrical engineers' stores and oils for the Electricity Station. Mr. A. P. Johnson, Town Clerk, Town Hall, Haverstock Hill, N.W.

Spain.—The municipal authorities of Albaida (Province of Valencia) have lately invited tenders for the concession for the electric lighting of the town during an unstated period. Tenders have also been invited for the concession for the electric lighting of the Town of Pedrochi (Province of Cordoba) during a period of five years.

Sheffield.—January 7th. Corporation Tramways and Motor Committee. 50 double-decked, top-covered, vestibule tram-car bodies with trucks. Mr. A. R. Fearnley, General Manager, Division Street.

CLOSED.

Australia.—Commonwealth Department of Defence:—

Electric motors for dock pumps, Commonwealth Dockyard, £5,796.—Lancashire Dynamo & Motor Co., Ltd.

Ilford.—U.D.C.:—

23-h.p. motor and starter, £145.—W. H. Sugden.

Windsor.—T.C.:—

Pulsometer pump and 56-h.p. motor and mains.—Windsor Electrical Installation Co., Ltd., £775.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, January 3rd. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Concrete Ships," by Mr. P. M. Frazer.

(North-Eastern Section).—Tuesday, January 7th. At the Mining Institute, Newcastle-on-Tyne. At 7.45 p.m. Paper on "Design of High-speed Generating Units," by Mr. G. Bonner.

Chief Technical Assistants' Association.—Saturday, January 4th. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Ordinary meeting.

Institute of Marine Engineers.—Tuesday, January 7th. At the Minories E. 1 At 6 p.m. President's address.

Roentgen Society.—Tuesday, January 7th. At the Royal Society of Arts, John Street, W.C. At 8.15 p.m. Paper on "Electrical Changes Produced by Light," by Mr. H. S. Allen.

Association of Engineers-in-Charge.—Wednesday, January 8th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "The Transport and Handling of Fuel," by Mr. J. H. Anderson.

Industrial Reconstruction Council.—Wednesday, January 8th. At the Saddlers' Hall, Cheapside, E.C. Lecture on "Industrial Unity," by the Rt. Hon. G. H. Roberts, M.P.

Greenock Association of Electrical Engineers.—Thursday, January 9th. At 22, West Stuart Street. At 7.45 p.m. Paper on "An Hour with Ultimate Electricity," by Mr. P. C. Kerr.

Institution of Electrical Engineers.—Thursday, January 9th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Lecture on "The Navigational (Magnetic) Compass as an Instrument of Precision," by Mr. M. B. Field.

Electro-Harmonic Society.—Friday, January 10th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking concert.

Manchester Association of Engineers.—Saturday, January 11th. At the Grand Hotel. At 6.30 p.m. Paper on "Iron and Steel Electric Furnaces," by Mr. J. Bibby.

NOTES.

The Coalition Government.—We believe that all who are anxious that the hands of those who have to represent Great Britain at the Peace Conference should be strengthened, and that our Statesmen should know that the nation is solid behind them in the heavy and delicate work that lies before them, have hailed with satisfaction the success of the Coalition Government at the polls. The avowed object of Mr. Lloyd George and those prominently associated with him was to clear party squabbling from the political arena, especially during the period of reconstruction. Most of us had become utterly sick of the clogging of the wheels of reasonable and legitimate legislation by party discussions and differences. The party machine now lies broken beyond immediate repair. The new Parliament will have an opportunity of showing what it can do for the good of the nation as a whole before it again splits up, as, we suppose, it inevitably must sooner or later—being a human organisation, and one which can only be efficiently run if there is a strong opposition as a corrective force—into groups and parties. In the Electrical Review of February 15th, 1918, we remarked: "If we have needed a coalition for securing unity in war, and require it for guaranteeing the interests of all in securing the right peace, we shall more than ever find it essential for securing unity and guaranteeing the interests of all in the period of reconstruction." In our issue of August 2nd, 1918, in referring to the deplorable skilled labour strike that had just ended, we said:—"There is unquestionably a need for a strong Government with the nation behind it, and if a Parliamentary Election is going to secure such for us the sooner it takes place the better. If there is a loose rein after the war, or if there are blunders due to vacillation, the way to ruin will be short and steep." The new Government is not yet formed; the new Parliament is only a few days old. But we suppose that it comes nearer than ever Parliament has done before to being a body wherein, comparatively speaking, "none were for a Party, and all were for the State." We venture no predictions, but the voting of the people of England, Scotland, and Wales fills us with confidence for the coming days, for there is obviously a general demand for stability and Peace at Home, and the forces that make for Bolshevism, though noisy, and to some extent dangerous if left uncontrolled, are unlikely to be able to summon a following of any proportions while the Government at the helm shows itself both strong and tactful.

Lighting Regulations.—Mr. H. H. Thompson, manager of the Kingsway Theatre, has been fined £5 at Bow Street for unlawfully lighting a number of electric lamps of 25 and 100 c.p. at the entrance of the building for the purpose of advertisement and display. The Magistrate, after inspection, held that the lights were in excess of what were necessary for mere safety. He said that the Advertisements Order was in force for effecting economy in coal consumption, and the matter must be judged from that standpoint.

Electric Welding.—In the *Journal* of the Engineers' Club of Philadelphia, Prof. Comfort A. Adams says, with reference to rigid *versus* non-rigid systems of welding, that the U.S. Shipping Board Sub-Committee on Research reported that the conclusion was that if two pieces of metal were allowed to lie loosely and free to move, they would warp and distort in their relative position during the process of welding; but if they were clamped rigidly, the stresses which were set up were taken up almost entirely by a slight giving of the weld, so that when the parts were released there was no tendency for them to spring out of shape, nor was there any apparent lack of strength which could be regained by supposedly releasing the strains by annealing. With reference to overhead work, the consensus of opinion was that, except for intermittent spots, overhead welds were extremely unreliable. It was difficult to deposit the metal at all without great fatigue on the part of the operator, and the quality of the work was markedly inferior. The conclusion had been come to that overhead welding should not be depended on at all, it was only suitable for temporary tacking. In connection with a certain welded ship, Prof. Adams gave figures, reduced to a ton basis, which had been worked out as to the probable cost of the steel hull. The cost was divided into two parts, namely, welded and other parts, and was considered a conservative estimate of the cost of preparing plates for welding and assembling. The total cost of labour, power, and electrodes, apart from the cost of steel itself, was $63.50 per ton of steel in the hull. In that ship there were only 2,300 tons of steel, instead of 2,800 tons, which would be used in the ordinary riveted ship. Reduced to the same basis of tonnage, the cost was only $52.50 per ton for the purpose of comparison. The cost of the riveted ship to-day was in the vicinity of $80 per ton. The average speed of welding was 5 ft. per hour, not allowing for the long waits of actual work; the amount of metal per running foot was 0.6 lb., and the current 150 amp. at 20 volts. The power was estimated to cost 3.6 cents per ft., bare electrodes 7.2 cents, and labour 13 cents. Total cost of weld per ft. was 23.8 cents. The costs were taken from English practice. The programme for permissible welding as outlined at Hog Island covered a total number of about 225,000 pieces, which it was estimated could be riveted at a cost of about $245,000, and welded for about $99,000, or approximately 60 per cent. of the cost of riveting. One reason why the completely welded ship was not being realised at the present time was the effect of crystallisation of the joints under vibration stresses. Most arc welds, although not all, were, relatively speaking, brittle, and ship designers and the classification societies were cautious and afraid of the brittle joint.

Heat Radiation.—In a letter in *Nature*, of December 26th, Dr. J. A. Harker gives particulars of some experiments which he made at the National Physical Laboratory in connection with some work on radiation from surfaces, which show that the colour of a hot surface at relatively low temperature has very little influence on the amount of radiation leaving it.

In a series of experiments the sides of a thin cubical metal canister were painted in panels of varying colour, the interior of the cube being filled with rapidly stirred oil electrically heated. The amount of pure radiation leaving each kind of surface at a series of steady temperatures up to about 200 deg. C. was compared with that coming at the same temperature from a "black body" constituted by a re-entrant tube with appropriate diaphragms. The exterior of the tube was washed by the hot oil. For temperature differences in the region of 100 deg. C. it was found that:—

1. A bright surface of ordinary tin-plate only gave off an amount of radiation equal to 5-10 per cent. of that from a "black body." The quality of the optical perfection of the surface was of little importance so long as it was bright. A metal surface treated with galvanit of various kinds showed effects of the same order as tin-plate. Burnished copper well cleaned with metal polish gave a lower intrinsic radiation than tin.

2. A coat of almost any paint, regardless of colour, brings the true radiation up to from 80-90 per cent. of that of a "black body," and a quite thin layer of paper varnish or of celluloid varnish, so thin and transparent as to be almost imperceptible to the eye, applied over the bright metal, has almost the same effect.

3. A layer of tissue-paper or wallpaper pasted over the bright surface, or a coating of whitening or limewash, shows the same kind of effect in restoring practically the full radiation so long as the coating is thin.

4. If the surface of the cube be metallised with aluminium paint, the pure radiation is reduced to from 45-55 per cent. of that of a "black body." Much depends, however, on the kind of vehicle used for the aluminium, and different samples of aluminium paint, though giving results similar in appearance to the eye, differ considerably in the effects produced. Bronzing and such-like processes produce intermediate effects.

In some later experiments, with which Mr. Ezer Griffiths was associated, a study was made of the total heat leaving surfaces, with the view of obtaining some data as to the relative effects of conduction, convection, and radiation in ordinary still air. From these experiments it would appear that in the case of low-pressure steam radiators in the region of 100 deg. C., almost exactly half the heat leaving the vertical surfaces, if these are of an ordinary character or painted in the usual manner, consists of pure radiation, the remainder being the combined effect of conduction and convection. Therefore, if, as is a very common practice, the radiators be metallised by painting with aluminium paint, the amount of heat reaching the middle of a room warmed by such radiators will be lowered to half, or double the amount of heating surface will be required to produce the same radiation effect as if the surface were black or of bare metallic iron.

Reconstruction Lectures and Conferences.—The following arrangements have been made by the Industrial Reconstruction Council:—

Saddlers' Hall, Lectures, Wednesdays, at 4.30 p.m.:—

January 8th.—"Industrial Unity," by Rt. Hon. G. H. Roberts, M.P.
January 22nd.—"Industrial Reconstruction in Government Departments," by Judge Edward Parry.
February 5th.—"The Industrial Awakening," by Mr. E. J. P. Benn.
February 19th.—"The Responsibility of Trade Unions in Relation to Industry," by Rt. Hon. J. R. Clynes, M.P.
March 5th.—"Industrial Changes Caused by the War," by Prof. A. W. Kirkaldy.
March 19th.—"The Functions of Government in Relation to Education," by Rt. Hon. H. A. L. Fisher, M.P.

Hall of Institute of Journalists, Conferences, Tuesdays, at 6 p.m.:—

January 14th.—"Reconstruction or Restoration," by Major H. J. Gillespie.
January 28th.—"The Workers' Interest in Costing," by Mr. M. Webster Jenkinson.
February 11th.—"The Place of the Merchant in British Industry," by Sir Charles McLeod.
February 25th.—"Welfare Work," by Miss Newcomb.
March 11th.—"Labour Conditions in Relation to Future Industrial Prosperity," by Captain J. O'Grady, M.P.
March 25th.—"Industrial and Educational Reconstruction," by Mr. F. W. Sanderson.

Ticker and Telephone.—In an interesting paper read by M. Gondet, before the Société Française de Physique, allusion is made to the possible applications of the ticker employed in wireless telegraphy, the function of which is to produce interruptions of current of a frequency capable of producing a musical note. A ticker of this type, used in conjunction with a telephone, could often be employed in practice, instead of a galvanometer, as a convenient means of detecting small continuous currents of the order of 1 microampere upwards. A sketch is given of a Wheatstone bridge arrangement using the ticker and telephone which is recommended for industrial work.

Volunteer Notes.—Royal Engineers Volunteers, London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 1, by Lieut.-Colonel C. B. Clay, V.D., Commanding. Monday, January 6th, to Saturday, January 11th.—Drills as usual.

C. Higgins, *Capt.* R.E., *Adjutant.*

Engineers in the Académie des Sciences.—The Academy has elected M. Rateau to membership of the new Division of Applications of Science to Industry. M. Leblanc was the first member elected.

Educational. — University of Sheffield. — Some particulars are given in the *Sheffield Independent* of the remarkable work that has been done by the University during the war In addition to the manufacture of gauges and shells in the Engineering Department, the production of cupro-nickel was developed experimentally by the Non-ferrous and Electro-metallurgical Departments, with most important results; the total output was 1,354 tons.

The Electrical Engineering Department, with the local staff of the Aeronautical Inspection Department, has tested and reported upon 27 samples of magnetic steels. 144 standard magnets, 150 tests on non-magnetic (nickel steel) steels, and 35,000 magnets. Since December, 1916, the staff of the Applied Chemistry Department has been engaged on investigations on carbonisation of coal.

In the Electro-metallurgical Section, wounded officers, previously trained in non-ferrous metallurgy, are employed on work in connection with the engineering repair shops in France—building up worn-out parts or rejected material by the electro-deposition of thinner or thicker films of various metals to restore them to normal dimensions.

The University has taken a prominent part in the foundation of the Officers' University Training Classes, a movement which promises to be of extreme value in enabling the wounded officer to take a useful place in the industrial development of the nation after the war. The Sheffield University was the first to establish a training course. Up to the present, 59 wounded officers have attended the course in the Faculty of Engineering, and 134 in the Faculty of Metallurgy.

During 1917 the staff of the Electrical Department advised and assisted the members of the local Anti-aircraft Defence Corps in the construction of frame-work required for the training of officers and men in the use of appliances for the location of aircraft.

These are only a few of the many important services rendered by the University to the State and to the city.

Inquiry. — A correspondent wants the name of a firm that will undertake the repair of various small electrical meters and measuring instruments.

Socials.—A very successful ball was held on December 26th at The Barracks, Grove Park, Kent, to celebrate the end of the Great War. It was arranged exclusively for "lads and lasses" of the Transport and Workshops Company at No. 1 Reserve, M T. Depôt A.S.C., Grove Park by kind permission of Lieut.-Col. P. H. Kitson, A.S.C., Commanding Depôt, and Capt. C. Crowther, A.S.C., Commanding Company. The hall was tastefully decorated under the supervision of Lieut. Cockerill. The electrical effects for the occasion were lent by the General Electric Co., Ltd.

The Bradford and Otley District Branch of the Engineering Foremen's Mutual Benefit Society held their annual social evening in the dining and recreation rooms attached to the works of Messrs. Thwaites Bros., Ltd., Bradford, last Saturday week. There were 170 members and guests present. At the whist drive which followed the repast the prizes were distributed by Mr. P. J. Pybus, of the Phœnix Dynamo Co., Ltd., who paid a handsome tribute to the manner in which foremen had performed their duties during the very difficult and strenuous war period. The evening's enjoyment was contributed to by musical friends, and the "annual" was a great success.

The Cable Censorship Handicap.—An actual example of the heavy handicap that is placed upon foreign trade transactions by the continuance of the cable censorship is given in the following letter, which appeared in the *Times* on Wednesday:—

> Sir,—On the 16th inst. I chartered the ss. *Taizan Maru*, then at Durban awaiting orders to load a cargo from British East Africa to Japan, at a freight of about £20,000. We immediately attempted to get a priority cablegram through to the captain, instructing him to proceed to his loading port on the British East African coast, but having received instructions to go on to Mauritius, in case no orders were waiting for him at Durban, he sailed from Durban on the 18th for Mauritius. We then cabled instructions to Mauritius, but, again through the delay on the cables, the captain found no orders waiting for him at Mauritius on his arrival there on the 24th-25th, and, on the 26th, still having no orders, he sailed for Colombo. The steamer is, therefore, now beyond recall, and cannot fulfil her charter from British East Africa, thus entailing a double loss to the trading community—namely, to the owners and the shippers of the cargo. It is taking quite seven or eight days for the delivery of commercial cables to South African ports and Mauritius, and another seven or eight days to get a reply, whilst to get a cable reply from Japan takes anything from three to four weeks. How can international trade be maintained under such disabilities?
>
> Donald Macleod.
>
> Sussex House, 52, Leadenhall Street, E.C 3
> December 31st.

Institution and Lecture Notes. Institution of Electrical Engineers.—The "Institution Notes" in the *Journal* for December announce that the Council has elected Mr. Percy R. Allen and Mr. Walter Judd to be Members of Council in place of the late Mr. J. O. Callender and Lieut. W. L. Preece; and Prof. A. E. Kennelly, D.Sc., of Harvard University, U.S.A., to be an Honorary Member of the Institution.

The President, having visited and addressed meetings at the British Territorial Centres, states that the action taken by the Council in the direction of improving the status of the former Local Sections has already proved most beneficial; the fundamental idea of the Council is that the Institution has no sections, but is one and undivided in whatever part of the country a meeting may be held, and it is clear that the steps taken to give effect to this idea are already meeting with a large measure of success.

The Council has decided to recognise the Electrical Power Engineers' Association as the protective Association for engineers qualified to hold a responsible position directly concerned with the production, transmission, distribution, or utilisation of electrical energy.

The expression "direct current" will in future be used in place of "continuous current" in all official publications of the Institution; this decision is in accordance with our own preference, which we have expressed on previous occasions and acted on when possible.

A list of the members of Committees appointed by the Council for 1918-19 is given in the *Journal*, as well as a list of representatives of the Institution on other bodies, the Roll of Honour Military Honours Awarded, members on Military Service, and Promotions, Transfers, &c., of members on service.

At Swansea, on Saturday last, Mr. W. Burr, borough electrical engineer, delivered an illustrated lecture on medical electricity.

Electrical Association of Australia. — At Melbourne, on November 28th, Mr. M. C. Timms read a paper on "Submarine Cables."

International Science.—*The Times* of December 21st gave particulars of the new international organisation for the promotion and co-ordination of scientific and industrial research. The first Conference was held in London in October, at the instance of the Royal Society, and decided that it was desirable that the nations at war with the Central Powers should withdraw from the existing international conventions and establish new associations. The representatives of the United States recommended that "National Research Councils" should be formed in the different Allied countries, with constitutions similar to that of the U.S. National Research Council, and that from them should be formed an "International Research Council," in whose hands the whole work of international co-operation in science could be placed. This proposal was adopted at the meeting in Paris on November 26th, and an "Executive Committee" of five members was nominated, with an "Administrative Bureau" to be established in London. The president of the Committee is M. E. Picard, one of the permanent secretaries of the Académie des Sciences; the other members are: Dr. G. E. Hale (United States); Prof. Volterra (Italy); Major Lecointe (Belgium); and Prof. A. Schuster (Great Britain).

Mine Signalling Patents. — Patent Application No. 116,426, Automatic Telephone Manufacturing Co., Ltd., and Charles Remington, was recently opposed by the Sterling Telephone and Electric Co., Ltd., upon the grounds that the invention claimed therein has been claimed in their prior Patents Nos. 112,497 and 19,854 of 1914. The application in question discloses a mine signalling system in which several onsetters are enabled to indicate signals upon a single indicator before the engineman. One onsetter upon signalling monopolises the indicator to the exclusion of the other onsetters, who receive busy signals should they commence signalling, until the signal set up by the first onsetter has been cancelled by the engineman complying therewith. The Controller-General heard the contending parties in this matter on December 12th Capt. Odell appearing for the opponents and Mr. Tomlin for the applicants. The applicants contended that the inventions claimed in the opponents' patents were quite different from the invention described in the applicants' specification, and this view was upheld by the Controller, who decided to dismiss the application, with costs against the opponents.

Appointments Vacant.—Mechanician (£250 + £120) for the Post and Telegraph Department, Nigeria; mains engineer for the R.E. camp at Upton Lovell; cable jointer for the Rawtenstall Corporation. See our advertisement pages to-day.

Investigating the Brazilian Machinery Market—An investigator is shortly to be dispatched to Brazil to ascertain the conditions and prospects for the sale of British engineering products in that market. He will go on behalf of the Department of Overseas Trade and the British Engineers' Association, who are acting jointly

Patent Office Library Closing Time.—"Student" writing to the *Times* urges that the Patent Office Library should now revert to its pre-war hour of closing (10 p.m.), so as to give Naval and Army officers who are unable to pursue their studies during the daytime an opportunity for access to its extremely valuable collection of technical works. The present hour of closing is 5 p.m., and we hope that the authorities will seriously consider "Student's" suggestion.

A Light-weight Battery.—Mr. N. D. Sturges, of New York City, has produced a light-weight storage battery which meets the rigid requirements of the airplane designers. It is said to be the lightest battery ever manufactured for watt hours per lb of elements. According to *Indian Industries and Power*, the battery is capable of a steady output of 20 watt hours per lb. of elements, which is claimed to exceed that of any other battery; and it is only half as heavy as the average automobile starting battery, which weighs about 80 lb. The over-all dimensions of the airplane battery are: Length 9¾ in., width 6½ in., height 8¼ in. The plates are 1/16 in. in thickness, nine to a cell, and six cells to a battery, or a total of 54 plates. The battery has an output of 50 amperes at 12 volts for 30 minutes.

The 47 Hour Week for Engineers.—It is announced that the following arrangements have been made in connection with the introduction of the 47-hour week on January 1st, pending further discussion between the Employers' Federation and the Trade Unions:—

1. The day shift shall terminate at the present hour of stopping in each establishment, unless otherwise agreed between the firm and their men.

2. Where necessary, in order to make up 47 hours on account of a 12 o'clock Saturday, half an hour extra shall be worked on one evening of the week, unless otherwise arranged between the firm and their men on a 47-hour basis.

3. The rate of men whose normal working week of 58 hours is in excess of the normal district week—*e.g.*, 54—shall be enhanced as if they worked the normal district week.

4. Time rate per hour to be increased for day-shift men according to amount of reduction in hours.

5. Night-shift to be paid on enhanced day rate.

6. Night-shift hours to remain as at present, pending re-adjustment.

7. Premium bonus earnings shall be calculated on enhanced day-shift rate.

8. No change shall be made in piecework prices or list rates.

It is understood that the Clyde engineers voted by a majority against the 47-hour week. The Scottish Trade Union Congress has by a majority called for legislation for a 40-hours week, preferably five days of eight hours.

Grimsby engineering and allied trade workers downed tools on Wednesday as a protest against the 47-hours week having been brought into operation. According to Press reports the men object to dinner-time being the only break during the day's work.

According to the *Leeds Mercury*, a conference was held on Friday last between the Sheffield and District Engineers Employers' Association and representatives of all the local Unions parties to the joint recommendation of November 19th, to consider questions arising out of the application in the district of a 47-hour working week. An arrangement was arrived at under the terms of which, as from January 1st, the hours of the day-shift shall be as follows:—8 a.m. to 12.30 p.m., 1.30 p.m. to 5.30 p.m., Monday to Friday inclusive. Saturday, 7.30 a.m. to 12 p.m. Regarding the night-shift, it was arranged that this should commence at 5.30 p.m. and finish at 6 a.m., with breaks for meals as at present, this to be a temporary arrangement pending the holding of further conferences to discuss the question of night-shift and men working on the shift system.

Miners in the South Wales district are discussing the question of a six-hour day in the mines, and the local Federation is seeking an interview with the Prime Minister on this and other matters. The Cleveland miners have decided to bring the same point before the Miners' Federation; they also want income-tax exemption up to £200 a year for miners; the abolition of piece-work; increased old-age pensions, and a reduction of the age-limit to 60; also the early abolition of all female labour at the mines.

A Diminutive Electric Motor.—An electric motor of extremely small dimensions has appeared on the market, says the *Polytechnische Rundschau*, a supplement to *Elektrotechnische Rundschau*. The motor is enclosed in a shell of 3 cm. diameter and 1 cm. length and weighs 150 gm. The shaft is arranged so as to hold tools that are required by dentists and surgeons, but the device should be of great use for other purposes, such as boring small holes in metals and rare stones. The motor can be driven by direct or alternating current, and runs at a maximum speed of 5,000 r.p.m.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Central Station Officials.—Rochdale Electricity Committee has recommended that the salary of Mr. F. H. Rudd, the manager of the electricity works, be increased by £50 per annum. He was appointed in August, 1917, at £400 a year, and in August last this was increased by £50, with a promise of a similar increase next August. In view of the extra work Mr. Rudd has performed the committee recommends that the increase should be given at once.

The *Australian Commonwealth Gazette* states that Mr. R. N. Partington, Deputy State Engineer, Electrical Engineer's Branch, has been appointed Deputy Chief Electrical Engineer at £700 per annum, and Mr. J. P. McGlinn, State Supervising Engineer, has been appointed Deputy State Engineer at £606 per annum.

Mr. F. Buckley, general manager of the Wigan Corporation tramways, has been appointed general manager of the Bury Corporation tramways department. There were 42 applicants.

On the occasion of their silver wedding, Mr. J. McLean, night shift foreman at the power house, Hamilton (tramways), and Mrs. McLean, were entertained by the power house employés and received presentations.

Mr. F. G. Cooper, electrical engineer of Colne, has accepted a position at Sheffield.

Mr. F. W. Green, shift engineer at the Bootle Corporation electricity works, was presented with a cut glass salad bowl and a pouch of tobacco on leaving to take up a similar position with the St. Helens Corporation. Mr. T. D. Clothier, borough electrical engineer, made the presentation.

Mr. F. W. Ketley, who has resigned his position as manager of the Norwich Electric Tramways Co., has been presented by Norwich City Police Force with a silver cigarette box.

Mr. C. F. Wells has resigned his position with the Swindon Corporation, having been appointed assistant engineer in the sales department of the Yorkshire Electric Power Co.

General.—Sir W. Guy Granet has accepted a seat on the board of the County of London Electric Supply Co., Ltd.

Mr. J. K. Morris, of the Kentish Shipbuilding & Engineering Co., has been elected a director of the Whitstable Electric Light Co., Ltd..

On the occasion of the retirement of Mr. W. T. Hodgkins from the position of works manager at Faraday Works (Gent & Co., Ltd., Leicester) the whole of the works and office staff and employés presented him with a travelling case and a Swan fountain pen. Regret at his departure was given suitable expression to by some present who had known Mr. Hodgkins during his long period at the works, where he passed from the stage of apprenticeship to that of works manager.

On New Year's Day, at the works of Messrs. Everett, Edgcumbe & Co., Ltd., a presentation, in the form of a handsome case of pipes, was made to Mr. Browning, chief of test, whose subordinates desired to give expression to their high esteem. The Test constitutes a very important part of the well-known factory at Hendon, where Mr. Browning has for many years directed the activities of the testing staff. Suitable speeches were made by members of the Test, and by Mr. Browning in reply.

The *Manchester Guardian* says that the new managing director of the British Westinghouse Electric & Manufacturing Co., Col. Lincoln Chandler, has resigned his position at Trafford Park owing to failing health. Col. Chandler is a director of the Metropolitan Carriage, Wagon & Finance Co., and he has been the representative on the British Westinghouse board of the Metropolitan and Vickers' interests. Captain Hilton, of the same group, has taken over the managing directorship at Trafford Park. Major Chandler, son of Col. Lincoln Chandler, remains as the new joint secretary of the British Westinghouse Co.

Mr. Cecil Leigh, F.I.C., for many years chief chemist of the Birmingham Metal & Munitions Co., Ltd., has been appointed general manager of Messrs. Thermit, Ltd.

Mr. R. W. Dalton, our Trade Commissioner in New Zealand, is beginning his tour of the provincial industrial centres. He will attend a number of Chambers of Commerce, starting at Norwich on January 7th and 8th. Bristol, Newport, Swansea, and Birmingham will follow, after which he will go to Lancashire, Ireland, and Scotland.

The Metallic Electrical Engineering Co., Ltd., of Birmingham, desire to inform the trade that Mr. W. T. Bower is not now acting on their behalf.

New Year Honours.—In the New Year Honours List we observe that Mr. Percy W. L. Ashley, Assistant Secretary, Department of Industries and Manufactures, Board of Trade, is appointed a C.B. (Civil Division). Mr. Edward Raven, Assistant Secretary to the G.P.O., receives a similar honour. Mr. James Fraser, M.Inst.C.E., Chief Commissioner for Railway and Tramways, New South Wales, appears in the Colonial Office List with the appointment of C.M.G., as does also Mr. W. R. Morris, I.S.O. Secretary, Post and Telegraph Department, New Zealand.

Roll of Honour.—Lance-Corporal L. A. Knight, S. Wales Borderers, who has died in hospital at Rouen from wounds received in action, was with the St. Helens Cable & Rubber Co., Ltd., Warrington.

Second Air Mechanic G. Penketh, R.A.F., who has died from influenza in France, was an armature winder with Messrs. J. P. Hall & Co., Ltd., Oldham.

Lieutenant G. T. Lyall, Canadian Home Army, who has been awarded the Victoria Cross for most conspicuous bravery and skilful leading during the operations north of Cambrai on September 27th, is 26 years of age, and a native of Manchester. He was trained as a naval engineer, but owing to deafness left the service, and in 1912 went out to Canada as an electrical engineer.

Lance-Corporal H. Stanley, R.E., who was employed in the Bradford Post Office engineering department, has been awarded the Military Medal.

Obituary.—Mr. Stephen Sellon.—We regret to learn that the death occurred suddenly on December 22nd, from heart failure, of Mr. Stephen Prescott White D'Alte Sellon, M.Inst.C.E., the well-known consulting engineer, of Westminster. In the years of his engineering training he was brought into contact with marine and railway engineering and main drainage work, but about 35 years ago he began to take an interest in electric tramway and light railway work, and this interest extended to several practical schemes, and was continued in his capacity as a consulting engineer. Some of his early operations in this connection included the first piece of electric trolley line at Leeds; later he was concerned with the manufacture, by one of the principal electrical engineering companies of the time, of electric traction material. He also acted as engineer to the British Electric Traction Co., Ltd., for some years. He was selected at different periods to serve on Government commissions such as those investigating Irish industrial developments and tramway traffic questions. Several years ago he gave evidence before a Parliamentary Committee regarding the public economies that would result from a policy of co-operation between gas and electric lighting undertakings.

Mr. E. Cunliffe Owen.—We learn with regret of the death of Mr. Edward Cunliffe Owen, C.M.G., which has occurred at Loughborough, at the age of 61 years, after a very long illness. Mr. Cunliffe Owen was called to the Bar in 1880, but he will be remembered in electrical circles by reason of his long connection with the Metropolitan Electric Supply Co., of which he was secretary, and the active part that he played in some of the electrical exhibitions held in London not very many years ago.

Sir J. Baxter Ellis.—There has passed away at Newcastle-upon-Tyne Sir Joseph Baxter Ellis, who was a member of the City Council there for some 38 years, was the first mayor of the city, and was brought into touch with some of our readers during the five years of his chairmanship of the Tramways Committee. He was 76 years of age.

Mr. J. Hubert Davies.—We regret to learn that Mr. J. Hubert Davies, chairman of Messrs. Hubert Davies & Co., Ltd., passed away at Capetown on December 12th. Mr. Davies, who was only 61 years of age, and was an M.I.E.E., M.I.M.E., A.M.I.C.E., &c., was in his early days a designer in the offices of Woodhouse & Rawson. About thirty years ago he went out to South Africa for Messrs. Farrar Bros. in connection with certain electrical mining installation, and thenceforth South Africa became his home. At first he acted in a consulting engineering capacity, but later he turned his attention to the commercial side, and entered into partnership with Mr. Spain, forming the firm which became so well known, and which was subsequently converted into a limited company. The concern carried out public and private electrical and engineering contracts of considerable magnitude, and the company had headquarters at Johannesburg, with branch offices in London and at Cape Town, Durban, and Salisbury. The strain of a very busy and enterprising life told upon him to such an extent that his health had been failing for a number of years, and we understand that the end when it came in December was not a surprise to those in his immediate circle.

Mr. Thomas Mangnall.—The death occurred on December 19th, at the age of 68 years, of Mr. Thomas Mangnall, of Manchester, for twenty years secretary of Electromotors, Ltd., Openshaw.

Mr. A. E. Greville.—The *Times* records the death, at the age of 72 years, of Mr. A. E. Greville, an Isle of Wight solicitor, who followed science as a hobby, and is described as "the inventor of the Greville electro-thermic treatment which is still in use at Harrogate, Bath, and Buxton."

Will.—The late Mr. J. F. G. Parsons, R.F.A., who was killed in April last, director of Messrs. C. A. Parsons & Co., and the only son of Sir C. A. Parsons, left £11,418 gross.

NEW COMPANIES REGISTERED.

Homo, Ltd. (152,306).—Private company. Registered December 19th. Capital, £2,000 in £1 shares. Electrical and general engineers, manufacturers, importers, exporters of and dealers in machinery and tools, &c. The subscribers (each with one share) are:—A. Rist, 53, Cecile Park, Crouch End, N. 8, engineer; A. C. Doo, 33, Ferme Park Road, N. 4, engineer. First directors: A. Rist and A. C. Doo. Registered office: 24-27, Rood Lane, E.C. 3.

Integral Oxygen Co., Ltd. (152,332).—Private company. Registered December 20th. Capital, £16,000 in 10,000 non-cum. pref. shares of £1, and 12,000 ord. shares of 10s. each. To acquire the interest of Arthur Lyon & Wrench, Ltd., in their agency arrangement with the International Oxygen Co. of the U.S.A., to take a licence from the American company to this company to manufacture and sell certain patent apparatus, to acquire any interest in inventions relating to electrolytic apparatus for the production of oxygen and hydrogen. The subscribers (each with one pref. share) are:—T. L. Reed Cooper, 10, Gordon Road, Ealing, electrical engineer; E. L. W. Byrne, 29, Gainsborough Road, Bedford Park, W. 4, engineer. First directors: H. T. Wrench, E. L. W. Byrne, T. L. Reed Cooper, and a nominee of the International Oxygen Co. of U.S.A. Manager: E. L. W. Byrne. Registered offive: 38, Victoria Street, S.W.

British Overseas Supplies, Ltd. (152,347).—Private company. Registered December 21st. Capital, £20,000 in £1 shares. Importers, exporters, merchants, and factors of goods and merchandise of all kinds, &c. The subscribers (each with one share) are:—F. J. Robinson, 91, Holyhead Road, Coventry, engineer's sales manager; W. Seal, 67, Wentworth Road, Harborne, Birmingham, electrical and mechanical engineer. First directors: F. J. Robinson, W. Seal, and S. T. Peirson. Solicitors: Browetts, Coventry.

Liverpool Copper Wharf Co., Ltd. (152,354).—Private company. Registered December 21st. Capital, £2,500 in £1 shares. To take over the business of James Lewis & Son's Copper Wharf Co., Ltd., hitherto carried on in Liverpool (now in liquidation), and to carry on the business of wharfingers of copper, silver, and other ores, precipitate regulas matte, and other metalliferous products, &c. The first subscribers (each with one share) are:—A. H. Lewis, Danesfield, Marlow, Bucks., gentleman; G. D. Lewis, 5, Fenwick Street, Liverpool, merchant. First directors: A. H. Lewis, G. D. Lewis, and J. A. Wilson. Registered office: 5, Fenwick Street, Liverpool.

Calworth, Ltd. (152,394).—Private company. Registered December 24th. Capital, £1,000 in £1 shares. Manufacturers of and dealers in electrical and other accessories, instruments, appliances, and novelties, &c. The subscribers (each with one share) are:—H. C. Caldecourt, 18, Brookfield, West Hill, Highgate, N. 6, pianoforte factor; A. V. Butterworth, 13, Allison Road, Acton, W. 3, engineer. The first directors are: H. C. Caldecourt and A. V. Butterworth. Acting secretary: A. H. Howard. Solicitor: B. F. Browne, 17, Hart Street, Bloomsbury, W.C.

International Electrical & Mechanical Supplies Co., Ltd. (152,370).—Private company. Registered December 23rd. Capital, £500 in £1 shares. To carry on in Birmingham or elsewhere the business of manufacturers of, dealers in, and lettors to hire, repairers, cleaners, storers, and factors of electrical and mechanical contrivances, machinery and accessories, and lubricants, cements, solutions, and enamels for use therewith, manufacturers of articles in wood, metal, composition, cement, china, plaster, celluloid, pulp, paper, and cardboard, builders and owners of motor cars, aeroplanes, ships, and vessels and their fittings, &c. The subscribers (each with one share) are:—G. W. Griffith, 57, Soho Road, Handsworth, Birmingham, accountant; A. J. Lytheer, 66, Newman Road, Erdington, engineer. The subscribers are to appoint the first directors. Registered office: 40, Herald Chambers, Martineau Street, Birmingham.

John Thompson (Dudley), Ltd. (152,333).—Private company. Registered December 20th. Capital, £100,000 in £1 shares. Engineers, founders, smiths, machinists, inventors, designers, and manufacturers of boilers of all kinds and parts thereof, manufacturers of roofing, bridges, tanks, cisterns, galvanising baths, iron and steel canal or other boats, creosoting cylinders, forgings, tubes, pipes, requisities for railways and tramways, sporting and athletic goods, anti-fouling compositions, soaps, fats, and oils, &c. The subscribers (each with one share) are:—J. Thompson, Ettingshall, Wolverhampton, engineer; A. E. Thompson, Ettingshall, Wolverhampton, engineer. Permanent governing directors: J. Thompson, A. E. Thompson, W. J. Thompson, and S. J. Thompson.

John Thompson (Motor Pressings), Ltd. (152,334).—Private company. Registered December 20th. Capital, £100,000 in £1 shares. Objects: As title. Power is also taken to carry on various businesses similar to John Thompson (Dudley), Ltd. The subscribers and directors are the same as in the last-named company (q.v.).

John Thompson (Wolverhampton), Ltd. (152,345).—Private company. Registered December 20th. Capital, £230,000 in £1 shares. Objects and other particulars similar to John Thompson (Dudley), Ltd. (q.v.)

Leonard G. Tate & Co., Ltd. (152,372).—Private company. Registered December 23rd. Capital, £1,000 in £1 shares. Electrical, mechanical, and hydraulic engineers and contractors, brass founders, metal workers, tool makers, mechanists, metallurgists, &c. The subscribers (each with one share) are:—R. L. Tate, Sylata, North Park Gardens, Gerrards Cross, underwriter; L. G. Tate, Vineyard House, Richmond, Surrey, electrical engineer; A. E. Catchpole, 17, Broxham Road, West Norwood, electrical engineer. First directors: R. L. Tate and A. E. Catchpole. Registered office: 20, Bucklersbury, E.C.

CITY NOTES.

French Companies.

The Société Industrielle des Téléphones reports that despite many difficulties encountered in procuring coal and other raw materials, a further increase was made in the number of manufactures produced in 1917-18. An extension of the telephone works in the Rue des Entrepreneurs was made, and further expansion was projected as soon as circumstances would permit. Owing to the exceptional depreciation of the machinery and plant—through intense working, it was necessary to write off £100,000, leaving net profits of £168,000. The sum of £52,000 has been placed to the reserve of the contingency fund, and a dividend declared at the rate of £1 12s. per share.

The directors of *The Electro-Métallurgie de Dives*, reporting on the year ended on June 30th, 1918, state that business with private customers remained very limited, the company's activity having continued to apply to manufactures for the national defence. New manufactures were undertaken at the instance of the Army authorities, including the production of tubes of duralumin, which was the property of one of the company's subsidiaries, but this branch would be discontinued as soon as the Government demand came to an end. Including £9,800 brought forward from 1916-17 the accounts show net profits of £178,000, and a dividend at the rate of £2 8s. per share has been declared. The reserve fund has been increased by £40,000 to £280,000, and the sum of £29,000 has been carried forward to 1918-19.

The report of the *Compagnie Générale d'Electricité* for 1917-18 states that all the manufacturing works suffered from the restrictions and the transport difficulties, and two works on military contracts were stopped at the request of the Ministry of Armaments. The liberation of Lille revealed the fact that the important Thumesnil works had been completely damaged and pillaged by the enemy, and the network of the Amiens Electricity Co. also was greatly damaged. As net profits the accounts indicate the sum of £192,000, as compared with £162,000 in 1916-17, and the dividend is at the rate of £2 per share on the whole of the share capital, whereas in the previous year the 50,000 old shares received £2 per share and the new shares £1. It is now proposed to increase the capital from £1,400,000 to £2,000,000.

Edison Swan Electric Co., Ltd.

The annual meeting was held on Monday at Winchester House, E.C. Mr. C. J. Ford, who presided, said that the gross profit for the year was over £100,000 in excess of that of the previous twelve months. The net profit, after allowing for the usual charges, was in excess of that earned for many years past, and amounted to £130,000. Unless the additional capital which was provided by the issue of preference shares had been available, such results would not have been possible. That achievement had been augmented by the gradual improvement of the company's plant and organisation. The negotiations with the Revenue authorities relating to the excess profits duty had been of a protracted nature, and had the original claim not been greatly modified there would have been no possible chance of the directors being in a position to recommend the payment of a dividend on the ordinary shares. As to the future prospects of the company, now that peace had come, all they asked was to be allowed to carry on their business in their own way, free from any interference or control by Government departments. Manufacturers had patiently submitted to all manner of petty and annoying restrictions and interference by officials, who in most instances had previously had no commercial training, without complaint, feeling that in calmly submitting they were doing their bit and helping to win the war, and as far as that company was concerned, they had placed the whole of their resources at the disposal of the country. It was to be hoped that the Government would find some means of raising revenue other than the present excess profits duty, or that in any event the tax would be very substantially reduced, as such a tax was a serious deterrent to industrial development. If an arrangement could be come to under which shareholders should receive, first a reasonable return upon their capital, and, after fair reserves were provided, the balance went to the Government, it would be a far more equitable arrangement than the present. If this country was to keep its place in the commercial world, large sums would be required for new industries, and if the present ratio of excess profits tax, or even anything like it, was to remain in force, new enterprises would be strangled in their inception—in fact, he did not think the money would be forthcoming to give effect to them. An equally important question was the dumping in this country of foreign goods to be sold here at prices in most cases below that at which they were produced. Before the war that process particularly affected the electrical industry, but reading between the lines from statements which had been made by responsible Ministers, it seemed as if at last the Government had become alive to the importance of the question, and he thought that the shareholders would agree that some form of modified tariff was necessary and should be one of the first measures of the new Parliament. Against that, however, he might say that quite recently an inquiry had been sent out by one of the departments of the Board of Trade to the electric lamp manufacturers of this country, asking if there was any immediate prospect of the importation of smaller candle-power lamps in order to save electric current, and suggesting that these should be obtained from Holland as the seas were now open. That was not very encouraging or promising. English lamp manufacturers were perfectly able to make smaller candle-power lamps, and no doubt they would have done so long before this, except for the fact that the whole of their lamp output was under the control of the Government, and a very large proportion of their production was requisitioned by the Government. He mentioned that fact in order that shareholders might be aware of the treatment which the electrical industry, and probably many other industries, were likely to receive at the hands of certain Government departments unless the interests affected took a strong stand. The board had in view a general policy of expansion, feeling, as they did that in the near future if a company like that intended to hold its own it must be in a position to supply direct from its own factories practically every class of electrical goods from the smallest to the largest. That would necessitate the employment of further capital, and it was therefore the intention of the directors to make a further issue at an early date. In connection with their schemes of expansion it would interest them to hear that the directors had practically concluded negotiations for obtaining a large interest in a well-known and old-established firm of cable and electrical wire manufacturers, and in view of the more than probability of the nationalisation of the railways of this country, and the further probability that if this came about, a great impetus would be given to the electrification of the existing lines, they were hoping that, apart from the participation in what was already a profitable business, their association with the firm in question would prove beneficial to the company. They were also carrying on negotiations which, if successful, would give them an important interest in the manufacture of all classes of heavy electrical machinery. His colleague, Mr. Gimingham, was shortly proceeding to the United States for the purpose of negotiating terms of manufacture and sale by the company of a well-known electrical contrivance for which they hoped to obtain a large sale. Having referred to the extensions which the company was carrying out at Ponders End, the chairman concluded by paying a tribute to Mr. Hunter and the staff generally for the zealous way in which they had conducted the affairs of the company during the past year, and which had contributed to the satisfactory balance sheet they were able to present.

Mr. E. B. Ellice-Clark, in seconding the motion, endorsed the remarks of the chairman regarding the services of Mr Hunter and the staff, and said that the work of Mr. Ford and the other directors also deserved special mention.

The report was adopted.

Alldays & Onions Pneumatic Engineering Co., Ltd.—The accounts for 1916, 1917, and 1918 cannot yet be presented. For the year ended August 3rd last a further interim dividend at the rate of 7½ per cent. (making 10 per cent. per annum) is recommended; also a further interim participating dividend on the 6 per cent. "B" cum. pref. shares at the rate of 1 per cent. (making 7 per cent. for the year). No further dividend in respect of the last financial year is recommended. The name of the company is shortly to be changed to Alldays & Onions, Ltd.

Cordoba Light & Power Co., Ltd.—Notwithstanding the strike of the tramway employés, there was an improvement in the results during the year to September 30th, 1918, of £32,038. This has resulted in a profit of £14,317 after meeting interest on the debenture stock and promissory notes, as compared with a loss of £17,721. The improved result is due in part to the extension of the electric supply business, but chiefly to the increased supply of water in the San Roque dam and the corresponding reduction in steam operation. But for the strike of the tramway employés the improvement would have been more marked. According to the *Financial Times*, it has been found necessary to postpone the issue of the annual report until it will include the accounts up to March, 1919.

West Kootenay Power & Light Co.—Year ended August 31st, gross receipts, $614,819; operating expenses, $181,891; net balance, $432,927. Dividends 7 per cent. on preferred and 8 per cent. on the common stock; $93,274 put to plant depreciation reserve. A meeting of shareholders last July increased the authorised capital stock from $2,500,000 to $5,500,000.

Humphrey Pump Co., Ltd.—The directors' report for the year mentions a continuance of adverse conditions due to the war. The financial results, although showing a small loss, are substantially better than those of the previous year. In view of the exceptional circumstances the directors have not drawn their fees.

Stock Exchange Notice.—Dealings in the following have been approved by the Treasury:—North Metropolitan Electric Power Supply Co., £250,000 6 per cent. cumulative preference shares of £1 each, Nos. 349,981 to 599,980, and £9,980 6 per cent. cumulative preference stock

Cork Electric Tramways and Lighting Co., Ltd.—According to the *Financial Times*, payment of dividend on the preference shares will be postponed until completion of 1918 accounts.

Manila Electric Railroad & Lighting Corporation.—Dividend of 1½ per cent. for the quarter to December 31st on the common capital stock.

Yates & Thom, Ltd.—Dividend of 7½ per cent. on the ordinary shares.

Lima Light, Power & Tramways Co.—Dividend 1½ per cent.

STOCKS AND SHARES.

New Year's Eve, 1918.

Just at the end of last year, 1917, appeared the interim report of the Coal Conservation Sub-Committee on the supply of electric power in Great Britain. Sweeping suggestions were made by the Committee for the amalgamation of authorities, and it was estimated that a saving of 100 million pounds in cash and 55 million tons of coal could be effected under the scheme proposed. From the point of view of the Stock Exchange market, these suggestions have had no effect whatever. They were too large for imagination to grasp during the war period, and it was felt that nothing practical was likely to be put into operation until Peace had been signed and the country had settled down again. Still, the Committee's first report has remained steadily in view, and has been supplemented by others which tend to bring the scheme into a nearer focus. The new Parliament may be called upon to deal before very long with the whole question from a national standpoint, and 1919 may see developments of the greatest interest to all those concerned in the subject.

Throughout the greater part of the year the market for electricity supply shares has been quiet and dull, but as the blessed figure of Peace came more clearly into the picture, there was a greater disposition to pick up shares, and prices advanced substantially. The railway stocks have been swayed on the one hand by labour troubles, and on the other by the prospects of nationalisation. Both these factors have played more or less indirectly upon the Undergrounds, though they have had a material influence over quotations of other railway stocks. In the Telegraph market a steady improvement has taken place, and, with the further rise in the Income Tax, attention has been more and more directed to stocks and shares upon which the dividends are paid tax free. In the foreign group, Mexicans have provided the most lively features. Prices have been run up and down, according to the hopes and fears as to settlement in the country; but on balance, the former have greatly prevailed, and Mexico Tramway 5 per cent. Bonds, which were 27½ a year ago, are now all but 40 points higher, while Mexican Light and Power Preferred shares, which were 29, have added 20 points to their price in the interval. The Anglo-Argentine Tramways group is also decidedly better, and British Columbia Electric stocks, which gave way heavily during 1917, have more than recovered their losses, the Deferred stock, which was 28 a year ago, now being 17 points up. Amongst Manufacturing shares, various schemes of capital rearrangement and bonus distributions of shares have taken place, with the result that prices stand considerably higher, actually, after making the necessary allowances. We append a few of the principal changes throughout the year in the various markets dealt with in these notes :—

Stocks or Shares.	Dec. 31st, 1917.	Dec. 31st, 1918.	Rise or fall.	Ordinary Shares.	Dec. 31st, 1917.	Dec. 31st, 1918.	Rise or fall.
HOME ELECTRICITY COMPANIES.							
Brompton ..	6½	7¼	+ ¾	London	1	1⅜	+ ⅜
Charing Cross ..	4	3⅝	— ⅜	Metropolitan ..	3¼	3	— ¼
Chelsea	2¾	4	+ 1¼	St. James' ..	7	7⅛	+ ⅛
City of London ..	13¼	13	— ¼	South London ..	3	3	—
County of London	11	11⅛	+ ⅛	Westminster ..	6⅜	7¼	+ ⅞
Kensington ..	5⅜	5⅞	+ ½				
TELEGRAPHS AND TELEPHONES.							
Ang.-Am. Pref. ..	95½	99	+ 3½	Indo-European ..	52½	58½	+ 6
Cuba Submarine	9¼	10½	+ 1¼	Marconi	3⅜	4¾	+ 1⅜
E. Extension ..	15	15½	+ ½	United R. Plate..	6 13/16	7⅞	+ 1 1/16
E. Telegraph ..	150½	157½	+ 7	W. India & Pan.	1 1/16	1 13/16	+ ¾
Globe Tel. Ord. ..	13¾	14¼	+ ½	Western Teleg. ..	15¼	16½	+ 1¼
Great Northern ..	36	33	— 3				
HOME RAILS.							
Cen. Lon. Assen.	60½	65½	+ 5	Under. Ord. ..	1⅞	3⅜	+ 1½
Metropolitan ..	22¼	31½	+ 9¼	do. "A" ..	5/-	8/9	+ 3/9
Met. District ..	16	26	+ 10	do. Income ..	81	92½	+ 11½
FOREIGN TRAMS., &c.							
A. Arg. Tr. 1st Prf.	2⅝	4 1/16	+ 1 7/16	Mex. Trams. 1st	27½	67	+ 39½
Brazil Traction..	45	57	+ 12	Mex. Light Com.	17½	38	+ 20½
B. Col. Elec. Prf.	42½	67½	+ 25	do. Pref. ..	29	49	+ 20
do. Preferred..	30	50	+ 20	do. 1st	32½	70	+ 37½
MANUFACTURING.							
Babcock & Wilcox	3¼	3 11/16	+ 7/16	Elec. Construct...	1⅛	1¼	+ ⅛
Brit. Aluminium	1 13/32	1 11/16	+ 9/32	Gen. Electric ..	19¾	17½	— [illegible]
B. West. Pref. ..	2 11/16	2⅝	— 1/16	Henleys	16½	2¼	+ 8½
Callenders ..	14½	10½	— 4	India-Rubber ..	14¼	17	+ 2¾
Castner-Kellner..	3 13/32	3⅜	— 1/32	Telegraph Con. ..	41½	48	+ 6½

After-war problems there will no doubt be many during the coming year, as the country changes over from war conditions to those of peace. There should be, however, wide scope for expansion in most industrial directions, and the expectation that electrical undertakings will take a full share in these developments lends sincerity to the offer of all good wishes for a very Prosperous New Year.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Dec. 31, 1918.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	7½	—	£6 18 0
Charing Cross Ordinary	5	4	3⅝	+ ⅛	5 10 4
do. do. do. 4½ Pref...	4½	4½	3⅜	—	6 13 4
Chelsea	3	5	4	—	6 5 4
City of London	8	8	13	—	6 3 1
do. do. 6 per cent. Pref. ..	6	6	10⅛	—	5 18 5
County of London	7	7	11⅛	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	5⅞	—	5 19 2
London Electric	Nil	Nil	1⅜	+ ⅛	Nil
do. do. 6 per cent. Pref...	4	5	4	—	6 5 0
Metropolitan	3	4	3	— ¼	6 13 4
do. 4½ per cent. Pref. ..	4½	4½	3¼xd	—	6 18 6
St. James' and Pall Mall	8	9	7⅛	—	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	7	9	7¼	+ ⅛	6 4 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23⅜	—	6 9 6
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	157½	—	*5 1 7
Globe Tel. and T. Ord.	7	7	14¼	—	*4 16 5
do. do. Pref.	6	6	10¼	—	5 14 3
Great Northern Tel.	24	22	33	— ½	6 13 4
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4¾xd	+ ⅛	4 4 2
Oriental Telephone Ord.	10	10	2¼	—	4 9 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	6d.	1/3	1 11/16	—	*3 12 6
Western Telegraph	8	8	16½	+ ¼	*4 17 0
HOME RAILS.					
Central London Ord. Assented ..	4	4	65½	—	6 2 2
Metropolitan		1	31½	+ 1	3 5 6
do. District	Nil	Nil	25	—	Nil
Underground Electric Ordinary..	Nil	Nil	3⅜	—	Nil
do. do. "A" ..	Nil	Nil	8/9	— 3d.	Nil
do. do. Income ..	6	4	92½	+ 1½	*4 6 6
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	4 1/16	—	—
do. do. 2nd Pref. ..	5½	—	3⅞	+ ⅛	—
do. do. 5 Deb... ..	5	5	74½	— 1	6 14 3
Brazil Tractions	—	—	57	+ 1	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	50	— 2½	Nil
do. do. Deferred	Nil	Nil	45	— 1½	Nil
do. do. Deb. ..	4¼	4¼	52	—	6 17 3
Mexico Trams 5 per cent. Bonds..	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	63½	— 2½	Nil
Mexican Light Common	Nil	Nil	38	—	Nil
do. Pref.	Nil	Nil	49	—	Nil
do. 1st Bonds.. ..	Nil	Nil	70	— 1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3 11/16	— 1/16	4 1 4
British Aluminium Ord.	10	10	1 11/16	+ 1/16	5 8 1
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref. ..	7½	7½	2⅛	— ⅛	6 0 0
Callenders	20	25	10½		5 19 1
do. 5 Pref.	5	5	5⅜xd	—	5 2 4
Castner-Kellner	22	20	3⅜xd	—	5 18 6
Edison-Swan, "A"	—	—	1	+ 1/16	7 10 0
do. do. 4 per cent. Deb. ..	4	4	71½xd	—	6 6 0
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10⅜xd	—	5 5 1
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2¼	—	5 11 2
do. 4½ Pref..	4½	4½	4	—	5 12 6
India-Rubber..	10	10	17xd	—	*5 17 8
Telegraph Con.	20	20	48	—	*5 0 0

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 1st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£77	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£60	..
a Potash, Chlorate	per lb.	2/1	..
a " Perchlorate	"	1/9	..
a Shellac	per cwt.	£17 10/-	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	"	£21	..
a " Lump	"	£26	..
a Soda, Chlorate	per lb.	1/1	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	..	..
c " Tubes (solid drawn) ..	"	..	..
c " Wire, basis	"	..	..
c Copper Tubes (solid drawn) ..	"	1/7¾	..
g " Bars (best selected) ..	per ton	£150	.
g " Sheet	"	£150	.
g " Rod	"	£150	.
d " (Electrolytic) Bars ..	"	£121	£3 dec.
d " " Sheets ..	"	£161	
d " " Wire Rods	"	£132	£3 dec.
d " " H.C. Wire	per lb.	1/3¾	½d. dec.
f Ebonite Rod	"	3/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	3/7½	4d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£37	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	9d. to 1/6	.
e " " " medium	"	5/- to 10/-	..
e " " " large ..	"	12/6 to 25-/& up.	..
			..
d Silicium Bronze Wire	per lb.	1/8	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	..	..
n " Wire, Nos. 1 to 16	per lb.	4/3	3d. dec.

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Something in the Stew.—Messrs. Johnson & Phillips, Ltd., the well-known cable manufacturers, have received from one of their business friends in the North an extract from a letter from "Somewhere in France":—

"Food, also, is nothing to growl about, even though you do find something in your jam tin full of stew, which turns out to be a piece of Johnson & Phillips's cab tire sheathing. Our cook is a good advertiser; he said, in reply to our query, 'Nothing but the best goes into *my* stew.'"

In passing us this communication, Messrs. J. & P. remark that they have heard of many of their manufactures being used for other than their legitimate purposes, but they think this is the first occasion on which anything they produce has been utilised as an ingredient for stew. Such is the penalty of quality—the toughness of the material in question was evidently an irresistible temptation to the Army cook, who naturally despaired of ever finding meat to match it.

British Scientific Products.—In accordance with the plan previously announced in our pages, the Exhibition of British Scientific Products, which was so successfully held in London last autumn, has been taken *en bloc* to Manchester, where it is housed in the College of Technology. This proceeding has been made possible by the public-spirited action of a number of Manchester business men, who have contributed to a guarantee fund. The Exhibition was opened on December 27th, and will remain open till January 9th. The exhibits, for the most part, are identical with those shown in London, which were reviewed in our columns at the time.

An E.T.U. Dispute. A dispute is in progress in the North Lincolnshire ironstone area between employers and members of the Electrical Trades Union. It appears that 160 men "downed tools" last Friday, affecting, it is said, about 6,000 workers, because the employers would not agree to certain demands without arbitration. The demands were for an increase from 9½d. to 1s. per hour, together with all awards granted by the Ministry of Munitions and the Committee on Production. One report states that the employers offered a concession which would bring the men concerned into line with Sheffield rates, which are fully equal to rates paid in iron and steel works throughout the country.

CARBON BRUSHES: CONSIDERED IN RELATION TO THE DESIGN AND OPERATION OF ELECTRICAL MACHINERY.

By P. HUNTER-BROWN, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from Vol. 83, page 640.*)

Selection of Grade.—The available grades of brushes may be divided into four classes: graphite, carbon, electro-graphitic and copper-graphite. The first mentioned consist of practically all natural graphite and are distinguished by their very high electrical and thermal conductivity and low coefficient of friction. Their sphere of use is primarily on high-speed commutators and on slip-rings if the current density and radiating surface permit.

The carbon grades may contain a considerable proportion of graphite at one end of the series, diminishing to no graphite at all at the other end. Generally speaking, they have a higher contact drop than graphite brushes.

The electro-graphitic brushes are made from carbon which after kilning is converted (including the binding material) into artificial graphite in the electric furnace. The characteristics of the material are radically changed by this treatment. The electrical and thermal conductivities are greatly increased, and the material becomes softer, yet can be made very tough. It also becomes very much more refractory; such brushes are therefore specially useful where circulating currents are excessive or overloads severe; this class is largely used for traction work. Heavy circulating currents can be controlled to a certain extent by using a high-resistance brush, but it not infrequently happens that the surface of the brush is eaten away by the action of such currents, and it is then necessary to employ a highly refractory brush. The copper-graphite brushes contain copper, with or without other metals, and graphite to the extent of from 5 to 60 per cent. This series of brushes is required for slip-ring work and to a certain extent for low-voltage plating and similar dynamos. It is characterised by its low-contact drop and high-carrying capacity.

The most important property of a brush is its current-carrying capacity. The actual current in a brush is usually very different from the nominal owing to the large number of disturbing influences. In the case of carbon brushes in parallel, the two parallel parts each consists of contact, brush material, connection of brush to flexible, flexible and terminal connection. The contact resistance is normally greater than the sum of the other four components, and the contact drop is by no means proportional to the current. A roughness on the commutator, a little dust under a brush, or some similar cause might easily raise the contact-drop curve of an individual brush sufficiently to cause it to take only half as much current as its neighbour.

Another fruitful cause of unequal load distribution is unequal pressure applied to the brushes. Fig. 2 (Vol. 83, p. 639) gives a curve of contact drop plotted against pressure applied to the brush. The same positive brush as was used in that test was also tested for contact drop at various current densities, first at 1½ lb. per sq. in. and then at 5 lb. per sq. in. The resulting curves are drawn in full lines in fig. 4.

In the case of two sets of brushes, say 2 in. long × 1 sq. in. section operating in parallel, the total drop in the terminal, flexible connection and material at 40 amps. per sq. in. would be about 0.2 volt, and would vary directly as the current. The broken line curves in fig. 4 include this extra drop, and thus show the total brush drop at 1½ and 5 lb. per sq. in. respectively. If the two brushes were nominally working at 40 amps. per sq. in. it is evident from the curves that the total current of 80 amps. would be divided between the two brushes in the proportion of 24 to 56. It is not uncommon in practice to meet with variations of pressure as great as 1½ to 5 lb. on the same machine. The different brushes on one spindle or on one slip-ring may share the load very unequally, and with a wave-wound armature for the same reason there may be very unequal distribution of load between spindles of the same polarity.

In practice we do not get ideal straight-line commutation, with the result that the distribution of current across the face of the brush is very unequal, in fact, very often an actual reversal of current occurs, current flowing into the brush at one part and out at another.

The carrying capacity of a brush is determined by its permissible temperature rise. The loss in the brush does not depend solely upon the nominal current, and the facilities for dissipating the heat generated are very indeterminate. Any figures given in brush manufacturers' schedules can only afford an approximate guide, and their chief value is relative. Indeed, the latter may be said of all brush data, since the brush itself is only one of many factors entering into the problem.

In the case of turbo-alternator rings the peripheral speed sometimes appears to be unnecessarily high. The diameter of the rings is sometimes made larger than the shaft demands, and there is certainly no need to push out the diameter in order to obtain sufficient radiating surface to dissipate the heat. To meet the altered conditions introduced by turbo machinery it has been necessary to develop new grades of brushes. The characteristics required are a low coefficient of friction, high carrying capacity, and absence of abrasiveness, also preferably low inertia as well. This restricts the selection to brushes in the graphite class.

Built-up mica precludes the possibility of a hard spot extending right through the sheet, and in this respect it is to be preferred to the pure sheet. On the other hand, excess of the adhesive used may lead to trouble. On high-speed commutators (and be it noted the majority of brush problems are concerned with such) the mica is invariably recessed.

In the case of slip-rings, the composition of the material used has an important bearing upon the behaviour of the brushes. Many mixings have been tried, and doubtless there is little to choose between several, but it may be mentioned that Admiralty gunmetal (88 per cent. copper, 2 per cent. zinc, 10 per cent. tin) has been found excellent in every way. Steel and malleable iron possess marked disadvantages. Their thermal conductivity is lower, and even when clean the contact drop with iron or steel is some 30 per cent. greater than with bronze. Also "flats" are very apt to develop.

If the current to be collected is large, low contact drop becomes of special importance, and a highly metallic grade must be chosen. If the current is comparatively small, and the ring surface relatively liberal, it is frequently advantageous to use a pure graphite brush.

Laboratory tests are of great assistance, especially when studied in relation to the performance of the grade under actual operating conditions. With the help of the necessary data relating to a machine, it is usually possible to select a suitable grade; however, similarly machines exhibit curiously marked idiosyncrasies and demand brushes to suit their individual tastes. The ultimate test as to suitability must be made on the machine itself.

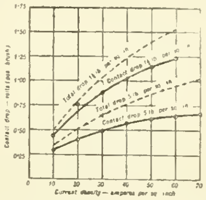


Fig. 4.—Contact Drop of Carbon Brush Containing no Graphite. Speed 3,500 ft. per min.

Operation.—The tendency to chatter is reduced by tilting the brush either against or in the direction of rotation. There appears to be no universally best angle for the brush. Experiments have shown, however, that if the brushes are set trailing, the angle from the radial may advantageously be from 5 to 15 deg., whereas if the brushes are set reaction, it should be considerably larger, say from 20 to 35 deg. When the angle approaches the maximum it is advisable to round off the sharp edge of the brush to prevent it from digging into the edge of the approaching segments. The holders should be set as close as possible to the commutator, say ⅛ in. therefrom. This affords a valuable means of cooling the tip of the brush.

Bedding is an operation that is frequently carried out in a most slipshod manner. The work should be finished with fine carborundum cloth pulled across the face of the brush in the direction of rotation. After bedding, all dust should be carefully removed. The machine should then be run on "no load" for some time, and the current gradually increased so that it is not out of all proportion to the amount of the contact between brush and collector. The pressure should be as uniform as possible, and a suitable spring balance should be used for definitely measuring this. The two primary difficulties in operating brushes are to maintain intimate contact between brush and collector and to ensure a reasonably equal distribution of current between the various brushes. Fig. 2 (Vol. 83, p. 639) shows that to prevent the latter trouble arising the pressure must be made uniform throughout. The actual value should be the minimum required to maintain efficient contact between brush and collector. This will vary from 1½ lb. in a well-balanced turbo dynamo to about 2 lb. in an ordinary industrial motor; whilst in a traction motor subject to severe vibration the pressure required may be as much as 6 lb. per sq. in., or even more. To prevent the formation of ridges on the commutator the brushes should be staggered. The correct method of doing this is explained in the lower portion of fig. 5.

It is highly inadvisable to mix different grades indiscriminately on the same machine. Occasionally with difficult commutating machines or with very low-voltage dynamos it may prove advisable to mount brushes of one quality in all the positive holders, and of another quality in all the negative holders. Also, in the case of slip-rings a few graphite brushes are sometimes mounted on the same ring with metallic brushes; the sole function of the graphite brushes is to lubricate the ring. Owing to their contact drop being so much higher than that of the metallic brushes they will carry no current whatever, and therefore incidentally there is no need to fit such brushes with flexibles.

The rate of wear of the collector is dependent upon the material it is made of, the quality of the brush, current density, and the intimacy of contact between the brush and collector. If the brush is too abrasive, obviously it will cause excessive mechanical abrasion. On the other hand, if it is insufficiently abrasive to keep the mica flush, copper picking is very likely to result, proud mica being one of the most fruitful causes of this troublesome malady. It is difficult to explain all the phenomena associated with copper picking, but that it is due to something akin to electrolytic action is clear from a consideration of the following:—

If a commutator is equipped with brushes arranged so that the positives and negatives sweep different tracks, and if the machine is run with no current, the two halves of the commutator will maintain the same appearance, and the wear caused by abrasion will be relatively very slight. If then current is passed through the armature the portion of the commutator under the positive brushes (speaking in a motor sense) will assume a dark polished appearance, as though carbon or graphite from the bushes passed in the direction of the current and were deposited on the surface of the copper. The portion of the commutator under the negative brushes will retain a bright coppery colour and become more or less raw in appearance. The rate of wear under the negative brushes will be very much increased compared with that observed when no current is flowing, perhaps by several hundred per cent., showing that, due to the action of the current, particles of copper are passing away from the surface of the commutator in the direction of the current flow. The minute particles of copper passing in the same direction as the current usually do not adhere to the face of the brush, but sometimes they are firmly deposited on the contact surface as though the latter had been copper plated. It is difficult to determine exactly the conditions under which copper will be deposited on the brushes. Undoubtedly the action is promoted by lack of perfect contact between brush and commutator, and it increases with the current density. Poor contact may result from insufficient pressure, chattering, or more frequently from high mica. If in addition to poor contact between brush and copper the current density is high, the conditions are favourable for deposition of copper on the brush, and when once the first speck is deposited the process becomes cumulative.

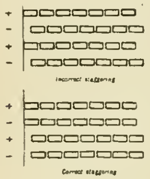


Fig. 5.—Methods of Staggering Brushes.

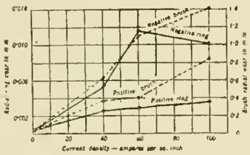


Fig. 6.—Wear of Slip-ring and Brush. Pressure 4 lb. per sq. in.

When brushes are staggered to prevent the formation of ridges on the commutator this should be done so that each track is still swept by an equal number of positive and negative brushes. Fig. 5 shows the incorrect and also correct methods of staggering brushes.

The presence of circulating currents appears to account for the fact that positive as well as negative brushes are liable to become copper coated as circulating currents pass into each brush as well as out of it; it is probable that if it were not for the circulating currents the current density in the brushes would seldom be high enough to bring about the conditions necessary for the deposition of copper.

Where persistent copper picking occurs an improvement may be effected by a change in the quality of the brush on lines suggested by the above; but in general the "electrolytic" action should be reduced to a minimum by ensuring good contact between brush and commutator, and by avoiding excessive current density, whether caused by the working current or by circulating currents. The problem is closely connected with the design of the brush holder, the quality of the mica, the shape of the pole tips, and the various other factors determining the extent of the circulating currents, as well as the density in the brushes due to the working current.

In addition to the electrolytic action described, a certain burning action occurs, even when there is no visible sparking. This is dependent upon the intimacy of contact and current density, and affects both positive and negative. There is a very close connection between the current density and the life of both brush and collector. Fig. 6 shows the relative amounts of wear produced at various current densities by an ordinary carbon brush. The tests were made on bronze slip-rings. The process rapidly becomes cumulative. That excessive commutator wear may be caused by the brushes being insufficiently abrasive to keep the mica flush has been proved repeatedly by overcoming such wear by deliberately replacing the brushes by another quality of a more abrasive character. The wiser course to adopt with large machines, and the absolutely necessary course in the case of very high speeds, is to recess the mica. When this is undertaken, however, the work must be very well carried out or the results will be worse than before. The depth of the groove should not be greater than the thickness of the mica, and the latter should be cleanly removed so as to leave a groove rectangular in section. The edges of the segments should then be very slightly bevelled. The slots should be regularly cleaned out.

When the mica is well recessed a high-grade non-abrasive graphitic brush may be used, and the wear of both commutator and brush is reduced to a minimum.

The rate of wear of the brush also is very largely affected by the current density. In fig. 6 curves relating to pure carbon brushes are given which show how very marked this influence may be.

Modern high-grade graphitic brushes are practically self-lubricating, and wherever possible it is advisable to abstain from applying lubricant to the commutator. Frequently the conditions are rendered unnecessarily difficult through a lack of appreciation of the factors essential to successful operation on the part of the attendant rather than from mere wanton neglect.

Close attention to what may appear trivial mechanical details should be emphasised, for experience shows that it is not as generally recognised as it should be how much the life of both brushes and collector may be increased and the general performance improved in this way.

Commutators are never mathematically circular and a very small mechanical defect is sufficient to cause a momentary separation between the brush and the collector. It is of vital importance that the brush should be free to follow up any slight irregularities. Close attention to the condition of the brushes and brush gear leads not only to a saving in time, but also to a marked reduction in maintenance costs.

Standardisation.—Designers in America are of the opinion that very considerable latitude must be left to them in the selection of brush dimensions. The dimensions of the actual block, however, are only the beginning of the problem. There is the question of fittings to be considered. If brushes are really to be standardised as regards their mechanical design a certain degree of uniformity in the design of holders becomes necessary, so as to permit uniformity in the length and position of flexible, and also in the type and size of terminal. When it comes to a question of quality this would appear to defy all efforts at standardisation, except possibly on exceedingly broad lines. Even standardisation of machine design would not completely eliminate the difficulties here, since the differences in brush properties are so subtle and yet so pronounced in their influence on the behaviour of a machine that it seems fundamentally impossible to harness them in a specification.

A certain measure of standardisation is possible within prescribed limits. Any recommendations that could be applicable to all types of machines, however, must necessarily be on such very broad lines that they could scarcely be described as standardisation. It is therefore wise to proceed by stages, including at first only the mechanical design of the brush and applicable only to machines intended for a certain class of work, such as motors and generators (excluding turbo dynamos) for shipboard use. This is the sphere in which the benefits of standardisation would naturally make themselves most felt, and by proceeding cautiously in this way it may in time prove practicable to introduce recommendations of a more comprehensive character.

FINANCIAL FACILITIES FOR TRADE.

The Committee on the Provision of Financial Facilities for Trade After the War was appointed jointly by the Chancellor of the Exchequer and the Minister of Reconstruction in November, 1917, under the chairmanship of Sir Richard B. Vassar-Smith, of Lloyd's Bank. They introduce their Report (now published by the Ministry of Reconstruction) by expressing the emphatic opinion that the primary factor in repairing the wastage of capital caused by the war lies mainly in increased production and actual saving.

Discussing the financial requirements of industry after the war the Committee foresee:—

(*a*) A considerably more than normal demand for working capital owing to the higher cost of labour and materials, the necessity for giving longer credit, and the anticipated expansion in the volume of trade due to the fact that the basis for potential commercial output, as compared with pre-war output, has been very greatly enlarged during the war by the extension of existing works and the building of a very large number of absolutely new ones.

(*b*) A greater than normal demand for extended credits for the purpose of replacing at higher cost machinery and plant which has fallen into disrepair.

(*c*) Demands in connection with the reconversion of plant and works. These in many cases may be on the border line between working credit facilities and new capital requirements.

(*d*) New fixed capital requirements for extensions or new works.

The Committee point out that the ability of industry to cope with these unusual financial problems during the reconstruction period will be most limited in the case of entirely new firms which have come into existence owing to the demand for war material. They have been urged strongly that it was not in the national interest to allow these firms to peter out, and that every inducement should be given them to continue in business even to the extent, if necessary, of granting State financial assistance. The Committee express the opinion that it might be regarded as unjust to enable such firms by means of State aid to compete with old-established firms in the same industries, and also that it would be very difficult, if not impossible, to guard against wastefulness and inefficient management. The solution in these cases appears to them to lie in the establishment of new industries, the capital for which should be furnished by the investor or by the individual partners in the business. The ability to attract the necessary capital will depend upon the inherent soundness of the proposition in each case.

The Committee further point out that it would be of great assistance to manufacturers in making plans for the future if the future policy of the Government were made known as early as possible in regard to:—(*a*) Fiscal policy, (*b*) rationing of raw materials, (*c*) the break clause in connection with the termination of munition contracts, (*d*) the disposal of national factories and surplus stores.

Before discussing means of providing credit facilities after the war, the Committee give a short explanation of our credit system as existing before the war.

In normal times the amount of credit varies with the amount of gold, the necessity for keeping the gold standard effective acting as an automatic check upon the expansion of credit. As the balance of indebtedness of this country with foreign countries became unfavourable, and the exchanges in consequence moved against us, it became profitable to export gold to pay debts abroad. The consequent shrinkage in the amount of gold in the country, and the reduction in the Bank of England ratio of reserve to liabilities necessitated a rise in the Bank rate, which in its turn brought about a general rise in rates of interest. This rise in interest rates had a twofold effect. It attracted gold to this country, and induced gold, which would otherwise have been exported, to remain; secondly, it induced people to pay off loans, and discouraged the raising of new ones. If the drain of gold was severe enough to make money "tight," it became difficult to renew existing loans, and this caused the sale of goods and produce upon which the loans were secured, so bringing about a fall in prices, which encouraged exports and discouraged imports, so that the situation was gradually adjusted.

Further, from the point of view of purely internal trade, the fact that gold was the only legal tender was equally effective in preventing an undue expansion in credit, banks being obliged to maintain a proper relation between the extension of credit facilities and their available supply of gold. Thus the gold standard acted as a wholesome restraint upon over-trading, and often adjusted situations which, unchecked, might have developed into a severe commercial crisis.

The position to-day is entirely different. As there is no free international market in gold, the operation of the foreign exchanges has been interrupted, while at the same time the internal gold circulation has been replaced by a currency note issue. As there is no legal limit to the amount of currency notes which may be issued, there is therefore no automatic check upon the expansion of credit. The very large extent to which expansion has taken place is shown by the fact that whereas the total deposits at the banks of the United Kingdom, exclusive of the Bank of England, amounted at the end of 1913 to £1,070,000,000, the amount of deposits is now nearly £2,000,000,000. The enormously increasing purchasing power thus created has, in the Committee's opinion, been one of the main factors contributing to the general rise in prices.

In regard to the position after the war, the Committee express the opinion that it is essential for the reconstitution of industry and commerce to impose restrictions as soon as possible upon the creation of additional credit by the restoration of an effective gold standard. To attempt to rebuild industry by the further indiscriminate expansion of credit would endanger our position as the financial centre of the world, and would inevitably lead before long to grave disaster. The Committee accordingly seconded the cessation of State borrowing as early as possible, all available money being required for the financing of commerce and industry. The Committee also consider that any Government guarantee to bankers to enable them to provide by means of credits for fixed capital expenditure for the reconstitution of industry is undesirable, as being likely to occasion a further expansion of credit followed by an additional rise in prices. It is also recommended with a view to the gradual reduction of credit inflation, arising from the enormous volume of short-dated Government debt, that the State should undertake funding operations at an early date for this purpose.

As to banking facilities for carrying on ordinary businesses, the evidence submitted to the Committee led them to the opinion that the situation might safely be left in the hands of the banks. To enable the banks to give facilities for extended credit it is recommended that every facility should be given by the Government to enable the banks to issue any new share capital which may be found necessary to strengthen their position. It is thought that the rationing of available supplies of raw materials will provide a valuable guide to the banks in selecting the directions in which loans will be best secured and are most urgently required.

The policy of trade organisation which is now in evidence is welcomed by the Committee as furnishing a sound basis for the granting of credit facilities to industry. They also believe that if a portion of the new issues of shares which will be necessary for many manufacturing establishments, in the form of preference shares giving a good return in dividends, were reserved for the workpeople in these establishments, it would materially assist both financially and in other equally important directions.

The Committee consider that the continuance of some measure of State control over new issues is desirable for a certain period, and that, with a view to the further prevention of unsound promotions, the Companies Acts might be strengthened. The enormous potential increase in the number of small investors, as shown by the figures published by the National War Savings Committee, and the importance of the encouragement of this tendency for the rapid reconversion of trade and industry, are emphasised by the Committee, as is also the necessity for genuine saving to make good the destruction of capital during the war.

In regard to State aid, while the Committee do not recommend the guaranteeing of banks by the Government or the investment of public money in loans to persons who have been unable to obtain them from other quarters, it is considered that cases of hardship may arise in connection with firms who have undertaken, under considerable pressure from the Government, the manufacture of munitions of war. To meet such cases the Committee suggest the establishment of a small committee of Government officials and business men in leading industries to consider claims of this kind in the first instance, or to act as a tribunal to which applicants can make appeal. The Committee are also of opinion that it would be of very great assistance to manufacturers and others, who had been prevented from forming adequate reserves by the present high rate of Excess Profits Duty, if arrangements could be made by which a proportion of the tax would be retained for a period as a loan upon terms likely to secure early repayment.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Novel Lighting Fitting.

Mr. R. W. Fletcher describes in the *Transactions* of the South African Institute of Electrical Engineers a novel lighting fitting which he has found to be very satisfactory for special positions. As will be seen from the sketch, fig. 1, the principal features of the fitting are high insulation of the lampholder, ease with which a holder can be replaced, and freedom from vibration. The holder is carried on a fibre ring, so that any ordinary holder that has a shade ring can be used, and the insulation is much higher than is the case with insulated bushings. Another point is that the leads to the holder can be left slack, and a new holder can be fixed without any difficulty; anyone who has tried to fix a new holder on to a fitting with a nipple where enough slack wire cannot be got down the pipe will appreciate this feature. The spring suspension of the holder prevents loss of lamps through their falling out of the holder, and is also a valuable

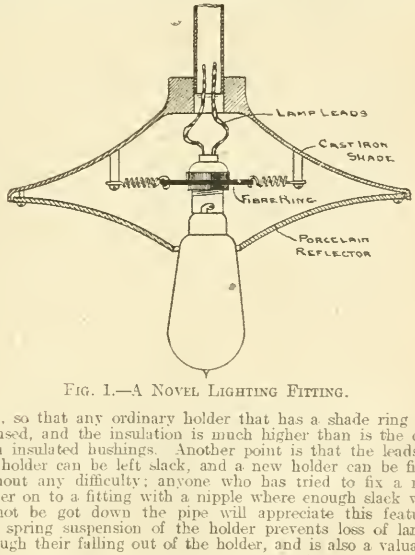


Fig. 1.—A Novel Lighting Fitting.

feature in the case of half-watt lamps. The fuse-box attached to this fitting consists of a round cast-iron watertight box fitted with Dorman & Smith's thumb fuses, the leads being arranged to enter at the bottom through bushings, and leave through the top. Ample space is allowed so that a fuse can be replaced without burning the fingers or short-circuiting with the sides of the box.

An Automatic Lamp Reel.

An automatic extension reel for electric lamps designed to be used in factories is shown in the accompanying illustration, fig. 2, which is taken from *Industrial Management*. The The reel itself is 9 in. in diameter by 2 in. in width, and is provided with 25 ft. of reinforced cord. The support for the reel is provided with a swivel joint permitting the cord to lead off in any direction. It is provided with an automatic lock so that any position of the reel and any amount of unwound cord may be held. The automatic lock catches and holds the cord through a slow backward movement after it has been unwound to the desired length. To rewind, it is merely necessary to give the cord a slight pull, which unlocks the catch, and the reel then automatically rewinds the cord as the person holding the lamp walks towards the reel holding the lamp in his hand. This device is manufactured by the Cincinnati Specialty Manufacturing Co., Inc., Cincinnati, Ohio.

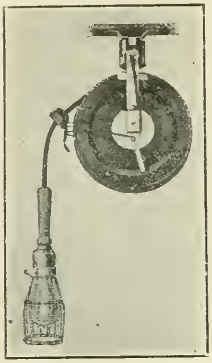


Fig. 2.—Automatic Lamp Reel.

An Electrically Heated Crucible.

The accompanying diagram, fig. 3, shows a melting plant adapted for use with a patent electrically-heated crucible of 150-lb. capacity brass, with special pouring spout. The crucible itself serves as the resistor through which the electric current is passed, and is so designed that the maximum heating effect is produced in the zone where actually required.

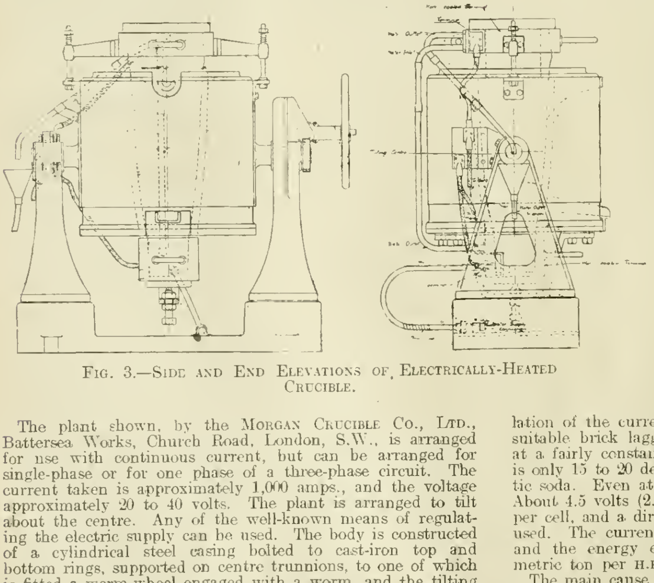


Fig. 3.—Side and End Elevations of Electrically-Heated Crucible.

The plant shown, by the Morgan Crucible Co., Ltd., Battersea Works, Church Road, London, S.W., is arranged for use with continuous current, but can be arranged for single-phase or for one phase of a three-phase circuit. The current taken is approximately 1,000 amps., and the voltage approximately 20 to 40 volts. The plant is arranged to tilt about the centre. Any of the well-known means of regulating the electric supply can be used. The body is constructed of a cylindrical steel casing bolted to cast-iron top and bottom rings, supported on centre trunnions, to one of which is fitted a worm-wheel engaged with a worm, and the tilting gear is operated by means of the hand-wheel.

The patent water-cooled terminals which make contact direct with extensions to the top and the base of the crucible are of gunmetal, machined on the inside, and made in halves hinged together, and provided with tightening bolts to ensure perfect contact.

The bottom water-cooled terminal is supported by a cone-pointed pin fixed vertically in the centre of a sling hanger carried from the bottom plate. By this means any variation which might possibly occur in the vertical alignment of the crucible is automatically adjusted. The top water-cooled terminal is maintained central and steady by means of two arms, bored and fitted with steadying spiral springs, which slide on vertical guide-rods with adjusting nuts attached to the plant. The arms are insulated from the terminal.

A slate or hard-timber terminal board is rigidly fixed to one of the standards, and is fitted with thimbles for taking the cables. Suitable flexible leads connecting the board to the water-cooled terminals are supplied with the plant. A similar arrangement is provided for the water-cooling pipes. The top extension of the crucible forms a convenient charging hopper for metal, and is provided with a special refractory cover. A drain spout is fixed at the front of the plant as a safety outlet for the metal should a crucible fail.

The interior of the plant comprises a thickness of insulating material entirely covering the steel casing, and a Battersea triangle (△) brand refractory sectional lining. The small space between the lining and the crucible is filled with suitable refractory and non-conducting material.

The heat efficiency of the electric crucible being high, the cost of power is correspondingly low, whilst the ease of handling, cleanliness of operation, and the accurate regulation of the temperature, and consequently the good quality of metal obtained, are outstanding features of merit. The company has several designs of crucibles still under consideration, but the broad principle in all of them is shown by the above diagrams. The company has also successfully produced tubes which are heated electrically in a similar manner, and can be used for the manufacture of gases of various kinds, for the reduction of oxides, and for many other metallurgical purposes.

ELECTROLYTIC PROCESSES.

All of the metals which are derived to-day in commercial quantity from their fused salts by electrolysis are those exceptionally electropositive metals, which either cannot be obtained at all in appreciable yields by strictly chemical means, or can be obtained thus only with great difficulty and at great expense. The following particulars are taken from the *General Electric Review* for November, which contains interesting articles on this subject.

Sodium.—Sodium is obtained at the cathode by the electrolysis of either fused caustic soda (NaOH) or of fused common salt (NaCl). The former is of advantage because of its much lower melting point, and because the escape of the gas freed at the anode does not have to be considered. Chlorine gas, on the other hand, cannot be allowed to escape promiscuously, and so must be used to make bleach, or collected for government purposes. The Castner process, which employs NaOH, is the best known, and is operated in America at Niagara Falls by the Electrochemical Co.

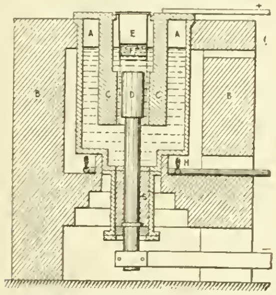
The principal details of the Castner cell are shown in fig. 1, p. 27. The current enters through the iron anode which surrounds the top of the vertical iron cathode. This cathode extends up through the bottom of the cell, passing through a cast-iron pipe or collar which is attached to the bottom of the cast-iron box which holds the molten electrolyte. The space between cathode and iron pipe is sealed by filling it up with the melt, which is then allowed to freeze. A fine nickel gauze diaphragm is inserted between anode and cathode to prevent globules of sodium from reaching the anode and reacting with the water vapour formed there. The molten sodium is collected inside of the chamber from which the gauze diaphragm is hung. In practice the charge is kept in a molten state by proper regulation of the current density. Heat radiation is reduced by suitable brick lagging. The electrolysis must be performed at a fairly constant temperature of 315 to 320 deg. C. This is only 15 to 20 deg. C. above the melting point of the caustic soda. Even at 325 deg. C., the yield falls nearly to zero. About 4.5 volts (2.2 volts decomposition voltage) are required per cell, and a direct current of 13 to 17 amps. per sq. in. is used. The current efficiency is probably about 45 per cent. and the energy efficiency about 22 per cent. About 0.56 metric ton per H.P.-year is estimated from the data at hand.

The main cause of the low efficiency is due to the fact that water is formed at the anode, which, if it does not react with sodium already deposited (which is apt to reach the anode occasionally), is itself decomposed into oxygen and hydrogen to greater or less extent.

Most of the sodium made is used to manufacture sodium cyanide and sodium peroxide. The metal has also been tried for drying transformer oils. About 2,000 tons were made in the United States annually before the war.

Calcium.—The cell comprises an iron box with water-cooled bottom, through which projects an insulated conical iron cathode. Inside the box and insulated from it is an annular carbon lining which serves as anode. The temperature of the bath and of the cooling water is so regulated that the iron bottom is covered with a thin protective layer of solidified salt. The deposited metal is drawn in stick form as soon as formed and sufficiently solidified at a speed equal to the rate of deposition. One advantage of this method of removing the deposited metal is the smaller tendency for metal fog to form which sometimes occurs at excessive temperatures and under reducing conditions. Addition of oxidising agents to the bath, or neutral salts in some cases, will destroy the fog. The explanation of the phenomenon is not certain. It consists in the sudden rise from the molten metal (cathode) into the fused electrolyte over the metal of dark clouds whose colour depends upon the nature of the cathode metal. These clouds seem to dissolve in the melt. It is probable that the clouds consist of colloidal suspensions of very finely divided particles of the fused metal. The effect of the fog is to reduce the current efficiency of the process.

The metal is at once obtained in pure, solidified massive form. The electrolyte consists only of fused calcium chloride ($CaCl_2$) held at a temperature of 780 to 800 deg. C. It is estimated that one of these cells may take as much as 25 volts, the decomposition voltage being only 3.24 volts. The very high current density of 650 amperes per sq. in. is used, which would account for the high voltage. Practically 80 per cent. of the potential drop is at the cathode. From this data, assuming a current efficiency of 80 per cent., an energy efficiency of only 10 per cent. is obtained. The yield per H.P.-year is thus only 0.1 metric ton. But little information has been published about the process. The present output per year is small, probably not over 250 lb.



A, cast-iron pot set in brickwork B; C, nickel anode; D, cathode; E, metal cylinder receptacle for sodium; F, liberated sodium.

Fig 1.—Castner Sodium Furnace.

Magnesium.—The metal is marketed in both powder and stick form. For an electrolyte a mixture of fused dehydrated carnollite (KCl, $MgCl_2$, $6H_2O$) plus one mol of salt (NaCl) is used. During the electrolysis $MgDl_2$ is added, and a certain amount of calcium fluoride (CaF_2). The temperature of the melt is probably 750 to 800 deg. C. From laboratory experiments, a current efficiency of 75 per cent. may be assumed. The energy efficiency is probably below 40 per cent. An average of 9 volts per cell is estimated. Available data would indicate a yield of about 0.37 metric ton per KW.-year.

Aluminium.—In America the Hall process is used, while in England and on the Continent the somewhat similar Heroult process is worked. The Hall cell consists of a rectangular cast-iron box, lined with carbon which acts as cathode until the bottom is covered with the molten aluminium, which then serves the same purpose. The current is led into each cell through a series of graphite rods which are distributed uniformly in the cell, dipping down into the fused electrolyte almost to the layer of molten aluminium at the bottom. The molten aluminium is removed periodically by tapping. The fused electrolyte consists of cryolite (AlF_3, 3NaF), to which enough pure aluminium flouride (AlF_3) is added to bring the melt to the formula AlF_3, 2NaF and of pure alumina (Al_2O_3). The alumina is the solute and the cryolite the solvent; in the fused melt the alumina is decomposed into aluminium at the cathode and oxygen at the anode. The decomposition voltage of Al_2O_3 is less than that of either NaF or AlF_3, which explains why it and not its solvent is electrolysed. Alumina has to be continually added to the melt to compensate for that decomposed. The normal current efficiency is supposed to be 90 to 95 per cent., but in many works it is not over 65 per cent. An average efficiency of 75 per cent. is about right. With a voltage drop of 5 to 6 volts per cell (assuming 2.2 volts decomposition voltage), this would bring the energy efficiency to 30 per cent. The yield per H.P.-year amounts to about 0.3 metric ton. Much of the loss is due to metal fog formation, the temperature of the bath being some 900 to 1,000 deg. C., which is maintained by the heating effect of the current, while aluminium melts at about 665 deg. C. The anode losses are high, as the oxygen liberated at the anode reacts with the graphite, forming carbon monoxide before escaping. The anode effect (the anode becomes covered with a film of gas through which the current is able to pass only by the aid of the formation of a great number of minute arcs, which play between electrode and electrolyte) has always to be guarded against by keeping the bath in proper working condition. The principle of the Heroult process is the same as in the Hall process. The cell is circular instead of rectangular, and the individual anodes are of much heavier cross section. Each cell takes about 7,000 amperes at 7 volts.

Figures showing the change in the cost of aluminium are of interest.

Year.	Price per lb.	Method of Reduction.
1855 ...	$90.00 ...	Old chemical (St. Claire Deville)
1886 ...	12.00 ...	Old chemical (St. Claire Deville)
1889 ...	4.00 ...	New chemical (Castner)
1889 .	2.00 .	Electrochemical (Hall)
1911 ...	.20 ...	Electrochemical (Hall)

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Purchase of Appointments.

Surely it is an error of judgment on the part of the Electrical Review that the advertisement under Box 6248 in the current issue was accepted, or have you purposely brought it to light?

If it does not come within the Corrupt Practices Act, such an offer is running very close to it.

To my mind it is a despicable form of bribery, and whilst I cannot imagine anyone entertaining the offer who has the interests of an undertaking at heart, the person who does so for his own interest should ponder well over the advertiser's boast of an "unblemished character."

Is this what we are to expect from these "well known" engineers of the "profession" (*sic*), who by reason of their exceedingly good pay whilst in the safe employ of the Ministry of Munitions have been able to save sufficient to make such offers?

What chance have our *real* engineers still "out there" against corruption of this kind? We look to you, Mr. Editor, to see fair play.

B. W. Gothard, A.M.I.E.E.
Electrical Engineer,
Aldershot Gas, Water, & District Lighting Co.

Electricity Works, Farnborough, *December 23rd*, 1918.

[We entirely agree with our correspondent; such offers as the one he refers to are highly objectionable and contrary to the public interest, besides being unfair to those who are in competition with the advertiser. Unfortunately we were not aware of the insertion of the advertisement until after its publication, but steps will be taken to prevent a recurrence.—Eds. Elec. Rev.]

The Royal Albert Hall.

Referring to this incident, permit me to amplify slightly the remarks of "Electric Supply" in your issue of 6th inst., and to point out that the action taken was provoked by the attempt of the management to break a contract entered into for the letting of the Hall. It is to be hoped that it may be a useful lesson to those who have been in the habit of suppressing, and who wish to continue to suppress, free speech, free publication, and free assembly. It may also be pointed out that no public inconvenience was sustained by the method adopted to prevent such suppression, as would have been the case by shutting down various electric lighting stations if this had been carried out.

W. Sisson.

Gloucester, *December 23rd*, 1918.

Charging Electric-Truck Batteries.

The article appearing in the Electrical Review for December 20th describes a very ingenious method which has been adopted for charging an electric-truck battery in the case in which the users of the battery were unable to obtain a small motor-generator set.

The engineer who devised this method, and the automatic gear which is described, is certainly to be congratulated upon the successful and economical solution of his difficulty.

Now that the impossibility of obtaining suitable charging plant has been removed the disadvantages of the method described should be clearly understood before any user who is installing electric trucks decides to copy it.

If the battery is connected directly to the mains, either in series with a motor, or in series with a resistance, it is subjected to the full line pressure to earth; that is to say, in the case of a 440-volt, 3-wire supply the voltage to earth will be 220 volts.

In many cases these electric trucks are fitted with insulated wheels, and in these cases there is a very considerable danger of obtaining a shock from any part of the truck to earth unless an earthing core has been provided on the charging plug. Unfortunately, many of the imported trucks are provided with plugs in which no provision is made for an earthing core. As there is usually slight moisture round the battery there is almost sure to be a leakage to the framework of the truck, and the danger is a very real one.

The recommendations of the Electric Vehicle Association are very strongly in favour of the provision of an earth core on the charging cable, and if this recommendation has been carried out, or if the truck wheels efficiently earth the framework, the danger of shock is eliminated.

A still more serious objection is then, however, met with, as the battery itself will now have to withstand the voltage to earth, and several cases have already occurred in which the leakage over the outsides of the battery while charging has been such as to cause serious damage. The following extracts are taken from correspondence with two of the principal makers of truck batteries when dealing with the question of the use of a method of charging which had the same disadvantages as the method now under discussion:—

(*a*) "The great disadvantage is that the battery must be subject to the full 200 or 250-volt pressure to earth, and this, in our opinion, makes the method quite undesirable. It is not a question of great risk of shock, but the pressure is too high for the walls of the cell containers."

(*b*) "We are afraid that the fact that the battery is subject to 220/250 volts to earth is a decided disadvantage, particularly when it is borne in mind that the outside container of the cell is alive. The method of insulating the cells from earth is only designed to deal with much lower pressures, and we would not take the responsibility of recommending the batteries to stand up regularly to a higher pressure."

It is true that in the case described in the article the mains pressure is only 250 volts, but in the majority of cases the supply is at a higher pressure, and even in the case of a 250-volt supply it is quite usual for one main to occasionally become earthed, in which case the full pressure to earth is available on the other main.

It would appear, therefore, that while the ingenuity of the method described is fully recognised, it should be regarded as a war measure only, and not good practice for use under normal conditions.

H. W. Bosworth.

London, *December 24th*, 1918.

The Electrical Contractor.

On the brink of a boom in electrical installations in private house, factory, or wherever it may be, perhaps a word or two on this subject may be useful to both intending installer and customer.

It has, unfortunately, occurred in very many instances which I have personally become acquainted with, that the first object of the contractor has been either by hook or by crook to book the contract. This over, he has "made good" by employing boys, improvers, or any other cheap labour he could get hold of.

What has resulted? The quality of the installation has suffered in consequence, and the customer has paid dearly in the long run for accepting a cheap tender. Again, it seems quite the usual thing for an intending customer, after being "quoted" for certain work to be done, to give the job to another less conscientious contractor who says he can do the job for so much less.

The customer, not being versed in electrical matters, is not in a position to decide which it will pay him best to accept—the one that is a little dearer in the first place, or the one that becomes a maintenance job indefinitely.

The loopholes for the cheap contractor are: Young cheap labour, inferior cable and material. This kind of thing occurs where a number of contractors are pricing for certain work without a specification drawn up by a practical man. It is the custom at present among customers who have not a lot of money to expend on electrical work to bite at the lowest price—very often to their sorrow.

I am afraid that the coming boom will bring a lot of cheap contractors into the electrical line, and it may be some time before the bad quality of the installation is found out.

It seems a pity that so many rubbishy qualities of electrical material are allowed on our markets to tempt the dishonest contractor—Japanese lampholders, ceiling roses, &c., American cable, and cheap iron conduit are the curse of any decent contractor. Why not establish definite standards which contractors would have to adhere to, and find it impossible to depart from?

There will be sufficient work and to spare in the near future, without dishonest under-cutting, which leaves the customer to pay the piper. The Phœnix Fire Office rules caution the intending customer against accepting the lowest tender without first acquainting himself with the quality of the material and workmanship about to be put in.

My chief reason for writing these short notes is that they may lead to something being done in the matter by the leading contractors to close the door to the "Do-your-job-at-any-price-man," who will otherwise become a menace to consumers of electricity. Let our motto be a "Straight price for a proper job," and the betterment of the electrical profession.

H. Fowler.

Liverpool, *December* 29th, 1918.

[The exclusion from the market of inferior materials is one of the objects of the proposed "National Proving House," which is in course of organisation under the ægis of the Institution of Electrical Engineers, with the co-operation of the National Physical Laboratory and other public bodies. The guarantee under penalty of good workmanship and material provided by the Electrical Contractors' Association corresponds to the admirable aims expressed in the last paragraph of Mr. Fowler's letter. Thus something is being done to improve the situation, but we agree that this is only the commencement of the work that is necessary.—Eds. Elec. Rev.]

ELECTRICAL TRADE BENEVOLENCE: AN APPEAL.

Mr. C. E. Hunter, the chairman of the Electrical Trades Benevolent Institution, is making a special effort on behalf of that organisation and fund, and he asks for the co-operation of the trade. He has issued an appeal in which he states that the invested funds are only £9,000 odd and the total revenue for the past year was only £781. We believe that everybody will agree with him that it is desirable to put the Fund on a better basis, "worthy of the most progressive business in the kingdom." He is eager to mark the period of his office by raising a large sum which will bear some relation to the importance of the electrical trade. Most of our readers are aware that the institution cannot at present pay pensions save out of revenue. That is one very good reason for building up a big invested capital. Another important reason for supplementing the present resources is the increase in the cost of living and the correspondingly decreased value of grants if limited to the pre-war amounts. The present invested capital was collected prior to the war largely at the annual festivals, but during the past four or five years while there has been a period of great activity for most departments of electrical engineering industry, the time has not been convenient for festival dinners or energetic propaganda schemes. Those who ought to be interested in the maintenance of this fund have hardly been able to plead poverty, and we believe there are some who to-day could put the institution in a far more satisfactory position without feeling the pinch. What has probably weighed with some people during the war has been the fact that industrial activity has lessened the immediate demands, but as the circular before us points out, after the overstrain on electrical production engendered by the war, claims on the fund will become heavier, and the resources should now be strengthened to enable them to be ready to meet whatever needs may arise. It is not inconceivable that there may yet be occasion to give some kind of assistance to discharged and disabled men from the Forces. We hope that contributions, large and small, will flow in to Mr. Hunter's offices at 123-125, Queen Victoria Street, London, E.C. 4. It is our intention to publish a list of all the "Hunter" subscriptions and donations in the Electrical Review.

Tramway Employes' Working Hours and Conditions.—Early in the New Year the two Tramway Associations are to discuss with representatives of the National Transport Workers' Federation the following proposals, which have been advanced by the latter organisation, for new working conditions for employés on municipal and company tramways of the United Kingdom:—

That the working week shall consist of 44 hours, inclusive of signing on and signing off.

That every employé shall be guaranteed a working week of 44 hours or payment equivalent thereto.

No day's work shall be in excess of eight hours.

In no circumstances shall a reduction in the working day entail a reduction in existing wages.

No spread-over duty shall exceed nine hours, inclusive of meal times or relief.

All national holidays, Sunday, and overtime labour to be paid for at the rate of time and a half.

All employés shall be granted 14 days' holiday annually, with pay.

THE
ELECTRICAL REVIEW.

Vol. LXXXIV. JANUARY 10, 1919. No. 2,146.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

THE ELECTRIC PROPULSION OF SHIPS.

IN the annual Report of the Secretary of the U.S. Navy, made public in Washington in the second week in December, it was announced that "the most striking engineering accomplishment during the year was the completion of the electrically-propelled battleship *New Mexico*," which can be described as the most powerful naval vessel afloat. She displaces 32,000 tons, as compared with the 27,500 tons of H.M.S. *Queen Elizabeth*. The result of the trials of this battleship, it is said, confirms the judgment of the Department in adopting this type of machinery for the battle cruisers, and marks an engineering advance which will affect battleship construction the world over. Secretary Daniels in his Report says:—"The wisdom of this decision has been amply vindicated by the performance of the *New Mexico*, which has been tested in every way, her trials including many more than those specified in the contract. She has failed in none of them; the operation of her machinery has been highly satisfactory in every respect, and to-day, in this unique vessel, the United States Navy has a battleship which has no peer in the world's navies, not only for economic propulsion and less liability to serious derangement, but for her military superiority in greater manœuvring power and increased under-water protection." Mr. Daniels is further reported to have said that all capital ships of the future U.S. Navy are to be electrically propelled.

It will be recalled that the decision of the Navy Department led to the bitterest criticism, not only from engineers pecuniarily interested in other types of machinery, but also from others eminent in their profession who had no pecuniary interest, who feared that an experiment was being embarked upon which would be fraught with national calamity. This report, then, is a striking tribute to Rear-Admiral Griffin, chief of the Bureau of Steam Engineering, and his able assistants, who gave approval to this new method of propulsion, and who, despite the storm of protest, never lost faith in the ultimate triumph of electricity. The *Electrical World*, commenting on the Report, states that had the system of electric propulsion been perfected and standardised a year or two earlier, without a doubt the entire new United States merchant marine would have been equipped with it.

On reading such statements as the above, a question that naturally suggests itself—seeing that electric driving has been found satisfactory in other Navies, and that it can be safely said that with proper design and application electric driving is a well-tried and successful feature of both gun and turret operation, as well as the actual propulsion of ships of war—is: what are we in this country doing in the matter?

On January 9th, 1914, we expressed our opinion in these columns with regard to the statement that H.M.S. *Invincible*, the only modern capital ship in the British Navy fitted with electric power throughout, was to undergo a long refit, at a cost of nearly £200,000, to replace the electric gun-operating gear by hydraulic mechanism. This, it should be remembered, was not on account of any failure on the part of the electrical gear, but simply because the British Admiralty was, and is, an institution with historic prejudices—prejudices that die hard. At the time we preferred to regard the refit merely as an incident, which in no way reflected on the adaptability of electric power for all purposes on a naval vessel, such adaptability, in fact, having been already demonstrated where traditional methods had less influence. Of the countries that, in the year previous to the war, had secured the advantages and efficiency that are consequent upon the use of electricity on board ship, progressive France topped the list, followed closely by the U.S.A. and Germany, and then by Austria, Russia, and Japan in turn, Great Britain's place, it is sad to relate, being at the very end of the list.

This being so, we are tempted to inquire whether it is compatible with the dignity of the profession of electrical power engineering in this country patiently to endure such a state of affairs. Are we going to sleep over it? Or are we going to do the right thing—and do it now that we have the chance?

In our opinion, the reconstruction of our shipping affords a unique opportunity of demonstrating the adaptability and efficiency of electric power on board ship, and it behoves all concerned to see to it that the opportunities which are at hand are seized upon. A start in the right direction, it is true, has been made, as shown by the equipment of the first British sea-going electrical merchant ship, the s.s. *Wulsty Castle* (described in our issue of May 17th, 1918), and we trust that this will prove to be only the forerunner of many similar enterprises. It is to be hoped that prejudices will have been severely shaken by the events of recent years, and that in consequence the powers that be will be in a better position to appreciate that such innovations as we have referred to are, in the interest of progress, not to be ignored.

Electricity Supply Progress.

In our "Correspondence" columns to-day we are gently taken to task by Mr. J. C. Williams, of Erith, who has not, however, quite correctly interpreted our meaning; he says we referred "particularly" to the adoption of the three-phase system, but, in fact, we merely cited this as one example, out of the many that could readily be put in evidence of the general rule—that a small municipal undertaking is inherently unable to take any risk; it must follow the beaten track, which is to say that it must not be enterprising. Only the *large* undertakings can afford to experiment, and our argument was directed to showing that, as the municipal boundary system inevitably implied the multiplication of small undertakings, it necessarily hampered technical progress, besides producing the other ill-effects that we mentioned.

We congratulate Erith on having adopted the three-phase system so long ago as 1903; but even then Erith was hardly a pioneer, for electrical transmission and distribution on the three-phase system was in use in the United States in 1894 for lighting and power (with self-starting A.C. motors), and the Dublin tramways were provided with three-phase transmission and rotary-converter sub-stations in 1896. Manchester is precisely one of those large undertakings which can materially affect progress, and it has done so; though the five-wire system, unfortunately, did not fulfil expectations, it was an enterprising departure, and in other ways the city has certainly contributed valuable items to electro-technology.

As for the steam turbine, it was fostered and developed mainly in the works of the Newcastle and District Electric Lighting Co., from 1888 onwards; the Cambridge Electric Supply Co., Ltd., from 1892; and the Metropolitan Electric Supply Co., Ltd., from 1894. So far as we can ascertain, Halifax adopted the turbine about 1901, not 1897: and before 1889, 300 Parsons turbines had been built, aggregating 4,200 KW.

Amongst other penalties that we have paid for excessive sub-division is that of being tied down to the use of direct current. Where power is transmitted 5 or 10 miles—still more, 50 miles—the use of the three-phase system is most convenient, appropriate, and economical of capital and labour. But when every little township must have its own little station, with its own little staff, the advantage of a storage battery as a reserve is obvious, and partly from this cause, partly owing to the prevailing fashion, the D.C. system became the rule in this country. On the Continent, on the other hand, three-phase is practically standardised. Few of our stay-at-home engineers realise how very far behind other European countries we are in this respect.

Wherever a supply system extends over a large area, the three-phase system has been almost universally adopted; and wherever three-phase supply is available, three-phase distribution is the most suitable and economical method to employ. Consequently, on the Continent, where supply companies have been allowed to develop far more freely than in this country, the three-phase system is in common use. Moreover, the use of overhead conductors for the transmission system has familiarised the public with the idea; hence the prejudice against aerial lines which is rife in this country does not exist abroad, and overhead lighting and power mains are as common as telegraph or telephone lines.

Here, therefore, we have the Board of Trade Committee advocating those very things—widespread supply areas, concentration of generating plant, and overhead mains—which on the Continent are commonplace.

The "Grievance" of the "Unskilled" Man as a Soldier.

An important sentiment, which we have long anticipated would find forceful expression after the war, is contained in a report issued by the National Amalgamated Union of Labour. The skilled man was for a long time protected from compulsory military service by his essential occupation. It had to be so. The unskilled man was compelled to go and fight, suffer hardship, and perhaps die, and his family often suffered pecuniary loss, and will continue to do so. The skilled man, on the other hand, was required—and sometimes, we admit, desired—to stay at home earning good wages. The later stages of the war necessitated that from certain trades even skilled men should be called away to join the fighting Forces; it was occasionally only the threat of military service that made them ready to end some of their disputes which held up war supplies. Now that the war is ended, it is recognised that "no class has been harder hit by the war than the so-called unskilled man." The Union mentioned above says that the unskilled men's Unions raised no protest at the time, but in days to come unskilled men will expect somewhat different treatment from that which has been meted out to them in the past. "If they are good enough to be called on to die for their country, they have a right to look for something very different from the hardest and dirtiest work and the worst wages, which have been all that their country has hitherto had to give them."

The *Sheffield Independent*, commenting on the matter, says:—"The unskilled man is often such from no fault of his. He is the victim of circumstance. Fate is unkind. So quite light-heartedly, when danger threatens the country, we look to the unskilled man to stand in the breach. The unskilled man does his bit, but having done it, is it reasonable to expect him to come back to the country—his country, poor chap!—and submit to "the hardest and dirtiest work and the worst wages?"

There is an important point, however, that the Union and the Sheffield paper both appear to overlook—namely, that in the early days of the war the skilled man joined up for active service very readily. Indeed, more men of this class joined up under the voluntary system than proved to be in the national interest when we found how vitally necessary the production of munitions in engineering and other works was if we were to hold the line against the enemy. It would be unfair to overlook the fact that at certain stages of the war it became imperative that skilled men should be "called back" from France and from the Home Camps in order that they might follow their industrial calling. On the other hand, the unskilled man who went away to fight and comes back still unskilled will feel his position keenly in presence of the dilutee, whether man or woman, who has had the opportunity of becoming more or less skilled while he himself has been fighting. Will the unskilled fighter agree to undergo training and become a skilled man or dilutee? And shall we all resolve to work together to take advantage of the industrial boom that ought to come along, so that there may be work for all? We can find many bones of contention if we are so minded, and questions such as the above can only be settled satisfactorily if everybody shows good feeling and a resolution to arrive at a fair and equitable solution of the problem. The national promise to do well by those who have fought for us must be fulfilled. We stand under quite as great an obligation to them as we do to Trade Unions who claim the fulfilment of Government promises respecting the reinstatement of their pre-war rules and restrictions.

So far as electrical, mining, and other engineers are concerned, the number of men who have willingly made the supreme sacrifice, or who have been wounded or maimed in the war, must have been very large. Our own weekly Roll of Honour, published for several years past, has shown how great the electrical losses have been. We do not know whether it will ever be possible for the authorities to classify the casualties of the war according to trade or profession, but, if such is ever done, we do not think that the engineering sacrifice of life and limb will be small in comparison with those of other sections of the community. After all, the war—"an engineer's war," be it remembered—could not possibly have been won without the technical skill and knowledge which became increasingly essential in practically every department of the war operations, land, sea and air, right down to the last.

The Wire-Drawing Industries. The transition from war trade to peace trade in the wire manufacturing industries should not be attended with quite the same difficulties that other trades will experience, but the most enterprising firms will probably be well advised to leave nothing undone that can be effected as early in advance as possible. The suggestion that each important firm should be represented in future by a first-class representative, experienced in the trade, has, we believe, resulted in the decision of several firms never again to present foreign competitors with practically a clear field for operations. Many of the most formidable German competitors attributed no small share of their success in these markets to the efficiency and thoroughness of their representatives. With the view that a first-class representative stands for efficiency in sales organisation, and not necessarily for cut-throat competition, this section should more than justify itself wherever it is introduced.

The appointment, also, of representatives and agents for foreign markets is a matter that can lose nothing by being attended to well in advance. The decision to have nothing to do with promiscuous Russian and other foreign representatives is, doubtless, a judicious one; and several British firms will probably conjointly appoint a sole representative whose qualifications and credentials are beyond dispute or criticism.

A further section to which increased attention will be devoted in future is that of the merchant representation. Hitherto some of the British firms have offered no preferential terms to merchants, as is done with profit in other trades, with the result that German and American competitors, adopting a policy the exact reverse of this, have benefited considerably.

Most of the leading firms in this country have greatly extended their output capacity during the war, and one of the chief anxieties of the future is undoubtedly the necessity for increased turnover to justify the capital expenditure. Many of the leading American firms have also extended their productive capacity, but on a still larger scale, we understand, than many of the British firms. The result seems bound to be increased competition between the two countries. The necessity for increased efficiency in the sales section of all British firms thus becomes the more apparent.

Fuel Economy. The announcement of the Coal Controller that the altered conditions now permit of an increased supply of gas and electricity for fuel and lighting to domestic consumers will be heartily welcomed not only by the consumers themselves, but also by the electricity supply authorities; and as at the same time the restrictions upon the installation of gas and electrical fittings are completely suspended, their pleasure will be shared in by electrical contractors and manufacturers. The restrictions which had to be imposed during the past year have greatly hindered progress in this important branch of the electrical industry, and while on patriotic grounds they were patiently endured, their removal will confer great benefit upon a large body of workers. The step has been made possible by the moderation of the heavy demands upon gas and electricity for industrial purposes, consequent upon the Armistice, which has enabled a larger supply to be placed at the disposal of household consumers; in industrial areas the power demand has naturally fallen off enormously, affording a welcome opportunity to the station staffs to overhaul the plant and carry out the many necessary repairs which have accumulated, in readiness for the resumption of the load when manufacturers have completed their arrangements for changing over to peace production.

The situation in the contracting business has been very uncertain since the Armistice was signed, as many of the Government contracts which were in progress came to a standstill, and, while there was plenty of civilian work in contemplation, customers were not disposed to move very energetically in the matter until the conditions were more favourable; the removal of the restrictions, however, will clear the air, and renewed activity may be confidently expected to result therefrom.

Co-operation Among Smaller Manufacturers. We desire to draw special attention to a letter from Mr. H. C. Siddeley, which appears in our "Correspondence" columns to-day. Our own views on the pressing need for the smaller specialist manufacturers to take serious action in the direction of co-operative effort in either production or salesmanship, or both, expressed in these pages many times during the last four years, were reiterated in our leading article of last week. The comments—whether critical or advisory—of the technical Press generally occasion a good deal of discussion in the circles directly interested in the particular matters ventilated, but under the heavy pressure of work imposed by war munitions production, and because of the uncertainty which hung over everything while hostilities continued, men of weight and experience have often been "too busy to write," or disinclined to do so, until the times were more propitious. The war being practically at an end, the subject of co-operation seemed to us to be one of the first for serious discussion in this New Year, and we trust that now that our manufacturers have got their heads deeply into their arrangements for securing a long period of profitable industry in both home and export trade, those who are best qualified to deal with the subject will follow the excellent lead set by Mr. Siddeley, and express their views through the medium of our pages without delay. There is a time when coming together in conference may reasonably be expected to lead to definite conjoint action.

ELECTRICITY SUPPLY IN SHEFFIELD.

(Concluded from page 10.)

The generating plant is housed in a long, lofty room, well lighted from the roof and one side wall; the original switchboard, of the cellular type, is mounted on a gallery crossing the north end of the room, but the new switchboard is arranged along the west side wall, with a gallery in front of it, from which gangways give access to the driving platforms of the large generating sets. Beneath the switchboard gallery are the offices for the station superintendent and the operating staff, and the chemical laboratory. The room is lighted with half-watt lamps. The walls are faced with white enamelled brick; the roof is carried on steel framework, and is matchboarded to prevent the dripping of condensed moisture on the generators, for which purpose also iron screens are suspended over the generators. Two cranes are provided—one to lift 30 tons, the other with two lifts of 50 and 10 tons respectively.

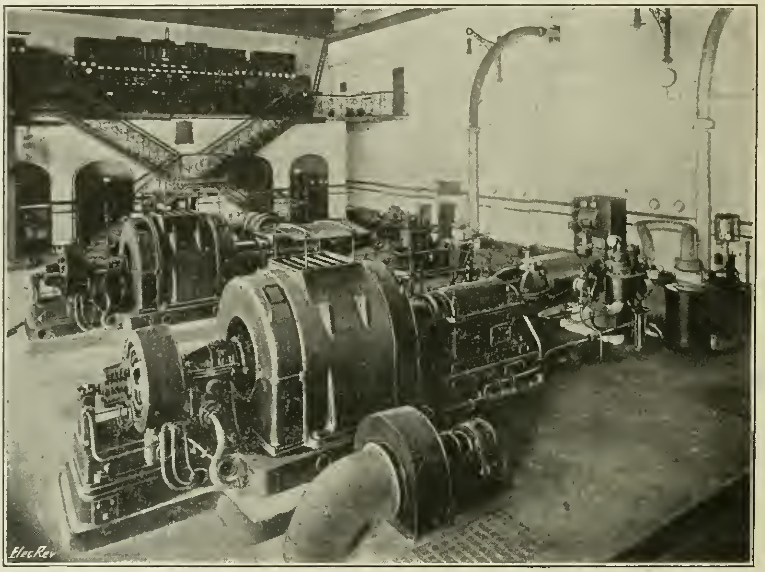

Fig. 13.—Parsons 2,000-kw. Geared Turbo-Alternators at Neepsend.

The generating plant comprises ten polyphase sets. In the earliest part of the station two 1,500-kw. Parsons two-phase turbo-alternators with revolving armatures were installed, but these have recently been replaced by two Parsons 2,000-kw. two-phase geared turbo-alternators, the turbines running at 5,000 r.p.m. and the generators at 1,500 r.p.m. We give a view of these sets in fig. 13. The increased economy of the new turbines has enabled them to be mounted on the original 1,500-kw. condensers without detriment to the vacuum obtainable. With the exception of these two sets and No. 6a, which are mounted at floor level, all the turbo-alternators are set on

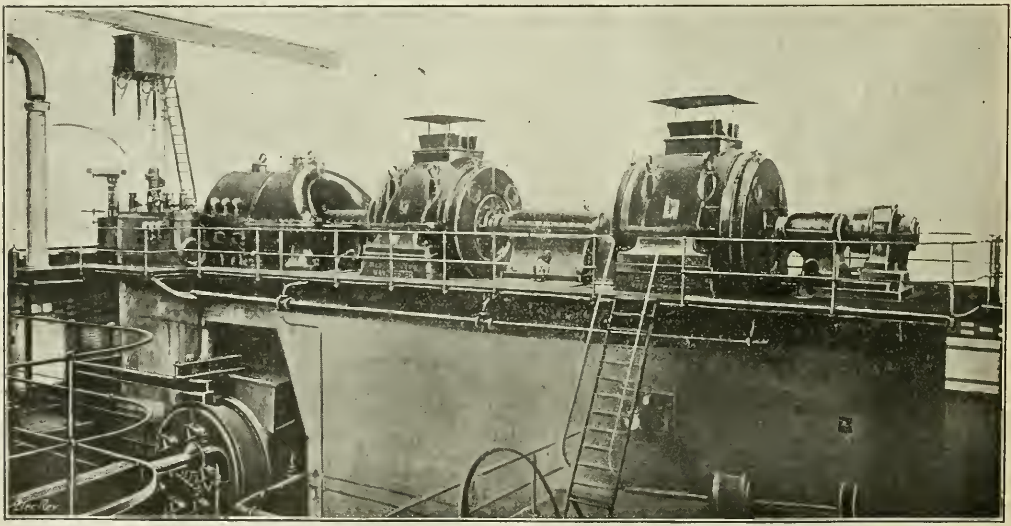

Fig. 14.—Westinghouse-Siemens 9,000-kw. Turbo-Generator.

concrete pedestals above the floor, as shown in our illustrations, the floor level of the basement being only a few feet above the level of the river.

No. 3 set is a Willans-Dick, Kerr 4,500-kw. turbo-alternator, the turbine in this case being of the pure reaction type; Nos. 4, 5, and 6 are also Willans-Dick, Kerr sets, No. 4 of 6,000 kw. and Nos. 5 and 6 each of 8,500-kw., with combined impulse-reaction turbines and Willans condensing plant. No. 6 condensing plant is of the Willans-Muller extraction type, which does not require a separate air pump.* Nos. 3 to 6 have six-pole fields, and run at 1,000 r.p.m. Nos. 7, 8, and 9 run at 1,500 r.p.m.; of these the first two are Parsons sets, of the pure reaction type, rated at 8,500 kw. each, and have both electrical and steam auxiliaries. We illustrate Nos. 6 and 6a in fig. 15, and No. 9 in fig. 14; the last is provided with a Contraflo condenser and Kinetic air-pump, made by Messrs. Richardsons, Westgarth & Co.

Set No. 6a is a Westinghouse-Rateau turbo-alternator of 2,000 kw. capacity, generating at 3,300 volts, 50 cycles, three-phase, at 3,000 r.p.m. The turbine is of standard design, and consists of a velocity element followed by several Rateau stages, working under a steam pressure of 200 lb. per sq. in. gauge, superheated 150° F., and exhausting into a vacuum of 28½ in. at full load.

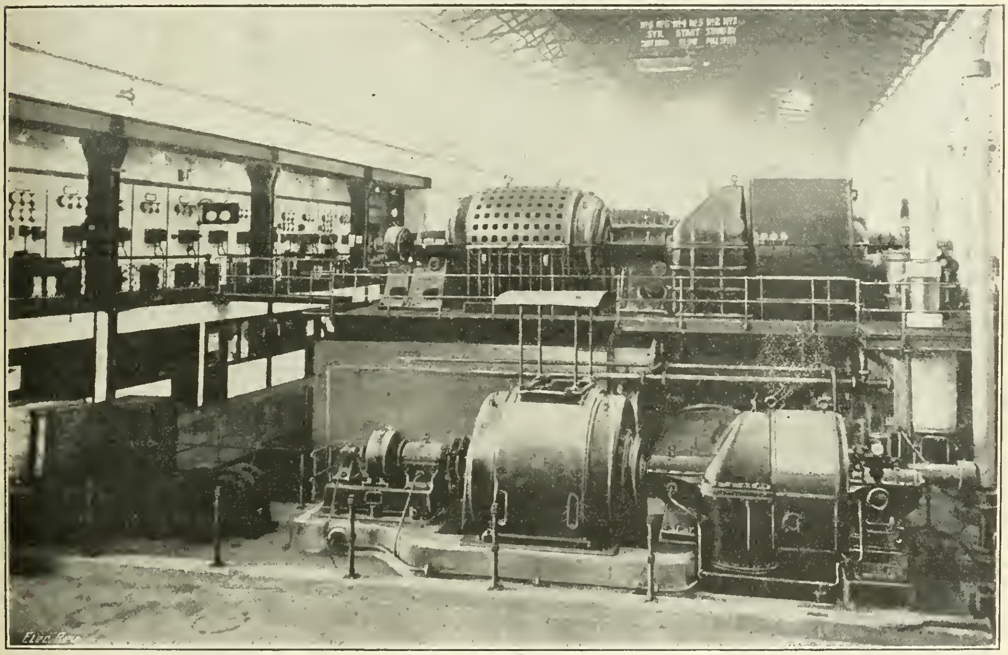

Fig. 15.—Willans-Dick, Kerr 8,500-kw., and Westinghouse 2,000-kw., Turbo-Generators.

The armature winding of the generator is of the concentric type, made up of separate bars and end connectors. The bars are insulated with mica and impregnated before they are placed in the semi-enclosed slots.

The rotor is of the smooth cylindrical radial-slot type, the field core being forged solid with the shaft. The field coils are held in the slots by means of metal wedges, and the connections are held by means of steel and bronze rings.

The surface condenser is of the double-flow type. The air and extraction pumps are of the Le Blanc rotary valveless type, driven by a 20-h.p. motor at 1,440 r.p.m. A separate lift pump for further raising the condensate is driven by a 5-h.p. motor at 1,440 r.p.m. A centrifugal circulating pump is driven by a separate motor.

The generator is electrically connected to two 1,250-k.v.a., three-phase, 3,300/11,400-volt, oil-insulated, self-cooled transformers.

Set No. 9 is a Westinghouse 9,000-kw. turbine running at 1,500 r.p.m., and coupled to two Siemens alternators. The steam and vacuum conditions are the same as those for the 2,000-kw. turbine described above, and the general design of the turbine also follows the same lines.

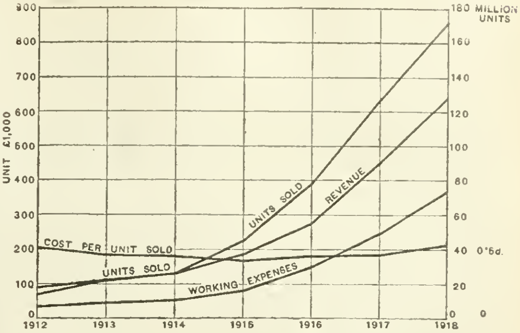

Fig. 16.—Progress Diagram of Sheffield Electricity Department.

The electrical portion of this set was supplied by Messrs. Siemens Brothers Dynamo Works, Ltd., and was built at their Stafford Works. The plant was ordered in the autumn of 1915 for very urgent delivery, and certain parts existing in the works of the contractors were diverted by the Ministry of Munitions for the execution of the order. Thus it became necessary to make up the total output required by combining two 4,500-kw. alternators coupled in tandem and running at 1,500 r.p.m. The machines are wound for 6,600 volts, and operate in conjunction with transformers stepping up to 11,400 volts.

The turbine set throughout is fitted with solid couplings, and the two alternator-transformer units are permanently connected in parallel with each other, and are supplied with exciting current from one exciter.

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* See Electrical Review, September 26th, 1913.

Each machine has a normal rating of 6,925 k.v.a. at any power factor between 0·65 and unity, and the machines deliver three-phase current at 50 cycles, with a temperature rise on normal full load not exceeding 45° C.

The design of the generators follows the makers' standard practice, ventilation being on their well-known axial system, and the rotor core and shaft ends consisting of one solid forging. The machines draw their cooling air through wet air filters of the revolving drum type, supplied by Messrs. Heenan & Froude.

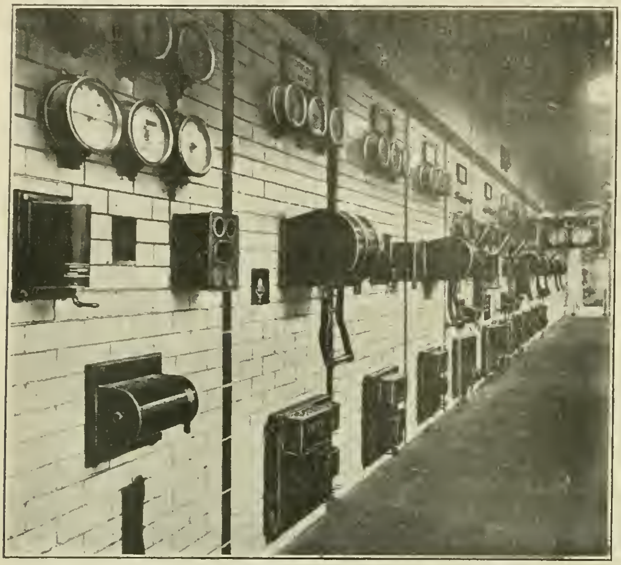


Fig. 17.—Front View of Switchgear.

The transformers to which each machine is connected are of Messrs. Siemens's three-phase water-cooled oil-insulated type, with a transformation ratio of 6,600/11,400 volts, and a temperature rise on normal full load of 55° C. Each transformer is fitted with the makers' patented expansion vessel to prevent sludging of the oil.

No difficulty whatever has been experienced in operation with the somewhat unusual tandem arrangement, and we understand that the plant has responded in the most satisfactory manner to the heavy demands made upon it during the war period.

The apparatus for cleansing and cooling the air supplied to the 9,000-kw. set consists of two 90-in. diameter "Heenan" air filters, arranged in parallel, and driven by one motor, developing ¾ h.p., through machine-cut spur and worm gearing. Each of these filters dealing with 20,500 cb. ft. of air per minute, the combined capacity of the set amounts to 41,000 cb. ft. per minute.

The machines each contain two filtering and cooling cylinders, built up of galvanised steel by Heenan and Froude's patented process; these are slowly revolved through water contained in the filter tank, which causes a thin film of water to adhere to the plate surfaces. The air passes through the narrow annular passages between the successive layers of plates, and is thoroughly scrubbed before issuing at the outlet of the machine to pass to the alternator. Means are provided for scraping out of the tank the sediment resulting from the extraction of the mechanical impurities from the air entering the filters, and moisture eliminators are fitted to prevent the passage of loose moisture to the alternator.

The governing gear of No. 9, which is operated by an oil-relay system, has proved particularly satisfactory, and may be adopted for other sets when a convenient opportunity occurs. The governor is controlled from the switchboard by an electric motor. An emergency oil-pressure system is provided, which is operated by a Worthington steam pump.

Each of the generating sets is provided with electrically-driven two-phase auxiliaries, controlled by switchgear mounted near the turbine; in addition, Nos. 7 and 8 sets have steam turbine-driven air and circulating pumps. Nos. 6A and 9 are the only sets provided with air filters. All the turbines are fitted with steam separators on the main steam pipes, and Nos. 1 and 2 have motor-driven cooling fans mounted alongside of the bed-plates.

All the generating sets are provided with their own exciters, mounted on an extension of the alternator shafts. The reciprocating air pumps are all of the Edwards type.

The aggregate output of the plant at full load is 59,500 kw.

The generating sets are cleaned by women, whose work is highly spoken of; they have been engaged on this duty for four years, and take a pride in their work, which, we understand, is done better than by men.

The switchgear is mounted on the west wall of the turbine room, on a gallery which extends two-thirds the length of the building; the floor of the gallery is on a level with the foot-plates of the large generators, with which it communicates at intervals by means of gangways. The gallery crosses the passageway which bisects the turbine room, and in order to provide for the admission of loaded wagons, a drawbridge with counterweight is provided, which is normally lowered, connecting the two sections of the switch gallery. The whole of the switchgear is of Messrs. Reyrolle's make, and is operated by hand; the wall is faced

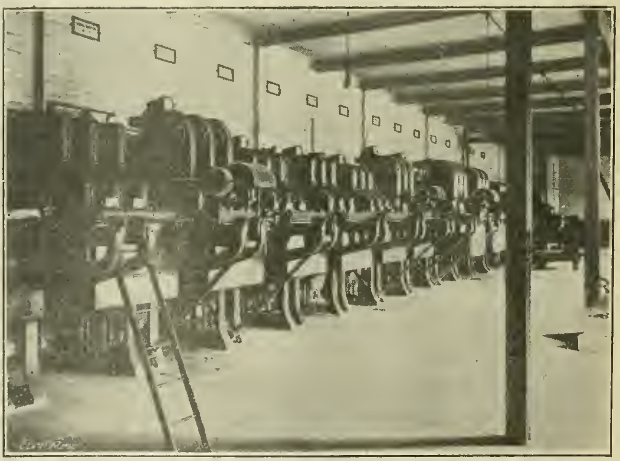


Fig. 18.—Reyrolle Ironclad Switchgear.

with white enamelled brick, and the instruments, switch-handles, &c., are mounted directly on it, as shown in our view, fig. 17. All the generators are provided with Merz-Price protective gear, the operation of which also opens the exciter circuit.

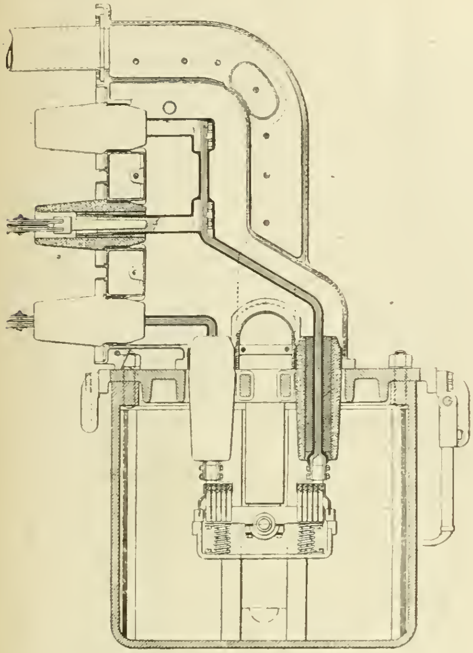


Fig. 19.—Reyrolle Ironclad Switch; Sectional Elevation.

The feeders are equipped with Reyrolle's overload and leakage protective system, and are being changed over to the split-conductor system of protection as the opportunity arises, two similar cables being grouped together for the purpose, and treated as one.

The ironclad switchgear itself is placed in two rooms behind the corresponding sections of the switchboard; the latest of these is shown in fig. 18. The switches are of a very substantial type, provided with boiler-plate-steel tanks and machined flanged joints; the tanks contain a large volume of oil, and all three phases are housed in one tank. These tanks and top plates are designed to withstand internal pressures of 400 lb. per sq. in., and a system of vent pipes is provided to allow for the exhaust of gases. All the conductors are completely enclosed in metal chambers, and are run in solid in compound, or surrounded with oil. No insulators are exposed, and thereby cleaning and other maintenance costs are avoided.

Two main bus-bars are provided, which can be interconnected by a switch capable of carrying the maximum capacity of the station, or run separately (the normal condition). The switches are arranged, as shown in fig. 19, so that by changing a contact plug, which fits into a socket with a bayonet joint, they can be connected to either bus-bar, the operation of changing over, when the switch has been run back, being a matter of seconds. An indicator is provided to show whether the switch is on the top or bottom bar. Above the bus-bar contacts is seen the iron vent-pipe. The switches in the newer part of the station embody various improvements over those installed earlier, the generator panels being of a heavier type and the handle gear of an improved pattern, with lever and rod connection instead of wire rope; moreover, the automatic mechanism is contained in the switch hood instead of being mounted on the switch wall. The potential transformers are situated between the draw-out switch sections and the bus-bar sections of the gear, and cannot be got at without first racking out the switches: and the bus-bar contacts are automatically covered when the switch is drawn out, so that accidental contact with any live part is impossible. The switchgear, as a whole, is of very massive construction, and has been aptly compared with heavy hydraulic machinery.

Provision is made for dividing the new part of the bus-bars from the old at the central passage-way by a hand-operated oil-break switch: the bus-bars can also be sectionalised by means of couplings between the panels if required.

The switch room has a concrete roof and floor, and is well lighted from the side. Coloured lamps on the front of the board show whether the switch is in or out, and on which bar, as the position of the handle does not give this information.

Rotary synchroscopes are provided, carried, with the voltmeters, on brackets which enable them to be seen from either end of the gallery. Illuminated signalling boards are suspended above the cranes in each half of the station, which enable the attendants to signal instructions to the drivers; to call attention to these boards through the roar of the running machinery, various devices were tried, without success, but a Klaxon horn solved the difficulty, and has proved completely satisfactory. Illuminated signals in the boiler house are also provided.

The old switchboard is now used entirely for the control of the station power plant, which is driven by two-phase motors; it is coupled with the main board through three 2,000-k.v.a. sets of Scott-connected transformers reducing the pressure from 11,000 to 2,000 volts. The auxiliaries are worked at 2,000 and 200 volts, and are controlled by Reyrolle switchgear, with Berry transformers when necessary. Duplicate supplies are taken to the pump rooms from the main and auxiliary boards to ensure continuity of operation.

An automatic intercommunication telephone system of the dialling type gives ready communication between all parts of the station.

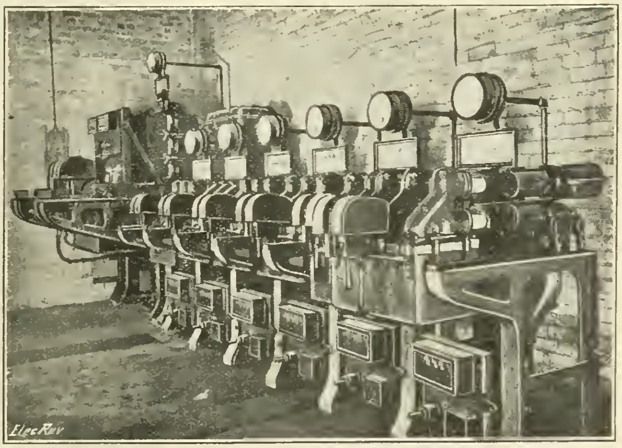


Fig. 20.—Switchgear in Sub-station (Main Switch on Left).

While the station is practically complete, there remain a few finishing touches to be added. A fitting shop is to be erected, but in the meantime, a room below the switchboard is used for this purpose. There is an admirably arranged fire-proof oil store adjoining the station, with five underground tanks in concrete, three being of 1,500 gallons capacity and two of 500 gallons each. The oil is raised from these by Bowser self-measuring pumps, with which a mistake is practically impossible. Near the store is the welfare and ambulance department, presided over by two capable women attendants, who deal with some 1,200 cases a year—most of them, of course, of minor importance. A pay office is also provided, and a system has been adopted which enables the whole of the employés to be paid in nine minutes. Fire pumps are installed in the tower pump house, which are used to keep the cooling tower timbers saturated inside and outside, every tower being sprayed once a week; these pumps also serve the fire hydrants.

In addition to the extensions at Neepsend, of course all other departments had to expand in proportion. The Mains Department had to make provision for distributing the extra amount of current generated, which involved the laying of 91 miles of cable, the erection and equipment of new sub-stations in different parts of the City, and the installation of additional switchgear and other controlling apparatus in many of the existing sub-stations. During the war period new works under the purview of the Mains Department were put in hand representing an expenditure of approximately £236,276.

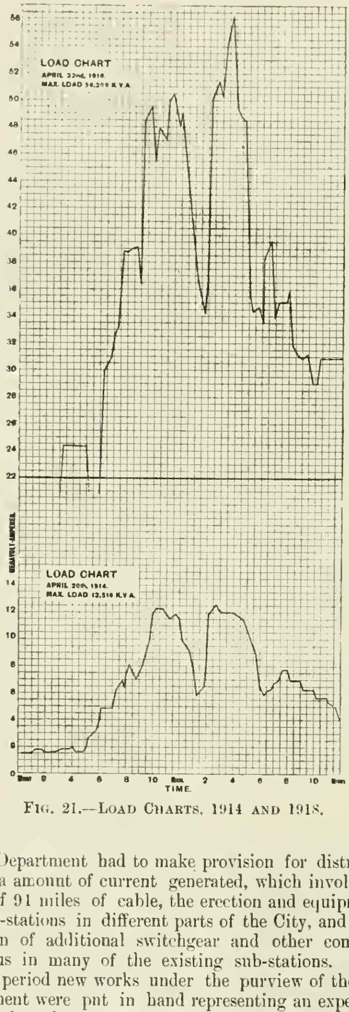


Fig. 21.—Load Charts, 1914 and 1918.

Here, as elsewhere, the progress of work was limited by the shortage of labour. When carrying out large feeder-cable extensions from Neepsend to the east end of the city, the work was proceeded with at night by lighting the trenches. Advertisements were issued for week-end work, to attract men who were free from other employment only at that time, and special arrangements were made for paying them on the spot each Sunday night. Good results accrued from this procedure, and the completion of the work was considerably expedited thereby.

Another innovation which was introduced as a result of the necessity of working with such a fine margin between capacity and demand was a complete private telephone system connecting the department directly with most of the large electric furnace installations, special facilities being granted by the Ministry of Munitions for the construction of these lines. The advantage of this interconnection was that, in cases of emergency, such as a breakdown at the station, shortage of coal, or any other contingency, the department was able immediately to control the heavy demand for furnace requirements during the continuance of the difficulty, and thereby to prevent the necessity of shutting down one or more sections of the general supply.

Female labour was introduced into the work of the department, with very creditable results; women are performing work, in some cases, of the roughest description, under conditions far from ideal. The department had no women employés on its books in 1914; the female staff now numbers 150, engaged in such duties as coal handling, stoking, boiler cleaning, ash handling, general labouring, engine-room cleaning, coal weighing, stores assistants, switchboard operating, motor-car cleaners, as well as an office staff of 48 and 4 meter readers.

In Sheffield the mains are mostly laid in cast-iron pipes, a fortunate circumstance, as during the war it was possible, in many cases, to draw new cables into spare pipes which were available, thereby avoiding a considerable amount of excavation; only a few armoured cables are used.

The cables are paper-insulated, lead-covered and vary in size from 0·025 sq. in. concentric to 0·5 concentric for high-tension, and 0·025 three-core to 0·25 three-core E.H.T. The centre part of the City, together with some of the outlying districts, is given a two-phase supply; part of this is supplied from the old Sheaf Street station, all of which is two-phase generation, the other districts being supplied from Neepsend through Scott-connected transformers, which vary in size from 250 to 2,000-K.V.A. From the end of 1914 to March 25th, 1918, 65 miles of 3-in. pipes were laid, and 51 miles of E.H.T. and H.T. cable was drawn in, together with 20½ miles of low-tension cable. All the E.H.T. feeders out of Neepsend are 0·25 three-core E.H.T. In several cases two of these feeders have been arranged for split-conductor working, forming a 10,000-K.V.A. feeder. We give a view of the switchgear in a typical sub-station, showing one of the large split-conductor switches; the load on these switches varies between 6,000 and 10,000 K.V.A. The main switch is capable of carrying 750 amperes, and the breaking capacity is put down at 100,000 KW. This sub-station was erected before the war, and is now associated with an electric furnace, spare land having been available on the site belonging to the Corporation. Thus the furnace was brought to the sub-station, the steel works growing up round the latter—an inversion of the usual procedure. Messrs. Reyrolle's switchgear, of the type similar to the smaller sizes (illustrated), is used on all the E.H.T. sub-stations. The outgoing circuits have overload protection, the trip gear being operated by a primary battery.

Ninety-five per cent. of the cables used in Sheffield are of Messrs. W. T. Glover's manufacture. The E.H.T. cables are provided with the maker's patent test sheath, the value of which is much appreciated. A novel method of identifying the cables, devised by Mr. W. J. Howard, mains engineer, is about to be brought into use in all the new feeders to be laid to the Blackburn Meadows station; it consists in drawing on the lead sheaths one, two or more corrugated ribs on the external surface, by means of which a cable can be identified, not only by sight, but also by touch. This corrugation, running the whole length of the cable, can be seen at any opening that may be necessary thus avoiding the use of labels, which are often lost, or illegible when required. The mains are laid along a frontage of 195¼ miles, there being 436¼ miles of 3-in. pipe laid in this frontage, together with 38 miles of 4-in. pipes, into which are drawn 185 miles of H.T. and E.H.T. cable and 168 miles of low-tension cable, exclusive of the tramway feeders.

The total number of electric furnaces connected to the mains is 51; these are of various types—namely, 27 Heroult, 14 Greaves-Etchells, 8 Electro-Metals, and one each of the Rennerfelt, Kjellin, and Chetwyn types. There are also 12 rolling mills connected, the largest motor being of 600 H.P., A.C. There are 217 motors on hire, aggregating 855 H.P., and 52 cookers, rated at 327 KW. The load is continually growing, the maximum demand having increased from 12,519 K.V.A. in 1914 to 58,909 K.V.A. in 1918, as will be seen on the accompanying load curves (fig. 21). The station load factor has remained during the four years practically constant at 40 per cent.

The "emergency station" which is being erected at Blackburn Meadows will contain plant of 28,000 KW. capacity, the boilers being of Stirling and Clarke-Chapman make, and the turbo-generators by Parsons, Willans, General Electric Co., and the British Thomson-Houston Co. Spray coolers have been adopted instead of cooling towers.

The Sheaf Street station is rated at 4,000 KW., and Kelham at 5,725 KW. A new station is in contemplation, to be of no less than 100,000 KW. capacity, so it will be seen that Sheffield is not going to rest on its laurels.

This article would not be complete without some reference to the other side of the subject—from the consumer's point of view. The undertaking, like others, has felt the effects of the increased cost of coal and labour, and the higher rate of income-tax; but, owing no doubt to the greater economy attained with the newer generating plant, the consumer has not felt them to the same degree. The average prices obtained during the past five years are as follows:—

	1918.	1917.	1916.	1915.	1914.
Light and heat ...	2·32d.	2·22d.	2·17d.	2·34d.	2·54d.
Power	·79d.	·74d.	·71d.	·72d.	·73d.
Total average price	·88d.	·85d.	·85d.	·97d.	1·13d.

It will be seen that there was a marked reduction in the average price for lighting and heating from 1914 to 1916, and the present price is lower than in 1915; power charges also fell somewhat, but now exceed the pre-war average. The over-all average price, however, has fallen by 21 per cent., and an analysis of the figures indicates that the power output in 1914 was 3·5 times the lighting and heating output, whereas in 1918 the ratio was no less than 16 : 1.

The tariff which is in force is given briefly below:—Lighting, 4d. per unit, or 4d. per unit less 50 per cent., subject to a minimum payment representing 4½ hours' use per day, for 365 days a year, of the maximum number of lamps in use at one time; domestic rate, all purposes, 10 per cent. per annum on the net assessment, plus ½d. per unit; outside lighting, 2d. per unit; picture theatres, 3½d. per unit for lighting, 1½d. per unit for lanterns or power; works lighting, 1d. per unit, subject to an agreement; heating, 1d. or ½d., subject to minimum payment; power, according to mode of use, 2d., 1½d., or 1¼d. (continuous working), up to 13·7 units per day, with discounts up to 10 per cent. for 2051·7 units per day.

An alternative charge for power of £4 per K.V.A. of maximum demand, plus ¼d. per unit, is offered for high-pressure supply in bulk. It is interesting to note that electric furnaces are charged at the power rate. The tariff was increased in 1916 and 1917 by the addition of 10 per cent. to charges over 2d. per unit and 33⅓ per cent. to charges of 2d. and under; and from September last the latter increase was raised to 45 per cent.

In addition to the supply undertaking, the department carries on a considerable contracting business, the accounts of which are kept distinct from those of the supply; in 1917-18 the revenue of this branch was £47,923, and the working expenses were £44,393. The department was responsible for the installation of 6,356 H.P. of motors, out of a total of 18,291 H.P. connected during the year.

The diagram on page 33 (fig. 16) shows graphically the progress made by the undertaking during the six years which have elapsed since we last gave details of its progress; it will be seen that development has taken place at a phenomenal rate. Throughout the whole of the proceedings connected with the work of the extensions, the Electricity Supply Committee showed that it was fully alive to the urgency of the situation, and never hesitated to depart from official procedure in the interests of the undertaking and to meet the national interests, whenever it was necessary to do so, and allowed the engineer to carry on unencumbered by a too close regard for adherence to rigid regulations, which may be very necessary under peace conditions, but at times of emergency often have a retarding influence, with no compensating advantage. We trust that the city will continue to advance, and that the electricity supply department will both contribute to, and share in, its prosperity.

A total of 194 employés left the department for service with His Majesty's Forces, of whom 21 have been definitely reported killed.

In conclusion, we must express our thanks to Mr. S. E. Fedden, engineer and general manager of the undertaking, for facilities for preparing this article, to Mr. H. E. Yerbury, deputy general manager, Mr. Cuthill, assistant engineer, Mr. Taylor, constructional engineer, and to all the members of the staff, who most courteously afforded us assistance and information.

ELECTRIC FURNACES IN THE NORTH OF SPAIN.

[BY OUR SPECIAL CORRESPONDENT IN SPAIN.]

A COMPANY (Altos Hornos de Vizcaya) has recently installed an electric furnace in its works at Baracaldo, near Bilbao, for the production of specially refined steel. The furnace is of the "Electro-Metals" type, producing 2½ tons of steel at each charge. The plant has been running experimentally for some months, but the staff is now conversant with its working, and is operating the furnace continuously when the supply of materials will allow of it.

Three-phase current is supplied by the Sestao power house, and is transformed to two-phase by means of two transformers coupled up in "Scott" connection.

The furnace is built of refractory brick strengthened on the exterior by steel slabs. The furnace bottom is of calcined and crushed dolomite. Two charging doors and one tapping hole are provided. The furnace crown, in the form of an arch, is of one piece of steel with a brick lining. The whole furnace is mounted on trunnions, and tilted by means of an electric motor.

The working pressure is 70 volts. The arc is struck by hand, and hand regulation is continued for some minutes, when the automatic regulator is put into service. The average consumption of energy works out at 450 KW.-hours per ton of steel obtained, but it is hoped to reduce this figure as the staff gets better acquainted with the peculiarities of the plant. A complete operation of the plant takes about four hours. The best record has been seven charges in 24 hours—17½ tons of steel.

Up to the middle of September nearly 300 tons of fine steel had been produced, in spite of great difficulties in obtaining materials of good quality. Occasional lack of coal at the generating station was also a drawback. It is hoped that the return to normal times will enable the furnace to be run continuously during the coming year.

There are one or two other electric furnaces now being established in the North of Spain. Messrs. F. Echevarria and Sons, of Bilbao, have under construction an Héroult furnace of five-ton capacity at their Recalde ironworks. Current will be supplied by the Sociedad Hidroeléctrica, of Bilbao. A small American furnace is also working in Pasajes (Guipuzcoa), and another in Araya (Alava). Another electric furnace for the production of ferro-manganese is being erected in the province of Teruel.

German Organisation of Technical Experts.—The German Economic Union and the Society of German Certificated Engineers have together formed a working association of economic and technical experts. The extent of the objects of the new society, in so far as these are of general interest, is not known. All persons with technical knowledge and experience have been called upon by the society to devote their services to the best advantage of the community under the present changed conditions.—*Soziale Praxis*, November 28th.

WHAT IS MEANT BY EFFICIENCY METHODS?

By E. A. Pells, Major, R.E.

Efficiency is a frightful bogey word, and certainly does not mean "slavery," as I once heard a labour agitator say, for "slavery," in the sense of the word as he meant it, is most inefficient. It means, on the contrary, the maximum result with the minimum of effort.

Some years ago, F. Winslow Taylor, an expert American engineer, began to study the expenditure of effort which is designated "work." He carefully studied the amount of effort a man had to put into his work, and the time he spent on each separate action; after which, he studied each individual movement, and by careful arrangement of the appliances the worker had to use in his work and a careful training of the worker to eliminate all waste movement, he was able to increase the productive value of the worker by from 25 to 50 per cent.

Now, this sounds all very well from the general standpoint; but one will ask, how did the employé get on? Supposing each operative increases the amount of work he does by 50 per cent., which is half as much again, then for every three men that were employed before, one is dispensed with and thrown out of work.

Let me answer the question in parts. First, the employé gets practically the whole of the extra value of the increased output, for the employer gets his reward in the added efficiency of his plant, although he must have a margin to cover the extra depreciation which usually follows a "speed up." Secondly, the worker does *not work* any harder—that is, he does not make any greater effort than before; but the difference is, that the whole of his effort is a useful one—all due to the new methods taught him by the efficiency engineer. So it is not 50 per cent. extra work—it is 50 per cent. extra result from the same amount of work. In fact, instances have occurred where output has been increased by 30 per cent., hours reduced by 12 per cent., and wages increased 15 per cent., which, considered carefully, shows a great advantage on the side of the operative. Thirdly, in all cases where "scientific management" or "efficiency methods" have been introduced under the "Taylor System" that have come under my purview, never in a single instance has any employé had to be dispensed with, and a very little thought will indicate the reason. The increased productivity at reduced cost which the employer enjoys enables him to compete in the world's markets very successfully, and demands increase so rapidly that he is enabled to extend his works and increase, instead of decrease, the number of workers he employs.

There is a further interesting point arising out of this which I should like to bring forward. Presuming that these methods are introduced into the whole of the industries in a particular country, the manufacturers of that country could then undersell all comers in their home markets, and foreign competition would not bother them. On the top of this, the purchasing value of the workers' wage would be greater, and an era of prosperity would exist such as never existed before.

But, one will say, surely the employer, when he finds out what a fine thing the worker is making of it all, will want to reduce wages; he will find reasons for this which will appear plausible, and then down goes the pay.

And! my reply will be, down goes the employer who could show such a lamentable lack of knowledge of human nature. Cutting in rates is one thing that the efficiency engineer will never agree to. I know that in the old days, happily gone beyond recall, the usual way a manufacturer would economise was by cutting his wages bill, and consequently cutting the throat of the goose that laid the golden eggs, for one seldom finds that such methods have met with success. They have, however, given us a perpetual mistrust of Capital, as such, and it is a recognised axiom in Trade-Union circles that the interests of Capital and Labour are diametrically opposed. This, I contend, is a complete fallacy, and but a very little study will prove it such. The fact is indisputable, that we all depend upon the success of the country's industries to a greater or lesser extent, and the individual can only be truly prosperous if the country is also. Therefore, it is obvious that anything that tends to promote that prosperity must also promote the prosperity of the individual, thus clearly showing that "Scientific Management" properly applied must make for the ultimate good of both employer and employé; and whilst it is bringing them prosperity, so it is bringing prosperity to the country they live in.

It may be asked, now, why is it necessary to make time studies, motion studies, and put in a system which appears to be very elaborate to achieve all this; surely this could be attained without a lot of elaboration? There is raised a very interesting point. It will have been noticed that games requiring skill of any kind require a certain amount of practice and careful coaching by those who know the best way of doing these things. What do we say when we see a man on the football field who apparently has no idea of the game? It, of course, depends a great deal on our capacity for sarcasm or the extent of our vocabulary. We expect the men to be carefully trained and taught their places in the team. In all other kinds of sport we expect the same thing, and object loudly and strenuously if it is not so; yet we often place a completely untrained man in a workshop or on a job, and expect good results. "Scientific management" wants to alter all this; and by carefully studying the methods and times of the best workers, we can arrive at what is, one might say, "championship form." Then, by carefully teaching each of the other operatives these methods, we must ultimately greatly improve the general work of the shop or factory as a whole. Certainly it may be seldom that any of the men really approach "championship form," but when they do why shouldn't they reap the benefit? Why should they be prevented from getting the real value of their talents just because they lie in the paths of industry instead of those of sport? If a man is an expert in any kind of sport he can make a fairly good thing out of it. Then let us bring the same kind of feeling into industry; and where a man is head and shoulders above his fellows, let him reap the benefit. The idea of the efficiency engineer is to put such a man in as a coach or instructor of the best methods, and surely this is a good idea. When doing this, we do not just let the man be made a foreman. That may entail a higher standard of education than your wonderfully skilled manual worker possesses; so, therefore, it is unfair to him. Make it an entirely separate job, and then see how soon he will justify his existence. Even if your best workmen do not desire to act in this capacity, they must reap the full benefit of their extra proficiency in larger wages, which will bring in its train a higher standard of self-respect, better housing, and happier home conditions.

A question may arise, what becomes of the dullard? My answer is, there are no dullards; there are lots of square pegs in round holes, and the effect of "scientific management" is to find all the right holes for the right pegs. I remember one instance of a man being sacked from job after job as absolutely useless and a fool, and yet that man finally became a skilled horse-keeper, and the veterinary surgeon who employed him valued him most highly. It was just the question of finding the right place for him.

There is a place in the world of industry where the great utility of "scientific management" will prove itself in time; by collecting and collating data it will be the means of placing many workers in occupations where they can realise a comfortable competency, instead of always grovelling along as "weaker brothers" all their lives.

Finally, the ability of a community to pay high wages depends more upon the avoidance of waste than upon increase of accumulations. The avoidance of waste in operative effort, time and fatigue, and employer's materials and power, means prosperity for the employé, employer, and the Empire.

Tradesmen Using the Royal Arms.—The *London Gazette* for January 3rd contains lists of tradesmen in London and elsewhere who hold warrants of appointment to Royalty, with authority to use the Royal Arms. These lists, as we suggested some years ago in connection with certain great public celebrations, should be of service to firms who will make a speciality of electrical illumination and device work when Peace rejoicings take place in a few months' time.

ELECTRICITY IN AGRICULTURE.

SEVERAL schemes for electric ploughing have recently been tried, but each system seems to have been designed with the idea that the sole object to be accomplished is to secure a sufficient pull on the plough, and, except that the steam engine is replaced by an electric motor, they differ very little from the Fowler system.

In applying electricity to agriculture it should be remembered that the main object is agriculture, and not merely the application of electricity, and that a first essential is good drainage.

An interesting system devised by Mr. G. F. COOKE, and described in patent specification No. 114,109, consists of elevated rail tracks which are permanently erected parallel to each other on opposite sides of the area to be cultivated, the tracks being designed to carry travelling electric motors, by which all the necessary hauling operations can be performed, from the draining and ploughing of the soil to the harvesting and transportation of the produce.

These tracks serve three distinct purposes: first, they form the main drains; secondly, supports for the travelling motors; and thirdly, a light railway, by means of which the seed and fertilisers may be carried to the soil and the crops transported; they also, incidentally, serve to divide the land into suitable areas, so that waste of land for hedges, ditches, and roads is rendered unnecessary. The distance between the tracks may be as great as half a mile, but, wherever possible, this distance should be uniform. Where the land is slightly undulatory, the level of the track may be preserved by making the supports longer or shorter, as the case may be.

The track consists of two steel rails, L shape in section, which are secured to the upper ends of A-shaped supports, preferably steel or ferro-concrete castings; the lower ends are buried in a suitable foundation, which also forms the main drain; two lighter rails are secured to the supports near the ground—these serve to maintain the vertical position of the traveller. The supports project about 4 ft. above the surface of the ground, and the track rails are so secured to them that a slot is left between the rails, through which a collector projects on to two conductor rails, which are mounted on suitable insulators inside the track rails.

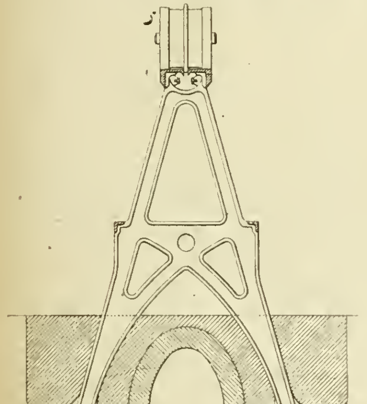


FIG. 1.—SECTIONAL ELEVATION OF SUPPORT OF RAIL TRACK, AND CONCRETE DRAIN.

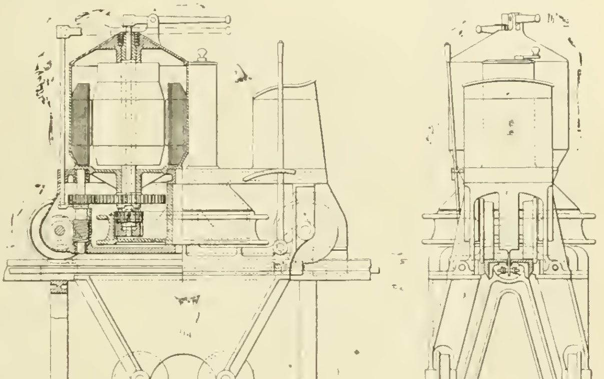


FIG. 2.—SECTIONAL SIDE VIEW AND END VIEW OF TRAVELLER.

Each track serves both as a horizontal and lateral support for an electrically-driven winding drum, which is arranged to travel along the rail as the cultivation proceeds, and is also provided with a brake by means of which it is locked to the rails during the hauling operations.

The implements are hauled by means of a wire rope, which is slightly longer than twice the distance between the tracks, the two ends of the rope being secured to the implement, whilst the rope itself is carried across the field and coiled two and a half times round each winding drum. By this means the necessity of coiling the cable evenly on to the drums is eliminated, whilst, it is claimed, securing a much higher and more uniform hauling speed and longer life of the rope. The power is also applied at two points of the cable simultaneously, thereby securing a 50 per cent. higher power factor than where one engine is idle half the time, as well as making a lighter system possible. All the implements are double-ended, *i.e.*, capable of working whilst travelling in either direction, and as they can be hauled right up to the tracks, there is no time lost in turning, and no subsequent finishing of wide headlands is necessary.

The total weight pressing on the land is that of the implement only, and there is no setting or removing of tackle, and no cartage of fuel or water.

Either D.C. or A.C. may be used, and where D.C. is available it may be supplied to the rails direct, if their total length does not exceed one or two miles. If the total length of rail is long, or the current heavy, it may be supplied by means of an insulated cable; the rails are divided into sections and connected to the cable as required, suitable switch boxes being arranged in the rail supports. The current would be supplied at about 500 volts pressure, series motors being used, controlled by ordinary tramway type controllers and resistances.

Where the total length of rail is very great and the load extremely heavy, single-phase alternating current has several advantages. An insulated high-tension cable can be carried inside the supports, from which tappings may be taken at suitable intervals to step-down transformers which reduce the pressure to about 350 volts, at which pressure it is fed to the conductor rails. With this system, single-phase commutator motors would be necessary, controlled by tramway-type controllers and auto-transformers.

The three-phase system has similar advantages to the single-phase system from the point of view of transmission over long distances, but requires at least two conductor rails and an earth return, and two sets of insulators.

The greatest advantage claimed for this system of elevated-rail tracks is that its installation would lead to the establishment of agriculture on a more permanent, as well as a more intensive, basis, as not only is the application of electricity to the machinery of agriculture made most easy, but the system provides at the same time a permanent means of soil drainage and of transporting the produce.

The drainage of the soil can be quite easily effected by means of a mole draining machine, hauled from the track by the same motors as used for hauling the plough, the concrete main drain being provided with suitable branch drains into which the mole drains can discharge.

Most of our agricultural districts are within 10 miles of a railway, but the annual cost of the necessary cartage almost equals that of ploughing, and any system which offers facilities in more than one direction must of necessity cost less than a single purpose scheme. Several schemes for the construction of light railways for agricultural produce have been promoted, but the chief obstacle appears to be the cost, and only some 500 miles have been so far constructed, at a cost of £7,000 per mile.

Assuming the cost of constructing the elevated rail tracks to be the same, viz., £7,000 per mile, this gives the cost per acre at about £30, for which sum the land is not only drained, but hedges, ditches, and roads, and the cost of their maintenance, are eliminated, while the advantages of cheap power are made available at all times, and several alternative routes provided for transport.

We understand that a company, named Electroculture, Ltd., is being formed to operate the patent, and hopes to have tracks ready shortly for demonstration.

Dielectric Loss in Cable.—An instance is cited in the *Electrical Review*, of Chicago, of very long 20,000-volt underground cables breaking down repeatedly, even when the kilovolt-ampere load was quite insufficient to cause overheating. It was noticed that the line broke down after it had been in service for a certain time, almost irrespective of load. The cause of failure was cumulative heating due to dielectric losses and consequent reduction of dielectric strength. By cutting pressure off the line at intervals so as to prevent cumulative heating, the number of breakdowns was reduced by 75 per cent.

CORRESPONDENCE.

Letters received by us after **5 P.M. ON TUESDAY** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electric Pressure Regulators.

I should be greatly obliged if any of your readers could give me their views on the question of the installation of electric pressure regulators.

The purpose for which I require a regulator is to regulate the running of an installation driven by a water turbine that is also fitted with a governor, but I need hardly point out to many users of this type of apparatus that even the very best of water-turbine governors are not very quick in action, so that as absolutely accurate running is desired, some additional form of electric governor must be installed. Most of the apparatus offered for this purpose appears to be at an extremely high price, but even this is not very important provided they carry out what is claimed for them.

In speaking of the question of the regulation of the speed of a governed water turbine, I am not, of course, alluding to the question of turbines operating under very high heads, as naturally a turbine that is governed by deflecting the jet that is working at high pressure will, of course, govern accurately, but in the turbine under discussion the head is small, and therefore the regulation is slow-acting. I shall be glad to be favoured with other firms' experience with the use of electric pressure governors under similar conditions.

Engineer.

January 2nd, 1919.

Greater London Electricity Supply.

In your last week's leader, dealing with the above subject, reference was made to the lack of enterprise and progressiveness on the part of smaller undertakings owned by local authorities, particularly in regard to the adoption of three-phase transmission and distribution.

It may interest you to know that the Erith Urban District Council, established as far back as 1903 a standard three-phase system of generation and distribution (professional advisers, Messrs. Hawtayne & Zeden).

Manchester, with its population of three-quarters of a million, had a few years previously adopted a low-pressure live-wire system, which many thought in those days might become a standard, and Manchester was always rather proud of its enterprise. But the "battle of the systems" will be fresh in the memory of most of your readers.

Again, in regard to steam turbines, the Halifax Corporation had steam turbines in use about the year 1897, and, although writing from memory, I doubt whether any of the Greater London companies had turbines installed prior to that date. Possibly Halifax and Erith may be merely exceptions that prove the rule, nevertheless—*Fiat justitia ruat cœlum*.

J. C. Williams,
Engineer & Manager.

Electricity Supply & Tramway Dept.,
Erith, *December 31st*, 1918.

[We refer to this subject in our leading columns.—EDS. ELEC. REV.]

British Fair Play?

As the I.M.E.A., to which my Committee belongs, expressed the opinion that chief technical officers should not be members of the E.P.E.A., I sent in my resignation of membership of that Association. Later, at another meeting of the I.M.E.A., the following resolution was proposed, seconded, and carried unanimously :—

"That, in the opinion of this Association, the higher officials employed in municipal electrical undertakings should have an increase in salary at least equivalent to the war awards."

Municipal Electricity Committee members only took part in the discussion and voting. When this recommendation came before my Committee, they, knowing that I had resigned my membership of the E.P.E.A., turned it down, although at the same meeting they offered an increase to members of the staff belonging to the E.P.E.A., and the workmen belonging to the E.T.U. This shows the sort of consideration we get if we do not belong to a strong association. For myself, as I thought that "Sauce for the goose should be sauce for the gander," I immediately withdrew my resignation from the E.P.E.A., and propose to continue as a member until an association is formed which can enforce the rights of the chief technical officers, although it is rather awkward for the chief (however much he may sympathise with them) to belong to the same association as the staff, but at present he apparently has no other alternative.

It is this sort of unfair treatment on the part of employers which absolutely forces their staff and men to join protective associations.

Borough Electrical Engineer.

January 6th, 1919.

The Future of the Shiftman.

I cannot but view with alarm the apathy of shiftmen over the problems involved in the matter of reconstruction; whilst other employés are gaining material advantages, the shiftman is left practically in his old position.

I cannot understand the action of the Electrical Trades Union, the National Union of Enginemen and Firemen, and the Workers' Union in accepting a 56-hour week for shiftmen, whilst applying for a 47-hour week for other employés; surely they cannot be voicing the views of shiftmen, who for years have been working a 56-hour week. I should think the time is now ripe for a universal 47-hour week.

Undoubtedly the shiftmen are not so well organised as they might be owing to the fact that they are distributed over the country, and are attached to several different trade unions, which do not, apparently, thoroughly understand the individual situation.

Cannot something be done to bring these men into closer unity, and so bring their grievances before the committee set up to inquire into the conditions that prevail, and to see that these men get their due in any reforms that are to be made in the matter of reconstruction?

A Shiftworker.

January 4th, 1919.

The Need for Co-operation Among the Smaller Manufacturers.

I have read with great interest your leader in your first issue for this year, and think you have touched on a subject which is of primary interest and importance to the British electrical industry.

The feature of British enterprise in the past has been the number of relatively small firms who are engaged in the engineering industry, and this has unfortunately prevented the production of standard gear in such quantities as would enable them to compete successfully in foreign markets as against their larger foreign competitors. The question of co-operative effort between such firms in order that they may be able to tackle the wide problems which await them at the present time is, therefore, one which should receive serious attention from all such manufacturers.

The large combination which we see being formed are undoubtedly a step in the right direction, as they will enable British manufacturers to compete successfully for the larger contracts which will be placed when conditions are again normal, but the further subject which you mention—that is, of co-operative efforts between specialist manufacturers—is also of equal importance. They are not concerned with the same problems as the large combinations, but it is essential that their efforts should be co-ordinated in such a way as to enable each maker to produce his standard apparatus in such quantities as to enable him to compete in price with his foreign competitors.

Successful production is the first step in any manufacturing industry, as without efficient production no selling organisation can be carried on satisfactorily. It seems, therefore, that such firms should so limit their range of production that they can introduce proper methods for quantity production in those lines which they continue to manufacture. At the same time, it will be necessary for them to associate themselves with other firms who have adopted a similar policy in order that collectively they may produce such quantities of each class manufactured that the cost is brought down to meet the international competition.

What, I think, is required, is some means of intense specialisation with regard to production, and a collective effort as regards the selling. Specialisation in production necessitates joint organisation for selling, because it is necessary for any sales organisation to have command of a complete range of apparatus in order to be successful.

It is for these reasons that I welcome the publicity which you have given to this matter as your New Year's message, and as one particularly interested in the success of small specialists' manufactures, I trust that the subject may be taken up by British manufacturers to see what steps can be taken with a view to their associating together to carry out the object you have outlined.

H. C. Siddeley.

London, W.C. 2, *January 7th*, 1919.

Electrostatic Dust Precipitation.—In an article on this subject *Industrial Management* says that a copper-smelting company installed a precipitating plant at a cost of $113,900. The operating expenses (power, labour, supplies, &c.) were $14,600 a year; but the value of the copper dust collected was $180,018 a year (all figures based on pre-war prices). Cement plants can also show a good return even on such low-value material as raw cement dust, but of special importance is the fact that many cement plants can collect many tons of potash per annum, which is valuable at all times, and immensely so at present. One cement plant, with a precipitating equipment that cost $180,000 to install and $10,395 a year to operate, obtained recoveries of cement dust worth $25,000, and potash worth $50,000 a year (also pre-war prices).

ADMIRALTY ELECTRICAL ENGINEERING STAFF DINNER.

Presentation to Mr. Wordingham.

At Cannon Street Hotel, London, on the 2nd inst., the Admiralty Electrical Engineering Staff gave a complimentary dinner and presentation to Mr. C. H. Wordingham, C.B.E., M.Inst.C.E. (President of the Institution of Electrical Engineers), on his relinquishing the office of Director of Electrical Engineering, Admiralty. As already announced in these columns, Mr. Wordingham has resigned the directorship in order to resume practice as a consulting engineer, but has been retained by the Board of Admiralty in a consulting capacity.

At the request of the staff, Mr. Wordingham presided over the festivities, and the proceedings were graced by the presence of Mrs. Wordingham. The company numbered upwards of 200, including Mr. A. D. Constable (Assistant Director of Electrical Engineering, now acting in charge of the Department), Mrs. Constable, Mr. E. T. Williams, Mr. W. McClelland, Mr. L. J. Steele, Mr. Z. Kingdon, Mr. Hunt, Mr. R. Wightman, Mr. F. Purser Fletcher, Mr. F. C. Forster, Mr. W. P. Scott, Mr Melville Ackery, Mr. Frank Morton, Mr. R. W. Willis, Mr. Uttley, Mr. E. E. Rogers, Mr. H. R. Green, Mr. J. Shaw, &c.

Proposing the health of Mr. Wordingham, Mr. Constable reviewed the progress of the Department during the past 15½ years, remarking that Mr. Wordingham had completely revolutionised the electrical equipment of the Navy, which was unequalled in any navy in the world, and had helped the Navy to carry through the recent supreme test without any serious breakdown. When Mr. Wordingham first joined the Admiralty service, he had only two assistants, both of whom were present that evening, and now the staff numbered something like 200 of all ranks. Mr. Wordingham was possessed of extraordinary energy, but for which he could not have accomplished half of what he had done for the Navy. He had been associated with Mr. Wordingham closely at the Admiralty for six years, and could testify to his straightforwardness of character, honesty of purpose, and genuine sympathy with the members of his staff, and all who came to him for a helping hand. Voicing the feelings of the whole of the staff, he said they regretted exceedingly Mr. Wordingham's departure, thanked him for his unfailing courtesy and consideration to them, and wished him long life, happiness, and the success which he deserved. In conclusion, he asked Mr. Wordingham's acceptance of a presentation (a handsome gold watch, together with a framed photograph of the staff and an illuminated album containing the autographs of the subscribers) as a small token of the esteem and affection in which he was held by the entire staff, and as a memento of the Department and of the work done by him at the Admiralty.

In acknowledging the gift, Mr. Wordingham said he would always treasure it with affection as well as gratitude. Mr. Constable had referred to the fact that 15½ years ago, when he was practising as a consulting engineer, he was invited by the Admiralty to take charge of the Electrical Department then being formed. There had just been presented a report by a committee on the electrical working of plant and gear in His Majesty's ships, and that report was intended to be the basis of the work of the new department. He found that report exceedingly useful; when it happened to tally with what he wanted to do he referred to the report, and whenever he did not want to do what the report said, he left it severely alone! In the early days, in order that the official trials of a ship might be passed it was necessary to eviscerate the electrical gear and put it into an oven. If a test was made, say, within 12 hours, the test was satisfactory and the gear passed; if they waited too long they had to do it all over again. Obviously one of the first things he had to do, therefore, was to get rid of insulating material that would absorb water. When he entered the service one of the chief materials in use was "Ambroin"; he had made the acquaintance of that German material before, and he knew it to be the very worst of its kind in existence. "My feelings towards the Germans then," he continued, "were the same as now, and I was quite determined that Ambroin was going, and it went very quickly. It was thoroughly bad, and it was being used in a thoroughly bad way. Contractors were complaining bitterly of the high prices which they had to pay the Germans for that insulating material for use on H.M. ships. There is no Ambroin in use now in the Navy, and there has not been any used for a great number of years." Practically none of the standard cables in those early days had wires in stranding numbers, and there were a very large number of cables to cover a comparatively small range. He introduced standard sizes of cable and standard stranding numbers, but he was told that his new cables would be so stiff that it would be impossible to put them into the ships. He did not agree; those cables were made, and he did not think anybody ever found out the difference. They had ordinary commercial standard cables instead of the old-fashioned ones! As the work grew, it very soon became evident that they had too many cables, and that if they wanted to go along on the old system they would have to enlarge the ships in order to get the cables through the bulkheads. That led on to the ring-main system, about which there had been a good deal of controversy, but which still survived, and which had survived the actions that had been fought in the great war. His experience was based upon work on a large scale, and he was accustomed to heavy underground paper-insulated cables. He had abandoned rubber as being anathema altogether. So when the ring-main system of distribution came in, he ventured to introduce armoured paper-insulated cables. Again he was told that he knew nothing about ships, and that it was quite impossible to get these underground mains into use—but they went there all the same, and it was an interesting fact that from the time the first ring-main paper-insulated cables were put in to this day, so far as he knew, there had never been a fault on them. The first thing which struck one was that the Admiralty as a whole, including shipbuilding firms, possessed all the attributes of "mass." It was a terrific task to alter anything which was already in motion, and it was a terrific task to start this mass moving. That was good in itself, because it prevented violent fluctuations, but it was a frightful job to get any reforms made when those reforms were needed. Then, again, one was impressed by the hugeness of the Admiralty machine, and the marvellous organisation which knit together all the several departments and ensured that the work which affected a number of departments was dealt with by them, and that all those who should know did know what was going on. He had nothing but admiration for the way in which this extraordinarily difficult matter had been worked out. The Admiralty Contract Department was a model for every Government Department to copy. Concluding, Mr. Wordingham proposed the toast of "The Admiralty Staff," coupled with the name of Mr. E. T. Williams (Assistant Director of Electrical Engineering), who responded in a few well-chosen sentences.

TRADE STATISTICS OF NEWFOUNDLAND.

The following figures, showing the imports into Newfoundland during 1916-17 of goods which are of interest to electrical contractors, are extracted from the recently-issued trade statistics. The figures for 1915-16 are added for purposes of comparison, and notes are given of any increases or decreases.

	1915-16. Dols.	1916-17. Dols.		Inc. or dec. Dols.
Radiators, electric light material, &c.—				
From United Kingdom ...	1,000	1,000		—
,, Canada	10,000	20,000	+	10,000
,, United States ...	36,000	89,000	+	53,000
,, Other countries ...	—	1,000	+	1,000
Total	47,000	111,000	+	64,000
Machinery for mining purposes.—				
From United Kingdom ...	1,000	55,000	+	54,000
,, Canada	2,000	265,000	+	263,000
,, United States ...	2,000	69,000	+	67,000
Total	5,000	389,000	+	384,000
Constructional material and machinery for local industries.—				
From United Kingdom ...	1,000	2,000	+	1,000
,, Canada	7,000	18,000	+	11,000
,, United States ...	16,000	257,000	+	241,000
,, Other countries ...	—	2,000	+	2,000
Total	24,000	279,000	+	255,000
Oils, lubricating.—				
From United Kingdom ...	2,000	1,000	–	1,000
,, Canada	9,000	7,000	–	2,000
,, United States ...	58,000	33,000	–	25,000
Total	69,000	41,000	–	28,000
Materials for Western Union Telegraph Co.—				
From United Kingdom ...	7,000	1,000	–	6,000
,, United States ...	6,000	6,000		—
,, Canada	3,000	—	–	3,000
Total	16,000	7,000	–	9,000
Goods for Anglo-American Telegraph Co.—				
From United Kingdom ...	1,000	500	–	500
,, United States ...	2,000	2,500	+	500
,, Canada	—	500	+	500
Total	3,000	3,500	+	500
Materials for wireless telegraphy.—				
From Canada	5,000	9,000	+	4,000
,, United States ...	—	3,000	+	3,000
Total	5,000	12,000	+	7,000

Dollar = 1s. 2d.

BUSINESS NOTES.

New French Company.—La Societe le Materiel General Electrique M.G.E. is the name of a new company which has lately been formed in Paris (15, Rue des Petits Hotels), with a capital of £19,200, to carry on an electrical engineering business.

Social.—"To mark the termination of the war," the directors of the Rochdale Electric Co., Ltd., electrical engineers, Shawclough, Rochdale, entertained their employés to supper on Friday. About 80 guests were present. A whist drive preceded the supper, and dancing followed. Mr. Walter Scott, chairman of directors, presided, and the speakers included Mr. W. D. Watson, managing director, Mr. W. L. Ashworth, manager, and Mr. Henderson, secretary.

Fire.—On the evening of January 1st fire broke out at the works of Messrs. Barraclough Bros., electrical engineers, Perseverance Works, Brighouse, cables being burnt.

The American Bosch Magneto Co.—The works and business of the American Bosch Co., at Springfield, Mass., which since May last have been in the hands of the U.S. Alien Property Custodian, were recently put up for sale by auction. There were five bidders for the property, which was eventually secured for the sum of £830,900 by Mr. H. C. Griffiths, of New York. The purchaser, who is reported to have bought entirely on his own account, is stated to have made a good bargain, a conservative and unofficial estimate of the value of the concern and its assets being one million sterling.

New Osram Company Formed at Berlin.—The *D.A.Z.*, November 22nd, stated that the Osram Co., Ltd., had been registered, with premises at Berlin, and a capital of Mk. 300,000, for the purpose of manufacturing electric bulbs especially with the Osram trade-mark, and other electrotechnical articles.

German War Profits.—German industrial companies may yet come to feel that it would have been better for them if they had had to pay Excess Profits taxes, as have British manufacturers. The *Kölnische Zeitung* of November 26th stated that the People's Marine Council was demanding an explanation from the Government about the dealings of the "Z.E.G." (Central Purchasing Association), which had made enormous profits unlawfully at the expense of the nation. The *Kölnische Zeitung* strongly advocated the holding of an inquiry, and the compulsory publication by the Z.E.G. of its profit and loss account and balance-sheet.

Export Restrictions Removed.—The *London Gazette* for January 3rd contains a further list of relaxations in export prohibitions.

Trading with the Enemy.—The *London Gazette* for January 3rd contains a further list of persons and bodies abroad with whom trading is prohibited, or whose names have now been removed from the list.

A Novel Lighting Fitting.—With reference to this device, which we illustrated last week, we understand that the fitting was designed and manufactured by Messrs. W. Lucy & Co., Ltd., of Oxford, who exported it to South Africa. This method of spring suspension of the lampholder has also been used by the Wardle Engineering Co., Ltd., of Manchester, in its "Beatark" fittings, and has proved very satisfactory. The company now uses a specially designed shade ring-type porcelain lampholder in a metal disk.

Catalogues wanted for Belgium.—Mr. A. Collumbien, of 2, Woodlands Road, Cheetham Hill, Manchester, who is shortly starting electrical business in Belgium, desires to receive catalogues and price lists.

American Engineers and French Reconstruction.—The arrival in Paris of a mission of American engineers to confer with French engineers on the subject of reconstruction is announced in the French Press. This mission includes delegates of the United States Society of Civil Engineers, the Society of Mechanical Engineers, the Electrical Institute, and the Institute of Mines. The Mission is to visit the liberated areas, and will work in five sections, as under:—

1. Port and canal improvements.
2. Reconstruction of roads.
3. Agriculture.
4. Utilisation of water-power resources.
5. Technical education.

—*Board of Trade Journal.*

Platinum in Spain.—Platinum to the extent of from 2 to 3 grammes per metre has been verified to exist in the Serrania de Ronda, as the result of three years of exploration conducted at the instance of the Spanish Government. The Serrania is an eruptive volcanic range, 1,400 sq. km. in extent, which thus far outstrips the platinum fields of the Ural Mountains, which are only 50 sq. km. in extent, have never yielded more than ¼ gramme per metre, and is tending to exhaustion.

Football Notes.—The return match between the Magnet F.C. and the Waygood F.C. was played on Saturday last, and resulted in a win for the former by 6 goals to 2. For the winners Dyke scored three goals, but the ground was so bad that most of the players covered themselves more with mud than with glory.

The Federation of British Industries.—From the *Bulletin* of the F.B.I. for January 2nd, we note that the total membership of the Federation is now as follows:—163 Trade Associations, 15 Associations of controlled establishments, and 822 firms, making a total of 1,000.

Lantern Slides.—Referring to our inquiry for lantern slides for the instruction of Army men, Messrs. Newton & Co., of 37, King Street, Covent Garden, W.C. 2, inform us that they are making preparations for the immediate production of lantern lecture sets on the general subject of engineering, and have obtained permission to reproduce photographs from well-known firms for this purpose. They send us a copy of their "Catalogue of Lantern Slides," Part II, which gives particulars of many thousands of slides dealing with educational and scientific subjects, but does not include the sets above mentioned.

Rationing Committee Disbanded.—With the general release from Government control of raw material used in industry, the necessity for rationing disappears, and the Civil Industries Committee through which that rationing has been exercised is now to be disbanded. The Committee was appointed by Dr. Addison, then Minister of Munitions, in February, 1917, under the name of the Priority Advisory Committee. Its duties were to investigate the claims of industries threatened with hardship or extinction owing to the shortage of raw materials, and to make arrangements whereby they might at least be kept alive, even if not maintained at their former level. The Committee comprised some departmental officials, but was composed mainly of business men. The chairman was Mr. John Wormald, of Mather & Platt, Ltd., engineers, Manchester.

In accord with the Controller of Priority, the Committee from the beginning undertook the rationing of manufacturers already grouped together in trade associations or capable of being grouped. It investigated the affairs of 91 trades, in 78 of which a rationing system was established. In addition, the Committee from time to time, by arrangements with the Minister of Reconstruction, investigated claims made to him for materials, plant, and machinery required in preparation for the resumption of peace-time work or for the starting of new industries. We understand that from the outset the Committee worked on the principle of winning the co-operation of the traders themselves. No decisions were made without consultation with representatives of the industries concerned, and the meetings between the two sides were full and frank. The Committee originated the system of appointing, as official rationing authorities, independent persons of high standing, chiefly firms of chartered accountants. This system is understood to have worked to the general satisfaction of the traders rationed. To ensure that the supplies of raw materials should be forthcoming, the Committee worked in closest touch with various Government Departments; a close liaison has also been maintained with the War Trade Department for the purpose of correlating manufacture to export. The Committee has met for almost two years twice a week regularly, and in its earlier months three times a week. The chairman, Mr. Wormald, has given the whole of his time to the work, assisted by Mr. Frederick Simmons, and by Miss Fraser as secretary, with no other staff. For its services the Committee has been warmly thanked, not only by the Government, but also by the traders whom it rationed. It is generally considered that this Committee has furnished a striking example of what can be effected in administration by appointing one man of experience and of approved business ability and by allowing him to select his own colleagues.

Catalogues and Lists.—The Equipment and Engineering Co., 2 and 3, Norfolk Street, Strand, London, W.C. 2.—Catalogue, consisting of several illustrated lists giving descriptive particulars of the E. and E. electric arc welding plant and the scope of its repair work, the E. and E. magnetic system of electric arc welding, and details and prices of arc welding accessories and operators' sundries and metallic electrodes.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—Publicity postcard, giving particulars and price of reflectors for industrial lighting.

Quasi-Arc Co., Ltd., 3, Laurence Pountney Hill, London, E.C. 4.—Two illustrated pamphlets; one of 32 pages contains full particulars of the Quasi-Arc system of electric welding for iron and steel, while the other, of 16 pages, contains notes on the system as applied to ship construction.

Non-Ferrous Metal Industry Act.—The *London Gazette* for January 7th contains a list of further licences granted under this Act.

Dissolution and Liquidation.—Peckham, Ducamp and Co., electrical engineers and manufacturers, 4 and 5, New Compton Street, W.C. 2, and Campbell Works, Campbell Road, Twickenham.—Messrs. G. S. Peckham and J. Ducamp have dissolved partnership. Mr. Peckham will continue the New Compton Street business and attend to its debts. Mr. Ducamp will continue the business at Twickenham, and attend to debts there.

English Electrical Co., Ltd. A meeting will be held at 3, Abchurch Yard, E.C., on February 10th, to hear from the liquidator an account of the winding up of this company, which was formed many years ago, and whose business is now absorbed in the Dick, Kerr organisation.

A Westinghouse Reunion.—Ex-Westinghouse men are holding their first reunion dinner on February 14th, at the Connaught Rooms, London. Any ex-Westinghouse man who has not received an invitation is asked to communicate with Mr. L. S. Richardson, 14, Sydney Road, Richmond, S.W., who will be pleased to furnish all particulars.

Plant for Disposal.—The Central Electric Supply Co. has for immediate sale one 1,560-kw. and one 780-kw. Willans-Oerlikon reciprocating engine and generator complete, and two 1,050-kw. l.p. Oerlikon turbo-generators, 6,000-volt, three-phase.

Sheffield Corporation Tramways Committee has for disposal a number of Dick-Kerr tramcar controllers. For further particulars, see our advertisement pages to-day.

Ball Bearings Order Suspended.—The Minister of Munitions has suspended the Ball Bearings Order, 1917, as from January 7th, 1919.

Foreign Trade.—The December Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

Imports.	*December.* 1918.	*Inc. or dec.*	12 *months*, 1918. *Inc. or dec.*
	£	£	£
Electrical goods, &c. ...	59.122	− 40,420	− 285,891
Machinery	792,892	+102,493	+ 1,837,511
Exports.			
Electrical goods, &c. ...	244,379	+ 56,594	− 773.710
Machinery	1.174,320	− 45,374	− 3.420.331

Trade Announcements.—Mr. H. Ashdown, late managing director of Enterprise Manufacturing Co., Ltd., has opened up a new works, Ashdown Electrical Co., as electrical engineers, at 8, New Inn Yard, Shoreditch, E.

Mr. Harry Moss, of Bradford, has been demobilised, after serving with the Forces (R.E.'s) since 1916. He is immediately re-opening his business at 116, Horton Grange Road, Bradford, and invites manufacturers and merchants to forward catalogues and price particulars of all lines.

Reconstruction Problems.—No. 10 of the series of twopenny booklets issued by the Ministry of Reconstruction deals with "Labour Conditions and Adult Education."

Book Notices.—The Christmas number of the quarterly *Chloride Chronicle*, published by the Chloride Electrical Storage Co., Ltd., Clifton Junction, contains appropriate Peace notes, references to Chloride staff changes, excellent photographs of Mr. D. P. Dunne, secretary of the company, and Mr. E. C. McKinnon, the engineer, letters from men with the Forces, Chloride men's war honours, and other interesting matters.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVII. No. 12. December, 1918. New York: The Institute. Price $1.00.

"Electrical Ignition for Internal-Combustion Engines." By M. A. Codd. Second edition. Pp. vii + 164; 120 figs. London: E. & F. N. Spon, Ltd. Price 6s. net.

"Manual of Electrical Undertakings and Directory of Officials." 1918-19. Vol. XXII. London: Electrical Press, Ltd. 22s. 6d. net.

Dutch Post-War Industries.—Discussing in *De Ingenieur*, November 2nd, the then conditions of trade in general, and the means necessary to protect Dutch trade against the tendency on the part of most Governments to make their home markets secure against foreign competition, D. J. W. Van Dongen refers at length to what has taken place in England, such as the re-organisation of the Consular Service, the introduction of State supervision in factories, and the amalgamation of the engineering interests, and recommends that similar measures should be taken in Holland.

Engineers' Wages in Norway.—The minimum wage schedule for engineers that was accepted last year by the Norwegian Engineers' Association, very soon needed altering owing to the increased cost of living. This has now been carried out and a new schedule established by the Labour Department, according to which the minimum salary for engineers in public services ranking in the grades of engineer-assistants and directors, ranges from Kr.4,000 to Kr.15,000 per annum. The rates now fixed are to be looked upon as minimum rates, and therefore if it is desired to obtain the services of highly qualified men for certain important posts, considerably higher salaries must be offered. At the same time the Engineers' Association put forward proposals with regard to the salaries of managers and engineers on the State railways. Kr.30,000 is to be the yearly salary for a general manager, and departmental managers will receive Kr.20,000.—*Verdens Gang*, November 20th. (Kroner = 1s. 1½d.)

German Efforts to Recover Lost Trade.—As an indication of the endeavours which the Germans are making and propose to make for the purpose of recovering their lost trade, it is of interest to note that they are circularising and dispatching agents to firms and business men in neutral countries, offering to buy shares, or lend money on stock or goodwill as security. These circulars seem to have been sent broadcast to Holland, Denmark, Norway, Sweden, Spain, and Switzerland; and many agents apparently are only awaiting their opportunity to cross the Atlantic as representatives of banking syndicates and industrial establishments, including even Krupp's, the vast armament firm at Essen. Unless the Allies get to business very rapidly when once the Peace Conference has been fairly started on its course, our commercial men and manufacturers generally may find themselves severely hampered by these German attempts to "peg out claims" by the use of money and machinery which rightfully are the property of the nations that have been devastated.—*Birmingham Post.*

German Trade Propaganda in Holland.—The Economic Association for German-Dutch Trade recently informed the *Deutsche Allgemeine Zeitung*, December 1st, that Germany's trade relations with neutral countries were reviving now that peace was approaching and the export prohibitions were cancelled. This was especially evident in the numerous applications from persons resident abroad for appointments as agents of German firms. It was of the greatest importance, both to the exporting and importing countries, that suitable persons should be chosen, and as regards Holland the above-named association placed itself at the disposal of interested parties in both countries, and was prepared to give confidential information as to the reputation, business capacity, &c., of persons who had applied already for such agencies.

The 47-hours' Week: A Strike.—About 2,000 engineers employed at the Thornbury works of the Phœnix Dynamo Manufacturing Co., Ltd., Bradford, came out on strike on January 2nd, in protest against the system of clocking in under the new 47-hours' week agreement, which involves a start at 7.30 a.m., and no period of grace for late-comers except those who are liable to delay by train and other special reasons, to whom special passes are granted. On this day, the first on which the new arrangement was acted upon, about 70 or 80 workers were locked out, but owing to severe weather the works manager admitted them. The employés, however, met inside the works and decided to strike against the system. They contend that the firm violated the old agreement, and should have conferred with the workers before adopting the new course. The employers, on the other hand, contend that the men broke an agreement under which local conferences are to be held on disputes, failing which a central conference is to be held, but work is not to be interrupted. On Friday, the day following the strike, a conference of the parties was held, and it was agreed that work should be resumed on the Monday morning, and that on that morning a further conference should be held on the points in dispute.

Small Traders and Demobilisation.—At the invitations of the Mayors of Southwark and Lambeth, a meeting of small employers of labour was held at the Southwark Town Hall, with the object of enabling the Local Advisory Committee to get into closer touch with them. At present the minor industries, the small trader or "one-man business" owners are not represented on the committee, and considerable difficulty has occurred in ascertaining what men they require from the demobilised Forces. As a result of the meeting two representatives were appointed to serve on the committee. Mr. J. T. Cummings, manager of the Borough Labour Exchange, said there was quite a mistaken idea abroad as to what was meant by "pivotal" men. They must be men upon whom other men depended for their work. They must be the organisers of the work, and must be released at once if they desired to avert a vast number of unemployed men walking the streets. There was no need for men over 43 years of age in the Army to put in applications for release nor for men in hospitals, as these were being demobilised. Men home on leave could also get their discharges if applications were filed. They would not have to go back to France. The "one-man businesses" were worrying the committee. They had received hundreds of applications for the release of these men, and they would be released immediately after the pivotal men. But when the committee scrutinised the forms for the release of many of these so-called "one-man business" owners it was impossible to pass them, though they dealt honestly with the genuine owners. Applications had been received from men describing themselves as owners of "one-man businesses" who were commission agents, newspaper sellers, and similar occupations, who were anxious to get out of the Army. These were not genuine "one-man business" owners, who would be of service to the country.

Returning to Peace Production in America.—A number of electrical manufacturers who have devoted a large part of their manufacturing facilities to the production of shells and other munitions are changing their plants back for turning out their normal electrical products. Little difficulty is being experienced in doing this except in isolated cases. The cancellation of government contracts for shell production has caused the Wagner Electric Manufacturing Co. of that city to dismiss between 800 and 1,000 employés engaged in this work within the last eight or ten days, about 300 being laid off in one day alone. The company was one of the first St. Louis manufacturers to engage in munition work after the start of the war.—American *Electrical Review*, December 14th, 1918.

After Many Years.—An incident which should not be permitted to pass unnoticed was reported to the Finance Committee of the Leeds Corporation last Friday. About 35 years ago the firm of J. & H. McLaren, owners of the Midland Engine Works, Leeds, had to make an arrangement with its creditors, who received 5s. in the pound. A firm of London accountants has just written to the Corporation stating that although no legal obligation rested upon them, it had been one of Messrs. McLaren's life ambitions to pay off their liabilities in full, and they had now placed in their accountants' hands an amount sufficient to pay the balance of 15s. in the pound.—*Engineer.*

Australians and Trade with Germany.—In a letter dated November 9th, and addressed to the Victorian Employers' Federation, Melbourne, Mr. P. J. Pringle, general manager of the Electric Supply Co., of Victoria, suggests that employers' associations "should at once finalise the future action in regard to trading with Germany and Austria. It would seem that some form of appeal by pamphlets and meetings should bring before our members the necessity, both from a self-preservation and a loyal point of view, that goods manufactured in or in any way connected with these countries should be banned. A clearly defined attitude expressed as early as possible seems desirable. Undoubtedly there are many persons and firms sufficiently unprincipled to again act as agents for goods manufactured in these countries. If a clearly defined policy is adopted against such a procedure, it will deter many from acting in this capacity." He further suggests that the pamphlets and illustrated sheets prepared by the *Mining Standard* in regard to Germany and the trade question should be reprinted, and distributed to members on the understanding that such shall be framed and permanently and prominently hung in their places of business—"Lest we forget." He continues:—

> "Consideration might also be given to the drawing up of statements, which should accompany all orders to manufacturers and agents, both here and abroad, that they are not stocking goods of German or Austrian manufacture. Unless they are prepared to sign such a statement in the affirmative, no business relations can exist with them. My company intend to act strictly on these lines, but the value of such a procedure would be entirely lost unless it is more or less general and accompanied with a full education and clear explanation of the danger of any other course being followed."

Valuation of Land for Business Uses.—The Ministry of Reconstruction has now issued the second report of the Committee upon the Acquisition and Valuation of Land for Public Purposes. The first report, which was issued last January, recommended measures for cheapening, shortening and simplifying procedure for obtaining compulsory powers for the acquisition of land, a procedure so cumbersome as to involve a delay of many months, and costs of anything from £500 upwards. It was made abundantly clear, moreover, that the committee interpreted the term "public" purposes in the widest sense, to include private, industrial, and business enterprises of public utility, as well as the enterprises of public bodies. In its second report the committee devotes attention to a suitable system for the valuation of land compulsorily acquired.

LIGHTING AND POWER NOTES.

Accrington.—Wages.—The employés of the Corporation electricity department have been granted a further bonus of 5s. per week, making 28s. 6d. a week, plus 12½ per cent., as from December 7th, 1918.

Argentina.—Buenos Ayres.—Owing to a dispute between the Primativa Gas Co. and the municipality over the nonpayment of the company's bill, the supply to all municipal buildings, except hospitals, has been cut off; the *Times* states that the municipality intends to install oil and electric lighting.

Water Power.—The Legislature of the Province of Mendoza has sanctioned plans for the development of the province, including water supply, sewers, and hydro-electric power; the cost is estimated at $13,000,000 m/n.—*Review of the River Plate.*

The Minister of Agriculture, who recently visited the Iguazu Falls, states that they are in no way inferior to Niagara, and considers their utilisation for the generation of electricity to be a feasible project, which should be undertaken as soon as possible. He recommends the appointment of a Commission of Engineers to investigate the project. The falls are 600 to 700 miles distant from Buenos Ayres.—*Pall Mall Gazette.*

Australia.—Sydney.—The N. Sydney Council has passed a resolution urging the Government to utilise the water powers of the Nepean, Warragambi, Grose, and other rivers for the production of electricity and the development of the water supply.

Sale—The B C. has decided to make inquiries with regard to the provision of an electric lighting scheme for the district.

Lismore.—The electrical engineer has reported upon the question of a municipal electricity scheme for the town. The report states that there are 250 creameries within a 30 miles' radius of Lismore, each of which might be expected to install a 4 or 5-H.P. motor, and co-operation with neighbouring municipalities is recommended.

Coburg.—The T.C. has arranged to borrow £13,000 for the provision of an E.L. installation, and is to take a bulk supply from the Melbourne City Council for ten years.

Electricity Supply and Standardisation.—A conference of engineers and managers of electricity supply undertakings, held in Melbourne, reported that as the supply of electricity to small private consumers usually resulted in a loss to supply undertakings, it was necessary that a monthly minimum charge for each service be made. As a supply undertaking might be called upon at any time to give a stand-by supply to premises also supplied from a separate source, and the stand-by might not be used to an extent sufficient to prevent the supply undertaking losing in connection therewith, the conference recommended that future legislation should include protection for undertakings which refused to give or maintain a stand-by supply; this legislation should follow the lines of Clause 15 of the British E.L. Act, 1909. The conference supported the principle of standardisation as applied to the electric supply industry, and was of opinion that British standardisation should be adopted, as far as possible, in Australia. The Advisory Council of Science and Industry was advised that the conference was of opinion that the Commonwealth should, at the earliest moment, establish a Bureau of Electrical Standards.

Barrow-in-Furness.—Wages.—The T.C. has increased the wages of the employés of the electricity department in receipt of wages not exceeding £300 per annum by 5s. per week. Consideration of an application for an advance of £65 per annum by the chief Corporation officials has been deferred.

Sewage Pumping.—The application of electricity to the sewage pumping plant is to be proceeded with as soon as possible by the T.C. Health Committee.

Belfast.—Turbine Breakdown.—With regard to the breakdown of one of the turbines at the T.C. electricity works some weeks ago, a report by Mr. J. H. Rider stated that the breakdown was due to purely accidental causes, and there had been no neglect or want of skill on the part of the employés.

Extensions.—In connection with the Harbour power station, the construction of which was pushed on at the request of the Government, in order to facilitate shipbuilding, the chairman of the E.L. Committee has stated that the negotiations in progress justify them in believing that they will be put in the same financial position by the Government as if they had waited another couple of years before undertaking the extension.

Chelmsford.—Price Increase.—The B. of T. has authorised the Electric Supply Corporation to increase its charges for electricity from 6½d. to 8½d. per unit.

Street Lighting.—As the contract with the E S. Corporation for the lighting of the North and South Wards expires in March, 1920, the Gas Committee has recommended the Lighting Committee to consider the advisability of lighting the wards by gas.

Crediton.—Proposed E.L.—The U.D.C. has decided to obtain expert advice as to the provision of an E.L. scheme for the town.

Croydon.—Price Increase.—The T.C. has decided to further increase the charges for electricity by 25 per cent., a total advance of 100 per cent. on pre-war rates.

Doncaster.—Prov. Order.—The T.C. has decided to apply for an order to supply electricity in the parishes of Adwick-le-Street, Carcroft, Bentley, Kirk Sandall, Armthorne, Cantley, Rossington, Wadworth, Loversall, Edlington, Conisborough, and Denaby.

Plant Extensions.—The electrical engineer has been instructed by the T.C. to prepare a report on the additional plant required in connection with the proposed extension of the area of supply and the tramway system. It was also decided to ascertain whether any of the collieries in the district would be willing to furnish supplies of electricity, if required.

Dover.—Supply to Admiralty.—In order to induce the Admiralty to increase its payment for electricity, the Electricity Committee has decided to threaten that the rate for the establishments outside the contracts will be raised to the maximum unless the Admiralty meets the Corporation in the matter.

The price of energy for charging electric vehicles has been increased from 1·8d. to 3d. per unit, and for power from 3d. to 3½d.

Grimsby.—Strike.—The application of the engineers at the electricity works with regard to working hours having been refused, they struck work on Friday evening last. The whole of the municipal electricity supply ceased, involving the stoppage of the tramways. An offer of assistance from the Naval authorities was accepted, and a contingent from mine-sweepers was put in charge of the station.

Hull.—Street Lighting.—The Works Committee has instructed the electrical engineer to present a report on the extended use of electricity for street lighting.

Ilford.—Proposed Loan.—The L.G.B. having refused to sanction the application of the U.D.C. for permission to borrow £10,000 for a scheme for the utilisation of the steam from the refuse destructor, the electrical engineer has been instructed to submit another scheme, with a view to a further application being made.

Ipswich.—National Electricity Supply.—On the recommendation of the chief engineer, Mr. F. Ayton, the E.S and Tramways Committee has passed a resolution, with instructions that it be forwarded to the President of the B. of T., to the effect that the Committee, having considered the report of the I.M.E.A. to the B. of T. upon electric power supply, dated November 29th, 1918, expresses its agreement therewith, except in regard to Clause 2, wherein the Association recommends that the District Electricity Boards should be so constituted as to be wholly independent of the influence or control of commercially-owned electrical enterprises; and that in order to secure this object, it is urged that the District Electricity Boards should consist of representatives of local authorities and large consumers, to the exclusion of the supply companies. The Committee strongly dissents from this view, and holds the opinion that the District Electricity Boards should consist of representatives of the undertakings concerned in electricity supply, and that where there are company-owned undertakings, these should not be excluded from representation on the boards.

Kingston-upon-Thames.—E.L. Failure.—For the third time in a few weeks the Corporation's electric light supply failed on December 31st.

In speaking at a meeting of the T.C. on the difficulties which had attended the supply of electricity during the past few weeks, the chairman of the E.L. Committee said that they were first faced with the breakdown of the condensing plant, and, owing to the inferior quality of the coal, it was impossible to maintain sufficient steam, and the works had to be closed down. Following that, two of the largest steam alternators broke down, the coils being burnt out, and later another set broke down. Also, during the past three months, both the Diesel engines had been out of working order, and other difficulties were caused by the overloading of the plant: it was only due to the determined efforts of the acting electrical engineer and staff that the supply had been kept going at all. He expected that the first new turbine would be working regularly early in January, and he hoped that would be the end of their difficulties. Alderman Hall said it was a lamentable thing that they ever had the two German engines, which at present were incapable of work. A British firm had now agreed to supply a new compressor for the four-cycle Diesel engine.

Kendal.—Price Increase.—The E.L. Committee has increased the price of electricity for power purposes by charging 2½d. per unit for 2,000 units per annum and over, instead of 2¼d. for 8,000 units and over.

Lighting Restrictions.—The Controller of Coal Mines has given notice that the conversion equivalent for gas, in terms of fuel, has been increased to 18,750 cb. ft. per ton, and for electricity to 1,000 units per ton. The allowance of gas or electricity for lighting purposes under Clause 8, or the special assessments for lighting under Clause 12 of the Household, Fuel, and Lighting Order, 1918, has been increased by 25 per cent. Clause 99 of the Act. relating to restrictions on gas and electrical fittings, has been suspended. The concessions only relate to England and Wales, and take effect from January 1st last.

London.—East Ham.—Street Lighting.—When the lighting restrictions are removed, the E.L. Committee has decided to install 1,000-c.p., half-watt lamps in place of the arc lamps previously used for public lighting, and has recommended that the work of fixing the cables, which will be carried by the tramway standards, be put in hand.

Lytham.—Proposed E.L.—At the last meeting of the U.D.C., the chairman said he hoped the Council would push on with the electric lighting of the town.

National Electricity Supply.—The B. of T. Bill for the provision of cheap electricity is to be introduced into the House of Commons at the earliest possible date. A Central News representative states that "Mr. Lloyd George is anxious to get the scheme into working order, and it is now only a question of how soon the necessary Bill can be introduced into the House."

Newcastle-under-Lyme.—Mains Extensions.—The T.C. has received L.G.B. sanction to the borrowing of £1,250 and £350, for the extension of the electricity mains.

Rochdale.—Proposed Bulk Supply.—The E.L. Committee has recommended the T.C. to obtain terms from the Oldham and Bury Corporation for a supply of electricity in bulk.

Rotherham.—Owing to the delay in the erection of the new power station causing an accumulation of the sinking fund, a Sub-Committee has recommended the T.C. to promote a Bill to postpone the sinking fund periods with respect to the loans raised, to pay interest charges out of capital, and to alter the periods granted by the L.G.B. for the raising of loans until the new station is completed.

Salford.—Wages.—The award of 5s. per week granted to the engineering trades by the Committee on Production, dated November 9th, 1918, has been extended to employés at the electricity works.

Sale of Plant.—The Electricity Committee has given instructions for the sale of the second 1,000-kw. turbo-alterator.

Price Increase.—The T.C. has accepted the offer of the Manchester Ship Canal Co. to pay an increase of 10 per cent., making a total of 20 per cent., on the charges for electricity.

Stretford.—Terms of Purchase.—The sum provisionally agreed upon for the purchase of the undertaking of the Trafford Power and Light Supply Co. by the U.D.C. is £184,342; this is subject to ratification by the shareholders of the company and the L.G.B.

Spennymoor.—Street Lighting.—The U.D.C. has decided to have 74 public lamps lit by the E.L. Co.

Swansea.—Plant Extensions.—The Director of Electric Power Supply has consented to the T.C. renewing its application for additional boiler plant, &c., in three months' time.

Tunbridge Wells.—Street Lighting.—The T.C. has fixed the following charges for lighting public lamps with electricity:—1,200 c.p., £24 per annum each; 300 c.p., £15; 100 c.p., £5; 50 c.p., £3; clocks, £10 10s.

United States.—Hetch Hetchy Scheme.—On December 9th San Francisco closed the sale of $1,000,000 of Hetch Hetchy bonds to the Anglo and London-Paris National Bank. The purchaser also took an eight-month option on the remaining $8,000,000 of 4½ per cent. bonds now authorised for sale. The $1,000,000 to be immediately available will cover construction costs during the next six or eight months. The $8,000,000 would cover the construction of the dam and the first section of the aqueduct. An effort will be made to complete the work as far as the Moccasin Creek power development as soon as possible, so that the 66,000 h.p. to be generated there will be available for the city's use.

York.—Water Power.—The Electricity and Tramways Committee has decided to proceed with a scheme for the generation of hydro-electric energy, and has recommended that the necessary permission be obtained; a site has been rented at Naburn Locks, on the River Ouse.

TRAMWAY AND RAILWAY NOTES.

Accrington.—At a meeting of the T.C., on Monday, a resolution was adopted condemning the tramway employés for refusing to work on Christmas Day. Alderman Higham, chairman of the Tramways Committee, said that another year the cars would certainly have to be run on Christmas Day.

Australia.—Melbourne.—In November a trial run was successfully made on the new electric railway between Newmarket and Essendon, and a speed of 50 miles per hour was attained. Energy is supplied from Newport at 20,000 volts a.c., and transformed to 1,500 volts d.c.

Bolton.—At a general meeting of the members of the Bolton Branch of the Tramway and Vehicle Workers' Amalgamation, held on Sunday morning, it was decided to give financial support to the Blackburn tramway strikers, and also to take a ballot during the week as to giving moral support by ceasing work when called upon to do so by the Executive Council.

Central London Railway.—The B. of T. has further extended the time for the completion of new works under the C.L.R. Act, 1913, for a year.

Continental.—Italy.—The first stone of the new electric railway between Rome and Ostia was laid on December 30th. The King was present, and signed a commemorative tablet, which was enclosed in the stone. The project includes the building of a harbour and a seaside residential resort within half-an-hour's run of Rome.

Dewsbury.—Proposed New Lines.—The Corporation has deferred consideration of an offer of the National Electric Construction Co. to construct tramways to Shaw Cross.

Keighley.—Wages and Fares.—In view of the recent award of the Committee on Production increasing the wages of tramcar drivers and conductors, the T.C. has decided to increase the fares to 1d. per mile.

Leeds.—Fare Revision.—The Tramways Committee has recommended the T.C. to apply for powers to increase the tramway fares to 1d. per mile, with a minimum charge of 2d. for any distance exceeding ½ mile, and to increase the charges for goods traffic by 100 per cent.

Lincoln.—New Cars.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £6,000 for the purchase of three tramcars.

The engineer has been instructed to report on the conversion of the existing tramways to the overhead system.

Liverpool.—Strike.—Owing to the fact that the 47-hour week granted to the railway men on the 1st inst. does not apply to them until February 1st, the skilled workers at the Formby power station of the L. & Y. Railway Co. struck work on January 2nd. Traffic was stopped on the electrical lines in the Liverpool area, and the electric trains on the Liverpool-Southport line were replaced by steam trains, which, however, were not illuminated. At a meeting on Monday the men decided to resume work on Tuesday, providing the N.U.R. obtains a satisfactory settlement of their grievance, but threatened to resume the strike on Saturday if it was not settled.

Maidstone.—Proposed Extensions.—The T.C. is to consider a scheme involving an expenditure of £100,000, for the extension of the tramways to Chatham.

Salford.—Wages.—The award of 5s. per week granted by the Committee on Production, dated November 9th, 1918, has been extended to the employés of the tramways department: the estimated annual cost is £1,220.

Sheffield.—Snowstorm.—Much damage was done to tramway trolley wires by the snowstorms last week-end, the service being completely disorganised. At Mansfield a telephone wire fell across the tramway trolley wires. A horse which trod on the wire received a shock and burns.

At Halifax a girl came in contact with a fallen "charged" wire, and received burns.

Walkden.—The colliers—with the release of men from the Army and Navy, their numbers are now growing—in Walkden and adjoining coalfields are now agitating for the provision of more cars in the afternoon to take them home as they leave work. They complain that the service provided, whilst better than it used to be, is often inadequate.

TELEGRAPH AND TELEPHONE NOTES.

Cable Breakdown.—An official of the Eastern Telegraph Co. informed a newspaper representative that telegrams to the Far East were being delayed 3½ days, owing to the breakdown of a cable on Sunday last; it was expected that the service would be restored in a few days.

Control of Wireless.—It is stated in the daily Press that an understanding has been come to between the Allies to exercise permanent Government control over all wireless communications. The U.S. Government is going further than this, and proposes to acquire all the shore wireless stations at an expenditure of £1,000,000. They will all be under the control of the Navy Department, and all German stations erected on U.S. territory are to be appropriated.

Snow Storms.—During the snow storms last week-end the telegraph and telephone services in the Midlands and West of England were seriously interrupted. Communication between Bath and parts of Wiltshire, Somersetshire, and Gloucestershire was cut off. Sheffield was practically isolated, while Manchester was cut off from 22 of the 40 large towns with which there is usually communication by telephone. Telegraphically also the city was completely isolated from at least a dozen large towns. In Yorkshire and Derbyshire 10,000 wires are down.

South America.—A new wireless station on Martin Garcia Island was declared open for public service on October 29th last.

Telegrams to Enemy Countries.—Until further notice no private telegrams of any description can be accepted for transmission to enemy countries. Telegrams for soldiers, addressed to their units, without indicating place of destination, will be forwarded whenever possible from the base.—*The Times.*

Trunk Telephone Delays.—Many complaints by business men at the delays on trunk telephone calls were considered, last week, by the Post and Telegraph Committee of the London Chamber of Commerce. The Committee decided to call a meeting of the London Telephone and Telegraph Committee of the Chamber with a view to action being taken.

In connection with the complaints, the Assistant Secretary to the Telephone Department, G.P.O., has explained to the daily Press that the delays are caused by the priority given to Government calls; also long-distance lines have been appropriated by the Government. New construction for civil purposes has been practically suspended for three years. As the necessity for priority is daily decreasing, and appropriated lines are being returned for general use, conditions are now being improved. Plans are being prepared for the construction of new lines, and it is expected that the system will soon be back to normal conditions.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Department. Five-ton tipping wagon for coals. Electric vehicle preferred, but not essential. See "Official Notices" to-day.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.

Melbourne.—March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

London.—Hampstead.—B.C. January 16th. Twelve months' supply of electrical engineers' stores and oils for the Electricity Station. Mr. A. P. Johnson, Town Clerk, Town Hall, Haverstock Hill, N.W.

Sheffield.—Corporation Water Department. Two 3-ton steam locomotive cranes and one 5-ton electric locomotive crane, D.C., 460—500 volts. See "Official Notices" to-day.

Spain.—The municipal authorities of Santa Eufemia (Province of Cordoba) have lately invited tenders for the concession for the electric lighting of the town during a period of ten years.

Uxbridge.—January 21st. U.D.C. 25-H.P. A.C. motor for the sewerage works. Mr. W. T. Harvey, Clerk, 63, High Street, Uxbridge.

Warrington.—January 28th. Electricity and Tramways Committee. One 300-kw. and one 500-kw. rotary converter. See "Official Notices" to-day.

CLOSED.

Glasgow.—T.C. Tramways Committee. Recommended:

Steel tires.—Jno. Baker & Co.
Trolley bushes.—Fleming, Birkby & Goodall, Ltd.
V.I.R. cable.—Liverpool Electric Cable Co., Ltd.
Asphalt buckets.—P. & W. M'Lellan, Ltd.
Copper bonds.—B.I. & Helsby Cables, Ltd.
Trolley wire.—F. Smith & Co., Ltd.
40/36 C.T.S. cable.—W. T. Henley's Telegraph Works Co., Ltd.
Lead-covered cable.—B.I. & Helsby Cables, Ltd.
Iron castings.—Carron Co., British Hydraulic Foundry Co., Ltd., R. Howie & Co., David King & Sons, Ltd.
Malleable iron castings.—A. Shanks & Son, Ltd.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, January 10th. At 8 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking concert.

Manchester Association of Engineers.—Saturday, January 11th. At the Grand Hotel. At 6.30 p.m. Paper on "Iron and Steel Electric Furnaces," by Mr. J. Bibby.

Birmingham and District Electric Club.—Saturday, January 11th. At the Grand Hotel. At 7 p.m. Presidential address on "Problems of the Future," by Mr. W. H. Varnom.

Institution of Civil Engineers.—Tuesday, January 14th. At 5.30 p.m. At Gt. George Street, S.W. 1. Ordinary meeting.

Industrial Reconstruction Council.—Tuesday, January 14th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Reconstruction or Restoration," to be opened by Major H. J. Gillespie, D.S.O.

Institution of Electrical Engineers (North Midland Centre).—Tuesday, January 14th. At 7 p.m. At the Metropole, King Street, Leeds. Paper on "Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery," by Mr. P. Hunter-Brown.

(North-Western Centre).—Tuesday, January 14th. At the Engineers' Club, Manchester. At 7 p.m. Tenth Kelvin Lecture on "The Dynamical Theory of Electric Engines," by Mr. Ll. B. Atkinson.

(Scottish Centre).—Tuesday, January 14th. At the Princes Street Station Hotel, Edinburgh. At 7 p.m. Paper on "The Supply of Single-phase Power from Three-phase Systems," by Prof. Miles Walker.

(Students' Section).—Friday, January 24th. At 7 p.m. At the Northampton Polytechnic Institute, Clerkenwell, E.C. Paper on "A General Outline of Telephony," by Mr. H. T. Body.

Belfast Association of Engineers.—Thursday, January 16th. At the Municipal Technical Institute. At 7.45 p.m. Paper on "Electric Welding," by Mr. K. Edwards.

Royal Institution of Great Britain.—Friday, January 17th. At 5.30 p.m. At Albemarle Street, W. Lecture on "Liquid Air and the War," by Prof. Sir. Jas. Dewar, F.R.S.

LEGAL.

The Trade Mark "Megomit."

Before the Controller of Patents (Mr. H. Temple Franks), in the Patents Court, London, on Thursday, an application was made by Albert Taylor and John Moores, trading as John Moores & Co., manufacturers and suppliers of insulating materials at Brougham Street Works, Blackfriars Road, Salford, Manchester, for the avoidance or suspension of the trade mark "Megomit," registered under No. 216,033 in Class 50, for "electrical insulating material in which mica forms the base and the predominating ingredient," and also for the avoidance or suspension of such part of the Trade Mark No. 276,811 as consisted of the word "Megomit," registered in Class 50 for "an electrical insulating material covered by that class, mica being the predominating substance therein."

Mr. E. J. Trustram, who appeared for the applicants, said that the registration of the marks was by Meirowsky & Co. Akt. Gesellschaft, of Cologne, dealers in and manufacturers of mica; the registration of No. 216,033 was on August 2nd, 1898, and there was a renewal in 1912. No. 276,811 was registered on October 28th, 1905. The manufacture of these mica electrical insulating materials had formed part of the applicants' business for many years. Before the opening of the war they found it impossible to develop and increase the sale of mica insulating material, being everywhere met by the German megomit, to which engineers and others had become accustomed. Since the war they had endeavoured to develop their trade in this line, but although they had somewhat increased their business, they were still met on every hand with inquiries for megomit. Engineers knew that megomit contained mica. The applicants knew that their mica plate contained mica, and was more than equal to megomit, but they could only quote for their various kinds of mica plate and micanite and explain to customers that they could not sell them as megomit. The specification or formula for the applicants' mica plate entirely corresponded to the specification or formula for megomit. With one exception only the whole of their mica and micanite was manufactured locally. The exception came from America and Switzerland. If they were allowed to sell their mica goods as megomit they could secure many orders, and largely increase the local industry. The Controller said that if there was to be avoidance of the trade marks it would have to be on the ground that it was a bad trade mark, as being the only practicable name for a specific article. For years, apparently, this substance had been largely sold as micanite and megomit, and the Germans had not monopolised the whole trade, as in the case of "aspirin."

After some discussion, the Controller said that it would be impossible to say that megomit was the only practicable name of a specific article, without which it would not be possible to sell the article, and they had laid down the rule that suspension could only be granted where the trade mark was the only practicable name of the article manufactured. Megomit was used as the name of a brand made in Germany, and it could not be transferred to anybody else. It would not be fair to avoid the mark altogether. In the case of aspirin, this had undoubtedly become the only name by which the public would buy the article. Under these circumstances, he thought at the present stage the application could not be granted. The applicants, when asked for megomit, should say it was German, and could not be got, and in that event the customer should be patriotic, and buy English goods.

Eventually the hearing was adjourned for further information to be submitted to the Court.

NOTES.

State and Technical Research in Germany.—According to *Welthandel*, December 6th, the Imperial Economic Office proposes to extend its functions to include the examination of scientific and technical methods of development, and offices are to be opened to collect material and assist in the solution of important practical problems. The first of these offices is to deal with the further utilisation of coal, with the object of increasing the productivity of available stores. Similar offices for other sections of industry are also about to be opened.

Hours of Labour in Australia.—There is a possibility of industrial turmoil in Australia in 1919, because members of Unions are demanding a 42-hours' week and higher wages, but the Governments of all the States are confident that Bolshevism will not become a serious menace.—*The Times*.

Educational.—Battersea Polytechnic.—A course of 12 lectures on "Solutions of Alternating Current Problems by Symbolic Methods," will be given on Friday evenings, commencing January 17th. The evening courses on D.C. and A.C. Engineering, Generation, Transmission and Distribution, will commence on January 13th. Day courses on January 14th. For further particulars, see our advertisement pages to-day.

The Electro-Harmonic Society.—The smoking concert, which will be held at the Holborn Restaurant in the Venetian Chamber to-night (Friday) at 8 p.m., will be presided over by Mr. W. W. Bradfield, C.B.E. The artistes will be:—Mr. Leonard Lovesey, tenor; Mr. Arnold Stoker, baritone; Mr. Wilfred James, bassoon; Mr. Walter Newman, humorist; Mr. Arthur Brough, ventriloquist; Mr. Thomas Sidney, entertainer at the piano; Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

The Grading of Electrical Artisans.—A correspondent, discussing the relative status of "wiremen," "electrical fitters," and "electricians," remarks that there are many difficult questions when dealing with labour matters: to him it is obvious that to be just to both master and man, they should be graded in rates. The present method of rate fixing is unjust to both master and true craftsman. The lower grades of craftsmen are certainly not worth 50 per cent. more than the labourer, and, personally, he has found the best of the labourers far better than many of the craftsmen.

The lower grades of craftmanship always call for the greater numbers, and, as a result of present methods, are overpaid in comparison with the labourer; the lowest grade of labour should be the basis—*i.e.*, for the living wage.

It certainly appears to us desirable that the terms above mentioned should be defined and classified, and this is rightfully the function of the Electrical Trades Union, which, if it claims to be a craft Union, ought to know and state the exact grade of every one of its members. It will be remembered that in the Committee on Production's award of last November the three classes were lumped together.

Demobilisation.—Mr. T. W. Cole, secretary of the Provincial Electric Supply Committee of the United Kingdom, writing under date January 8th, says:—"You were good enough to publish a letter of mine on the above subject in your issue of November 29th, 1918, in which I said that my Committee had taken the matter up with the authorities so as to ensure that the electric supply industry was placed among the "key industries," so as to be entitled to priority in regard to the return of their men in the Army. I have had further correspondence with the Demobilisation authorities, and undertakings will be pleased to know that Public Utility Companies (Group No. 35) have now been placed as one of the industrial groups open for making up drafts for Demobilisation subject to certain provisions which have been notified in the daily Press."

The "Tanks" Inaugural Dinner.—The new social body—the Tanks Association—held its inaugural dinner and concert at the Connaught Rooms, on Monday night. It has been formed with the object of bringing together at least once a year those who during the war were connected with tanks, those eligible for membership being members and ex-members of the Mechanical Warfare Department, officers and ex-officers of the Tank Corps and armoured cars, and representatives of the firms engaged in the manufacture of tanks and their components. Lieut.-Colonel Sir A. G. Stern, to whose initiative is largely due the Government's adoption of tanks as an arm of the Services, is president of the new Society, and the vice-presidents include, among others, Sir William Tritton, Major-General Elles, and Vice-Admiral Moore. The aims of the Association are philanthropic as well as social, and it is proposed to establish a scholarship in the engineering profession for the children of members.

Wireless in the Air Service.—Addressing the London Chamber of Commerce, on Tuesday last, on the commercial air service which is likely to be organised in the near future, Major-General Sir F. H. Sykes, Chief of the Air Staff, declared that the problem was largely one of navigation, meteorology, and wireless. An organisation capable of centralising at the starting point all information about the immediate weather conditions all along the route was essential. A development, which would be of the greatest use for enabling machines to fly in all weathers, was the direction-finding wireless apparatus carried in all aircraft for ascertaining the bearing of ground wireless transmitting stations. This method was at present secret, and was developed in the service during the war. Aircraft so equipped could fix their position frequently, and could report to their base at any moment where they were, what course they were steering, or if they were in any difficulty. The ground transmitting stations were, in fact, a form of aerial lighthouse, unaffected by fog and with a range of 600 or 700 miles. In his opinion, it was essential that the development of wireless telegraphy should take place along broad imperial lines. British aircraft would soon be as widely spread as the British Empire.

Volunteer Notes.—Royal Engineers' Volunteers, London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 2, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Monday, January 13th, to Saturday, January 18th, drills as usual.
C. Higgins, Captain, R.E., *Adjutant*.

Stocks of Non-Ferrous Metals.—The Ministry of Munitions publishes the following particulars of the stocks (exclusive of old metals and scrap) in this country in the possession of the Minister on January 1st:—

	Tons.		Tons.
Copper	36,000	Soft pig lead	62,852
Spelter, G.O.B. ...	22,273	Nickel	2,096
Spelter, refined ...	8,017	Antimony regulus ...	3,508
Aluminium	11,957		

It is intended, the Ministry states, to publish at monthly intervals the stocks held on the first day of each month. In addition to the above, the Minister holds large quantities of scrap, mainly brass, of which it is impossible to give any particulars at present.—*The Times*.

The Fuel and Lighting Order.—The Coal Controller has announced that, commencing with the New Year, the allowances of gas and electricity for fuel and lighting under the Household Fuel and Lighting Order, 1918, will be increased by 25 per cent. For the present this concession relates only to England and Wales, and does not apply to Scotland. At the same time, it is proposed by arrangement with the Ministry of Munitions to suspend all restrictions on the fitting of gas and electrical equipment. Economy of coal is still necessary.

In accordance with this decision, the conversion equivalent for gas in terms of fuel will be increased to 18,750 cb. ft. to the ton, and for electricity to 1,000 Board of Trade units to the ton as from the meter readings taken for the close of the quarter ending December 31st last (except in those cases in which a higher conversion equivalent has already been specially agreed.) The allowances for lighting under Clause 8, or the special assessments for lighting agreed under Clause 12 of the Order, will from such meter readings be likewise increased by 25 per cent. Further, the Controller agrees to the suspension of Clause 99 referring to the restrictions on gas and electrical fittings as from the 6th inst.

Institution and Lecture Notes.—Birmingham and District Electric Club.—The arrangements for the first half of the 1919 session are as follows:—

January 11th.—Presidential address, "Problems of the Future," by Mr. W. H. Varnom.
February 8th.—Paper on "Signalling," by Captain F. H. Woodrow, R.E.
February 22nd.—Annual Dinner, Grand Hotel.
March 8th.—Paper on "Electric Welding as a Commercial Proposition," by Mr. H. W. Wolton (vice-president).
April 12th.—Paper on "Electric Converting Plants," by Mr. F. Gould.

Institution of Electrical Engineers.—In order to enable the necessary arrangements to be made, members wishing to dine together at the Waterloo Restaurant, Charles Street, Haymarket, after the I.E.E. Meetings, are asked to send their names to the Institution Offices, not later than the Wednesday morning preceding the meeting. Owing to food difficulties, the proprietor of the restaurant is unable to cater for an unspecified number of visitors.

Chadwick Public Lectures.—Mr. A. H. Barker, B.A., B.Sc., is delivering a course of three lectures on "Fuel Economy and Health," at the Royal Society of Arts, John Street, Adelphi, W.C. 2, on Mondays, January 6th, 13th, and 20th, at 5.15 p.m. The ground covered on the three occasions will be:—"The Heat Requirements of the Human Being"; "The Heat Requirements of a House"; "Heat Economies."

Electrical Power Engineers' Association.—A meeting will be held at the White Lion Hotel, Coventry, at 6.45 p.m. to-day, for the purpose of forming a South-Eastern Section of the Midland Division. All engineers interested will be cordially welcomed.

The Liverpool Section of the Northern Division has arranged for a smoking concert to be held at the Bee Hotel, Liverpool, at 7 p.m. on Wednesday, January 15th. Each member will have the privilege of bringing one friend. Tickets may be had from members of Committee or corresponding members.

Appointments Vacant.—Shift engineer (77s.) for the Farnworth U.D.C. Electricity Department; shift engineer (78s. 9d.) for the Woking Electric Supply Co., Ltd.; instructors in mechanical and electrical engineering for the Stoke-on-Trent Education Committee; charge engineer (70s. + 23s. 6d. + 12½ per cent.), for the Croydon Corporation Electricity Department; shift engineer (37s. 6d. + 20s. + 12½ per cent.), for the Peterborough Corporation Electricity Department; meter mechanic and test-room assistant (£4), for the Newport B.C. Electricity Department; chief assistant engineer, for the Bo'ness Electric Power Station; sub-station attendant (35s. + 28s. 6d. + 12½ per cent.), for the Walsall Corporation Electricity Supply Department; meter tester (45s. + 28s. 6d. + 12½ per cent.), for the Barrow-in-Furness Corporation Electricity Works; shift engineer (93s. 6d.), for the Warrington Corporation Electricity and Tramways Committee; charge engineer (£175), for the Worcester Corporation Electricity Works; mechanical and electrical engineer (£350), for the Docks Committee of the Bristol Corporation; mains superintendent (£425), for the George Town, Penang, Municipal Electric Light and Tramways Department. See our advertisement pages to-day.

The Women of Coblentz.—The *Times* correspondent with the American Army at Coblentz, in the course of a recent dispatch, says :—"Already in Coblentz there is considerable unemployment, and large numbers of demobilised soldiers are anxious to oust women from the well-paid positions they hold as tramway-car conductors and in other municipal services, as well as in industrial and commercial undertakings. Despite all the efforts of the German authorities to induce the women and girls to go back to household work, little or no progress is being made. The women refuse to resume their pre-war status in the community."

Electrical Development in Japan.—Statistics compiled by the Japanese Department of Agriculture show, says the *Journal of Electricity*, that almost 16 per cent. of Japan's hydro-electric and steam-electric power development took place during the 12 months prior to 1918. The total water-power development completed was 116,385 kw., with uncompleted projects under way amounting to 317,131 kw. Similarly, the steam-electric power showed completed projects to the amount of 118,968 kw., and uncompleted of 158,754 kw. In comparing this power development programme of 1,011,243 kw. with the completed and uncompleted programme of the previous year it was found that the year 1918 showed an increase of 156,330 kw., of which 73,184 kw. was for water power, and 83,146 kw. for steam power development. The total number of electrical enterprises, including power and railway, was 687, representing a capitalisation of about $365,000,000, which compared with the same date of the previous year showed an increase of 39 enterprises with a capitalisation of $32,595,000. An idea of the magnitude of some of these enterprises may be gleaned from a statement of three typical power installations of the Tokio Electrical Light Co., the Inawashiro Hydro-Electric Co., and the Ujigawa Electric Co., the first two supply in Tokio and the last the great industrial centre of Osaka, as follows:—

	Capacity (kw.)	Max. voltage.	Distance (miles).
Tokio Light No. 2 ...	35,000	55,000	50
Inawashiro No. 1 ...	35,000	115,000	140
Ujigawa	25,000	66,000	30

Electricity on Board Ship.—Referring to the British section of the Allied Fleet taking over that portion of the Russian Black Sea Fleet which had been seized by the Germans, a Press correspondent says that all the machinery on the battleship *Volga* was electrical, and the whole arrangement of the ship differed from anything known in the British Navy.

Requirements of Russian Engineering Works.—The *N.A.Z.*, November 1st, in commenting on the requirements of the Russian engineering industry, remarked that under normal labour conditions 14 million poods of metal would be needed. Up to the present about 4 million poods of fresh and 200 million poods of old metal have been registered. There is a sufficient quantity of copper forthcoming. The amount of pig-iron essential is estimated at 13 million poods, which can only be supplied when the coal shortage is relieved. Owing to lack of coal a number of works in Tula and Tomboy have had to close down. The Petrograd Soviet has sanctioned R.12 million for purchasing machine parts and technical materials in Scandinavia.

Referring apparently to the same matter, the *Deutsche Allgemeine Zeitung* of Nov. 25th said that the Commissaries of the Petrograd communal administration had decided to purchase machinery and materials from various undertakings in Sweden, and had voted R.12 mill. for the purpose.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. F. M. Fletcher chief assistant electrical engineer at the Rochdale Corporation electricity works, has been appointed electrical engineer to the Darwen Corporation.

Rotherham T.C. has decided to increase the salary of Mr. E. Cross, the borough electrical engineer, by two annual instalments of £125, making a maximum of £1,000 per annum.

Mr. E. E. Hoadley, borough electrical engineer at Maidstone, has been installed Worshipful Master of the Belvedere Lodge of Freemasons.

Bangor T.C. has decided to increase the salary of the electrical engineer by £20 a year, the present bonus being continued.

Doncaster Corporation Special Electricity and Tramways Sub-Committee has recommended that the pay of the shift engineer at the power station be increased to £4 per week, and that the increment due to Mr. J. W. Hibbert in November, 1919, shall take effect as from January 1st, 1919; that Mr. T. Pott's salary be increased to £275 per annum from January 1st; and that the borough electrical engineer's salary be increased from £550 by an amount equivalent to 28s. 6d. per week, plus 12½ per cent., with a deduction of £50. The Town Council, in committee, has adjourned the proposal so far as concerns the borough engineer, pending a report by the Finance Committee upon a recent circular of the Local Government Board dealing generally with certain war allowances for administrative, technical, and clerical staffs of local authorities.

Exeter T.C. has increased the salary of the tramway manager from £300 to £350 per annum.

Rochdale Town Council has approved the Electricity Committee's recommendation to increase the salary of Mr. F. H. Rudd, the borough electrical engineer, from £450 to £500 a year, as from November 1st last, thus anticipating the increase promised for next August.

Mr. R. U. Bailey, resident engineer, Nechells generating station, Corporation of Birmingham electric supply department, has resigned in order to take up the appointment of Birmingham representative for Messrs. Brown-Bayley's Steel works, Ltd., Sheffield.

Having regard to the extra work consequent upon the shortage of staff at the power station, and the increasing difficulties which have arisen during the war, the Northampton Tramways Committee proposes that Mr. Cameron, the tramway manager, shall be granted an honorarium of £100.

Horsham U.D.C. has increased the salary of Mr. H. L. Cottam, electrical engineer, to £300 per annum as from December 31st, 1918.

Chesterfield T.C. has accepted the resignation of Mr. R. L. Acland, electrical engineer and tramway manager, and has decided to appoint him consulting engineer at a salary of £100 per annum. The Electricity Committee recommends that no appointment to the vacant position be made at present, but that Mr. Torrin, assistant electrical engineer, be in charge of both departments.

Mr. Mark Ruddle, chief electrical engineer of the Dublin Corporation, has tendered his resignation on the ground of ill-health. He became engineer and manager of a large chemical works in Portsmouth in 1871, and some years later joined the Bell Telephone Co., which, in 1880, amalgamated with the Edison Co., of New York. When the Edison Syndicate started in London, the New York directors appointed Mr. Ruddle one of their engineers, and under his direction the first system of underground cables was laid down. Later, when the Edison Syndicate started a local company at Manchester, he became its chief engineer, and subsequently he was engineer to the Metropolitan Electric Lighting Co. His association with Dublin municipal affairs began 28 years ago. He was engineer of the mains under Sir Alex. (then Mr.) Kennedy, and afterwards acted under Mr. Hammond, whom he succeeded as engineer-in-chief. Mr. Ruddle was chairman of the Irish Institution of Civil Engineers for two years, and he had filled the chairmanship of the Dublin Branch of the Institution of Electrical Engineers. The salary attached to the office which he has vacated is £750 per annum, with a war bonus of £150.

St. Helens Town Council on Wednesday confirmed a decision of the Electricity Committee, appointing Mr. B. T. Hawkins chief electrical engineer, in the vacancy created by the resignation of Mr. E. M. Hollingsworth, the salary to be £500 per annum. It was also decided that the staff at the electricity works be re-arranged, with increases, as follows: —Mr. C. E. Green to be mains superintendent (£300), Mr. F. N. R. Baker station superintendent (£300), Mr. H. C. Duncan chief clerk (£260), Mr. H. J. Greer, motors and installation inspector (£250), the salaries to be paid without any bonus. Various increases of salary were granted to the office staff of the Electricity Committee. Mr. E. M. Hollingsworth, who is taking up work under the United Alkali Co., has been retained by the Tramways Committee in an advisory capacity for six months at a fee of £200. This is in connection with the negotiations for the transfer of the tramways from the company to the Corporation.

General.—The *Manchester Guardian* states that Lieut.-Col. Lincoln Chandler, who, as mentioned here last week, has resigned the managing directorship of the British Westinghouse Co. at Trafford Park, has been co-opted on the general board of the company. A portion of the 10 per cent. cum. pref. share scrip created under the recent reorganisation of capital was being offered to the employés last week for subscription under easy-payment terms.

Mr. T. W. Shaw has joined the staff of Messrs. Cunningham, Ltd., and will have charge of their motor repair department.

Mr. J. A. Woods has resigned his position as chief engineer to the Newcastle Breweries, Ltd., and has joined the staff of the British Electrical & Manufacturing Co., of 2, St. Nicholas Buildings, Newcastle-on-Tyne, Sunderland, and London.

Ald. A. R. Jephcott, the new M.P. for the Yardley Division of Birmingham, is chairman of the Birmingham Corporation Electric Supply Committee.

Swansea Corporation Electricity Committee has elected Col. Alexander Sinclair chairman, and Ald. James vice-chairman, of the Committee for the ensuing year.

Mr. E. L. Shepherd, who has been with the Midland Electric Corporation for Power Distribution, Ltd., Ocker Hill, Tipton, for between six and seven years (and previously for five years at the St. Helens generating station), has resigned his position in order to become electrician on the outside staff of the electric crane and lift department of Messrs. Holt and Willetts, of Cradley Heath.

Mr. W. E. Crawley, who has been connected with Messrs. Ferranti, Ltd., for 27 years, has now been appointed their sales representative for meters and instruments in the South of England. Mr. Crawley's district will not include the London telephone area, as clients in that area are already being attended to by the company's London branch office.

Messrs. G. Duncan Mann, S. E. Sheerman, and F. R. Pendergast have resigned their positions as sales managers in the Midland Counties for Messrs. Veritys, Ltd., with whom they had over 57 years' combined service, and are now trading as the United Electrical Co., at Newhall Chambers, Newhall Street, Birmingham. They have been appointed sole selling representatives in the Midland Counties by Messrs. S. G. Leach & Co., Ltd., London, and are also representing Messrs. Wright & Wood, of Halifax.

A Nottingham paper states that Sir John Snell, having taken up a Government appointment, is unable to advise the combination of the local authorities of Nottingham, Derby, Leicester, Mansfield, and other East Midland towns on the question of electric power supply. It is, therefore, proposed to retain his partner, Mr. Rider, in his place.

We are asked by Mr. A. G. Cooper, M.I.E.E., to let it be known that he is not the Mr. F. G. Cooper, of Colne, who, as stated in our last issue, has accepted a position at Sheffield. Mr. A. G. Cooper left Colne, where he was borough electrical engineer, in July last, and joined the Inventory Staff of the Engineering Department of the Ministry of Munitions at Manchester, where he is now employed.

Mr. C. M. Ferguson has rejoined the staff of Messrs. James Gordon & Co., of Queen's House, Kingsway, W.C. 2, in charge of their steam power department, where he will be pleased to see old friends.

Mr. J. F. McEntee, who has been elected M.P. for South Monaghan in the Sinn Fein interest, was appointed assistant electrical engineer under the Dundalk Urban Council in 1914. He took part in the Irish rising of Easter Week, 1916; was tried in respect of the murder of a policeman and acquitted; was deported and released, but was re-arrested, and is among the Irish leaders now interned in England.

War Honours.—The following gentlemen, to whom the Electrical Review offers its congratulations, appear in the lists published yesterday of those who have been appointed to, or promoted in, the Order of the British Empire for war services:—

Mr. C. L. Budd, C.B.E., member of the Non-ferrous Materials Department of the Ministry of Munitions, Mr. J. McLaren (chairman of J. & H. McLaren, Leeds), Mr. W. Thom (director of Yates & Thom, Blackburn), and Mr. John Wormald (managing director of Mather & Platt, Ltd.), are made *Knights Commanders (Civil Division)*.

Mr. G. H. Banister (Vickers, Ltd.), Major J. L. Benthall (Vickers, Ltd.), Principal J. C. M. Garnett, of Manchester, Mr. G. E. Chadwyck-Healey (Director of Materials and Priority, Admiralty), Mr. W. W. Lackie (city electrical engineer, Glasgow), Mr. D. S. Marjoribanks (Sir W. G. Armstrong, Whitworth & Co.), Mr. S. L. Pearce (city electrical engineer, Manchester), Mr. R. P. Sloan (managing director; Newcastle-on-Tyne Electric Supply Co., Ltd.), become *Commanders (Civil Division) in the Order*.

There is also a lengthy list of Officers and Members.

The Order of the British Empire has been conferred on Mr. George Webster, manager of the Rochdale Corporation tramways, for work in connection with the war. Mr. Webster was for two years the hon. secretary of the Rochdale Shell Factory, and was afterwards elected a member of the board of directors.

Second-Lieutenant H. Hopkinson, R.A.S.C., whose name appears in the list of M.B.E. (Military Division) of the Army Honours, and also in Sir Douglas Haig's dispatch dated November 8th, 1918, was sales engineer to the Walsall corporation electric supply department.

Congratulations to Brigadier H. W. Thornton, R.E. (T.F.), manager of the Great Eastern Railway, on his appointment as K.B.E. (Military Division).

Roll of Honour.—More than a year ago we announced that the Military Medal had been awarded to Lance-Corporal J. A. Barlow, an employé in the public lighting department of the Stepney borough electricity undertaking. Lance-Corporal Barlow has now been awarded a bar to his Military Medal for further conspicuous bravery in action. The official reference to the matter reads:—

> Under very heavy shell fire at Klein Zillebeke, on September 30th, 1918, this N.C.O. went to the assistance of a party of men and pack mules who had all been either killed or wounded. Without any assistance he got all the wounded to a place of safety and dressed them, and remained with them until the arrival of stretcher-bearers to remove them. By his action he undoubtedly saved the lives of the wounded men. He showed great courage and tenacity of purpose, and absolute fearlessness, and is at all times a cheerful and willing soldier.

Private J. Nelson, Manchester Regiment, who has died from influenza whilst a prisoner of war in German Poland, was employed by Messrs. Charles Macintosh & Co., Ltd., Manchester.

Private J. Hardman, 6th Manchester Regiment, reported as having died in a German hospital, and Corporal W. J. Cawley, Royal Welsh Fusiliers, killed, were both employés of the British Westinghouse Co., Ltd., Trafford Park.

Private W. Lonsdale, West Riding Regiment, formerly a tram driver in the employ of the Leeds Corporation, who was condemned to death for striking a sentry while a prisoner of war in Germany, arrived home on Saturday last.

Obituary.—Mr. J. R. Heckley.—The death occurred on January 3rd at Sheffield, suddenly, of Mr. J. R. Heckley, of Messrs. Vickers, Ltd. The deceased gentleman had been with the company for 50 years, latterly as secretary.

Coun. Richard Holt.—We regret to announce the death of Coun. Richard Holt, J.P., Chairman of the Blackpool Electricity and Tramways Committee, which took place on Friday, 3rd inst. Coun. Holt, who was also Deputy-Mayor, had been a respected member of the Blackpool Town Council for some 17 years. During his public career he had always worked hard for the well-being of Blackpool, and his loss will be keenly felt by many of the public bodies of the town. He was held in the highest esteem by everybody, and the electricity and tramway department in particular has been deprived of the services of a chairman who was everything that could be desired.

Mr. L. E. Horrell.—The death has occurred from injuries sustained through being run over by a taxi-cab, of Mr. Louis Edwin Horrell, electrical engineer, of Garsington (Oxon.). He was 37 years of age, and was on the staff at the Milton power station.

Mr. Edward Jackson.—The funeral took place on Saturday, at Barnt Green, near Birmingham, of Mr. Edward Jackson, a director of the Midland Railway Carriage and Wagon Co., who had been for 60 years identified with that concern.

NEW COMPANIES REGISTERED.

Electricars, Ltd. (152,477).—Private company. Registered January 2nd. Capital £15,000 in 100,000 7 per cent. cum. pref. participating shares of £1 each and 300,000 ord. shares of 1s. each. Manufacturers of and dealers in carriages, omnibuses, trucks, tractors, lorries, locomotives, tramcars, motors, vehicles, submarines, launches, boats, barges, &c., and especially those using storage batteries for motive power. The subscribers (each with one pref. share) are:—Brig.-Gen. H. C. L. Holden, 2, St. John's Park, S.E. 3; J. G. Mommer, 12, Grove End Road, N.W. 2, engineer; C. T. D. Burchall, 5, The Sanctuary, S.W., solicitor; A. W. Burchall, 5, The Sanctuary, S.W., solicitor; J. K. Christie, 14, Colville Road, W. 11, clerk; J. A. Braik, 20, Cambridge Road, S.W. 19; C. Vines, 178, Venner Road, S.E. 26, solicitor's managing clerk. No persons had consented to act as directors to January 2nd. Registered office: 2-3, Duke Street, St. James's, S.W. 1.

Engineering Publications, Ltd. (152,498).—Private company. Registered January 3rd. Capital, £1,000 in £1 shares. To enter into an agreement, the parties to which are not named; in the articles as originally printed this was stated as an agreement with R. V. O. H. Lash or Lush, but the name has been erased. To carry on the business of publishers and proprietors of newspapers, journals, magazines, books, and other literary works, printers, stationers, advertising agents, &c.; also to establish competitions and insure (gratuitously or otherwise), or arrange for the granting of free insurances. The subscribers (each with one share) are: J. E. Passmore, 8, Parkside Avenue, Wimbledon, printer; H. Randall, Earnshaw Cottage, Esher, Surrey, proprietor, Royal Worcester Warehouse Co. First directors: H. Randall and J. E. Passmore, each of whom may retain office while holding 20 shares. Registered office: 93-4, Chancery Lane, W.C.

Electric Tapes, Ltd. (10,185).—Private company. Registered December 23rd in Edinburgh. Capital, £6,000 in £1 shares. To carry on the business of manufacturers of and dealers in rubber, asbestos, and insulating materials. The subscribers (each with one share) are: J. C. Sinclair, 47, Waterloo Street, Glasgow, rubber and asbestos manufacturer, A. J. Terry, 3, Haydon Street, Minories, E. 1, rubber and asbestos manufacturer. First directors: J. C. Sinclair and A. J. Terry. Registered office: 47, Waterloo Street, Glasgow.

George England, Ltd. (152,455).—Private company. Registered January 1st. Capital, £4,000 in £1 shares (500 7½ per cent. pref.). To take over the business carried on at Walton-on-Thames as George England, and to carry on the business of manufacturers of electrical, steam, gas, or other motor vehicles and aircraft; aerodrome, aero school and club, hangar, garage, and shed proprietors, &c. The subscribers (each with one share) are:—F. H. Aarons, The Firs, Fir Road, Kenley, Surrey, solicitor; L. P. Potter, 28, Brookfield, West Hill, Highgate, N. 6, solicitor. First directors: G. England and E. C. G. England. Registered office: Broad Street House, E.C. 2.

CITY NOTES.

Blackpool, St. Annes & Lytham Tramways Co.—The balance sheet shows liabilities on the 5 per cent. debenture stock and interest accrued to date, £197,375. On the revenue account, the items show traffic expenses £11,048, general expenses £4,504, general repairs and maintenance £13,184, power expenses £5,274. The traffic receipts (less £20,993 paid to Blackpool Corporation) amounted to £63,620. A profit of £10,348 was made. £7,500 was paid in interest on debenture stock, and £1,500 to sinking fund. The adverse balance was reduced from £40,433 to £39,085

Direct United States Cable Co., Ltd.—Interim dividend 2s. per share (1 per cent. per annum), less tax at 6s., for the quarter.

Marconi International Marine Communication Co., Ltd.—Interim dividend of 5 per cent., being 1s. per share, less tax at 5s. 9d.

Bell Telephone Co. of Canada.—Quarterly dividend 2 per cent., less tax.

Anglo American Telegraph Co., Ltd.—Balance dividend of £1 10s. per cent. on the consolidated ordinary stock for the year, less income-tax at 5s. 10½d. Balance dividend of £1 10s. on the preferred stock, less income-tax at 6s. First and final dividend of £1 10s. upon the deferred stock, less income-tax at 5s. 9d. These dividends, together with those already paid, will amount to £3 15s. per cent. on the consolidated ordinary stock, £6 per cent. on the preferred stock, and £1 10s. per cent. on the deferred stock for the year 1918. A bonus of 1s. 9d. per cent. is to be paid on the undivided ordinary stock, and 3s. 6d. per cent. on the deferred stock, free of income tax.

Companies Struck off the Register.—The following companies have been struck off the register, and are accordingly dissolved :

Contractors' and Engineers' Publications, Ltd.
Dickson Corthesy Steam Turbine Developments, Ltd.
Efficient Heating & Ventilating Co., Ltd.
Harvey Electro-Chemical Co., Ltd.
High-Speed Printing Telegraph Co., Ltd.
Kentish Town Motor & Electrical Engineering Co., Ltd.
Mid-Sussex Electric Light & Power Co., Ltd.
North-Eastern Electric Smelting Co., Ltd.
Radium Electro Emanation Co., Ltd.
Telephone Accessories Co., Ltd.

Chile Telephone Co., Ltd.—Interim dividend 6 per cent. per annum, free of tax, on ordinary shares for the half-year.

London United Tramways, Ltd.—Meetings are to be held on January 23rd of the preference shareholders and the debenture stock holders to consider a scheme of arrangement.

Victoria Falls & Transvaal Power Co., Ltd.—Dividend for six months on the preference shares at the rate of 6 per cent. per annum, less tax.

Kaministiquia Power Co.—Dividend at the rate of 8 per cent. per annum for the quarter.

STOCKS AND SHARES.

Tuesday Evening.

Military and civil unrest had a dullish effect upon Stock Exchange markets, and, in particular, has made Home Railway stocks heavy. The industrial sections are, however, in considerable favour, and even those which were at first weak on the signature of the Armistice are now recovering, and enjoying, their full share of popular support. Evidently not all the money in the country is going into diamonds and other precious-stone investments, because the provinces are substantial buyers in the Stock Exchange. When Treasury restrictions are relaxed in regard to new issues, there will be a rush, judging from present experience, for anything good enough to offer the public a fair channel for money.

Labour troubles started early in the new year on the Brighton Railway, and the electrified portion of the Lancashire and Yorkshire Railway. That it might spread to a much wider circle afforded reason for putting down prices of Home Rails. The outstanding exception of strength is still the Underground Electric Railways of London income bond issue, the price of which has risen 1½ further to 94 on the hope of the dividend getting nearer to the full 6 per cent. distributed in 1916. As the coupons are paid free of tax, the 6 per cent. would be equal to 8½ per cent. gross, and although it may be rather optimistic to expect the present 4 per cent. to jump 50 per cent. next month, the conditions of travelling point to an early increase over the former rate. The other purely electric railway stocks are about the same as they were. London Electric shares are higher at 4, and Underground £10 shares rose to 3½. It may be mentioned, in passing, that the details of the United States electrically-propelled battleship *City of Mexico* have aroused mild interest in the Stock Exchange.

While there is not much business doing in the shares of home electricity companies, Bromptons have risen ⅛ to 7⅜, and City of London at 13¼ are the fraction better, while other recent rises have been fully maintained. South Metropolitan preference hardened to a guinea. The manufacturing shares are also firm. Attention may usefully be called to the misleading character of some of the titles of electricity issues in the Stock Exchange Official List. For example, Edison-Swan 5 per cent. debenture stock is still called 4 per cent., and General Electric preference, the dividend on which was recently raised to 6½ per cent., are retained in the list as being 6 per cent. shares. Other instances might be cited, and, in spite of the protests which have been lodged to the appropriate department of the Stock Exchange which attends to these matters, nothing has been done to put them right. By way of protest, certain of the quotations have been withdrawn altogether, the dealers refusing to supply them, on the ground that while titles are wrong, it is useless to give prices. No doubt the Stock Exchange officials are suffering, like everyone else, from shortage of staff and other war conditions, but the necessary alterations are so slight, and yet so important, that it is high time they should be made.

A considerable business has been done during the last few days in the 6 per cent. cumulative preference shares of the North Metropolitan Electric Power & Supply Co. The company is in a good financial position, and, although the war conditions necessitated a reduction of the 12 per cent. dividend paid in 1913 and 1914 to 10 per cent. for the three succeeding years, it is not at all unlikely that the 12 per cent. will be resumed before long. The preference dividend is well covered, and at 18s. the yield works out to £6 13s. 4d. per cent. on the money, dividends being due on April 30th and October 31st.

Telegraphs and Telephones have regained their firmness, and advances have been secured by Eastern Extensions, Westerns, Eastern Telegraph ordinary stock, Globe preference, and one or two others. Great Northern Telegraphs, however, have lost 10s. at 32½. Callenders continue to rise, and are 5s. up at 10¾. Marconis have gone back to 4⅝, and Americans are a little easier at 30s., Marines being quoted 3½. Amongst other manufacturing shares, Babcocks at 3¾ are 1/16 harder, Edison-Swans at 15/16 are 1/16 lower. A demand has arisen for Edison "B" shares, which were supposed to be about 3d., until a buyer of several thousand shares came along and found that he could not get them, even with a bid of 1s. a share.

In the foreign group there are no changes to record, with the exception of a point fall in Mexican Light preferred shares, which has reduced the price to 48. Mexican issues generally are, however, a goodish market, and much is expected from the probable action of the United States Government as soon as the American troops have mostly returned home. There is a disposition to buy Brazilians, but enterprise is somewhat curbed by the slight feeling of dulness that has spread over markets by reason of the labour difficulties at home, together with the news from Russia. A sharp fall in the price of copper, the metal, had no effect upon prices of the companies connected with it. The rubber market is better, and a feature of the past few days has been resumed buying of armament shares, a movement that has sympathetically influenced prices in the iron, coal, and steel section.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Jan. 7, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7⅜	+ ⅛	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref...	4½	4½	8⅜	—	6 13 4
Chelsea	3	5	4	—	6 5 4
City of London	8	8	13¼	+ ¼	6 0 9
do. do. 6 per cent. Pref. ..	6	6	10⅛	—	5 18 5
County of London	7	7	11⅛	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	5⅞	—	5 19 2
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref...	4	5	4	—	6 5 0
Metropolitan	9	4	3	—	6 13 4
do. 4½ per cent. Pref. ..	4½	4½	3¼xd	—	6 18 6
St. James' and Pall Mall	8	9	7⅛	—	6 6 4
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	+ 6d.	6 13 4
Westminster Ordinary	7	9	7¼	—	6 4 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99	—	6 1 0
do. Def.	1½	1½	23⅛	—	6 9 6
Chile Telephone	8	8	7⅝	+ ⅛	5 5 0
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅝	+ ⅛	*5 2 5
Eastern Tel. Ord.	8	8	158½	+ 1	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	+ ¼	5 14 3
Great Northern Tel.	24	22	32½	— ½	6 15 0
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅝	— ⅛	4 6 6
Oriental Telephone Ord.	10	10	2½	+ ¼	4 0 0
United R. Plate Tel.	8	8	8	+ ⅛	*5 0 0
West India and Panama	6d.	1/3	1 11/16	—	*3 12 6
Western Telegraph	8	8	16⅝	+ ⅛	*4 16 3
Home Rails.					
Central London Ord. Assented ..	4	4	65½	—	6 2 2
Metropolitan		1	31	— ½	3 4 6
do. District	Nil	Nil	26	—	Nil
Underground Electric Ordinary..	Nil	Nil	3½	+ ⅛	Nil
do. do. "A" ..	Nil	Nil	8/9	—	Nil
do. do. Income ..	6	4	94	+ 1½	*4 5 1
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	4 1/16		—
do. do. 2nd Pref. ..	5½	—	3⅞	—	—
do. do. 5 Deb... ..	5	5	74½	—	6 14 3
Brazil Tractions	—	—	57	—	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	50	—	Nil
do. do. Deferred	Nil	Nil	45	—	Nil
do. do. Deb. ..	4¼	4¼	62	—	6 17 8
Mexico Trams 5 per cent. Bonds..	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	53½	—	Nil
Mexican Light Common	Nil	Nil	38	—	Nil
do. Pref.	Nil	Nil	48	— 1	Nil
do. 1st Bonds.. ..	Nil	Nil	70	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¾	+ 1/16	4 0 0
British Aluminium Ord.	10	10	1 15/16	—	5 3 1
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref. ..	7½	7½	2½	—	6 0 0
Callenders	20	25	10¾	+ ¼	5 19 1
do. 6½ Pref.	5	5	5⅜xd	—	5 2 4
Castner-Kellner	22	20	3⅜xd	—	5 18 6
Edison-Swan, "A"	—	—	15/16	+ 1/16	8 0 0
do. do. 4 per cent. Deb. ..	4	4	74½	—	5 6 0
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10⅜xd	—	6 5 4
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2¼	—	5 11 2
do. 4½ Pref..	4½	4½	4	—	5 12 6
India-Rubber	10	10	17xd	—	*5 17 8
Telegraph Con.	20	20	48	—	*5 0 0

*Dividends paid free of Income Tax.

WALTER RATHENAU ON THE GERMAN SITUATION.

An Alleged Average of £7 per Week in the Berlin Engineering Trade.

Some remarkable speeches have been delivered by Herr Walter Rathenau, chairman of the A.E.G., during the course of the war, but now that the Germans have been defeated the tone of his observations has completely changed. In the course of a recent interview with the representative of a New York newspaper, the chairman expressed the opinion that "Germany is ruined for several generations; ruined politically, industrially, and economically." This purely political statement has been made for American consumption, no doubt, in the hope that it may exercise the desired political effect in the United States. On the other hand, the speech which Herr W. Rathenau made before the shareholders at the recent general meeting was intended not only for home consumption, but also for that of Great Britain and her Allies. An abstract of the speech is given below, and one of the most noteworthy statements therein is the remark that with the adoption of the 8-hours' day the wages of the mechanics and engineers in the district of Berlin now amount to about £7 per week. The abstract is as follows:—

Herr Rathenau stated that on the last occasion when he addressed them they were on the eve of the Russian peace offer. At that time he remarked that they could assume that the war had entered into liquidation, and he added that he wished no "final calls" would be made in connection with the liquidation. It would have been impossible for him to have expressed himself more distinctly, although it might be that his observation had not been listened to. In the meantime, the most serious "final calls" had been made upon them, and they would have have great difficulties in settling them. The directors had estimated the dangers and the duration of the war quite seriously, and had not withheld the estimate from the shareholders. They had never entertained optimism, but had regarded it as their duty to serve the country as well as they were able, and keep their plant at the disposal of the country. They had not accepted war contracts in order to earn war profits, but in order to protect their fighting front. In the interval a great revolution in the country had taken place. The directors had welcomed the revolution, and believed in the new realm; they believed in the possibility of a changed order of things. They were willing and ready, in community with all orderly forces, to co-operate in the reconstruction of the country. In order to strengthen their opinion, and to show they believed in the order and the constancy of circumstances in connection with the character and the convictions of the German nation, they had decided to recommend the payment of the Peace rate of dividend. They would have to reckon in the future that the fate of the company, as well as the destiny of the entire German industry, would no longer depend solely upon economic opportunities, but predominatingly on political events.

Much had been said recently concerning the nationalisation of industries—catch-words and general theories being largely brought into play. It was possible, he said, to organise industries so that an increased participation in them could be granted to all parties, workmen and officials in particular, both in the material results and in the determining controlling factors of the community. But the supposition for any new order was a condition which would augment the productiveness of industries. It was impossible to place increasing burdens on their industry, according to general political wishes, and leave the future to chance as to whether the industry could, or could not, bear these burdens. The first problem was the development and expansion of productiveness, and the speaker failed to see any fruitful proposals in that direction in the public discussions. He believed in the possibility of increasing productiveness and its efficiency if they excluded the losses through friction to which they were subject at present. The losses in material, transport, and labour could and must be overcome. In contradistinction to this idea, however, the burdens were growing provisionally in such a measure that they could only be borne with great difficulty by all industries, but could no longer be borne by the Berlin engineering industry in particular. The Berlin manufacturers might be reproached for having been too yielding in regard to the demands made upon them by officials and workmen. The speaker believed, however, that it had been well to follow the policy of conciliation which had been pursued in Berlin, in so far that it had been said that peace in industry should be maintained at the seat of the Government in these times of crises in favour of the general community.

It could not be concealed, however, that against these sacrifices had to be set provisionally a weakening of their productiveness. It was easy to calculate what that meant when the wages of workmen to-day, reckoned on the eight-hours' working day, were said to amount to over 7,000 marks (£350). That implied, with a number of workmen which the speaker would only estimate at 300,000 in Berlin, a charge upon their national income of £100,000,000. It was obvious that such a burden could not be demanded permanently by a comparatively small section of the population, as the entire national income amounted to £1,750,000,000. It was necessary to keep in view, and say to the public without reserve, that the growing demands meant not only serious economic dangers, but also serious political dangers. They must be clear on the point that the aversion to Berlin was growing. If Berlin, as it seemed, came out of the ranks in so far that wages were granted there which could not be obtained in the country, the aversion to Berlin would not disappear, but increase; and the dangers of a separatory division of the country would not decrease. At the same time, however, it would be a serious danger to German economic life if the great Berlin industry were to be so far weakened as no longer to form the factor which it constituted in the whole economy.

The chairman further remarked that exaggerated demands made by those at present employed in the engineering works in Berlin were a disadvantage to the returning soldiers. If now, and so long as the companies were able to bear them, the wages of the individual were so much increased that a general decline and a reduced efficiency of the works awaited the returning men, the latter would seriously complain that in their absence the works had been so weakened as to leave no work for them to do. The country was faced not only with internal economic dangers, but also with the conclusion of a peace which they did not know and which might place upon them enormous burdens. One thing alone could help them in such times: orderly reconstruction of industry in the sense expressed by the speaker—namely, the extension of productiveness and the most complete solidarity of all operating factors in the country—between employers and workmen and between all professional classes.

ELECTROTHERMIC PROCESSES.

As a science electrothermics has been the means of developing several distinctive types of electric arcs, and has indicated methods of chemical synthesis and decomposition. Thus many new compounds and metals have been discovered and commercialised, while several products have been manufactured better and cheaper in the electric furnace than in the previously used fuel-fired furnaces. It will therefore be of interest to briefly consider a few typical processes, the following particulars being taken from the *General Electric Review* of November, 1918.

Calcium Carbide (CaC_2).—Calcium carbide was one of the earliest commercialised electric furnace products. The formation is represented by the reversible reaction shown in (*a*); simultaneously the two side reactions shown in (*b*) and (*c*) occur. In each case, as the temperature is raised the reaction proceeds to the right.

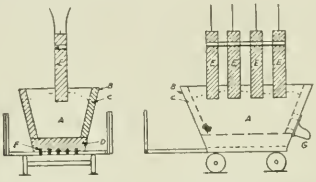
(*a*) $CaO+3C=CaC_2+CO$

(*b*) $CaC_2=Ca+2C$

(*c*) $CaO+C=Ca+CO$.

The charge consists generally of good quality lime (56 parts) and low ash (under 3 per cent.) anthracite (36 to 39 parts), crushed to pieces one or two inches in diameter. Coke is generally used. Phosphorus should be avoided and the sulphur kept low.

The product is not pure CaC_2, which in reality is a colourless, transparent substance, but is a dark grayish-black crystalline material, containing about 15 per cent. lime and carbon, and also impurities in small amount retained from the original charge.



A, charge; B, steel shell; C, brick lining; D, carbon and tar hearth; E, electrode bundle; F, steel grating; G, tapping hole.

FIG. 1.—CALCIUM CARBIDE FURNACE OF THE TAPPING TYPE.

Calcium carbide furnaces are all of the arc type, but vary greatly in capacity and in the method of operation. A furnace of the tapping type is shown in fig. 1. In order to supply the large currents used (28,000 amperes at 50 volts) it is customary to use a bundle of electrodes. A carbon-tar mixture is tamped in the bottom over some steel grate bars, forming a conducting hearth. The electrode contacts are water-cooled. Each unit is mounted on wheels and a tap hole is provided for drawing the sluggish molten carbide. Some furnaces of similar construction do not possess the tap hole, in which the operation is intermittent, the charge being removed after solidification. The furnace used for a time by the Union Carbide Co. at Niagara Falls is of quite different construction from the others. It is called the continuous type furnace and is shown in fig. 2. It consists essentially of two slowly revolving concentric drums. The furnace makes about one-third revolution per day. The outside plates are removable where the electrodes enter, and at the point where the sufficiently cooled carbide is broken up and taken out. At other points the plates hold the charge in place. The end plates are fixed. Only single-phase furnaces have thus far been mentioned, but large three-phase units of 7,000 H.P., 45,000 amps., 80 to 100 volts, are in operation in Europe. The energy required to produce calcium carbide varies from 1.7 to 2 KW.-hour per pound.

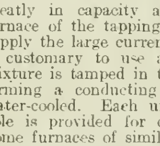


FIG. 2.—CONTINUOUS TYPE CALCIUM CARBIDE FURNACE.

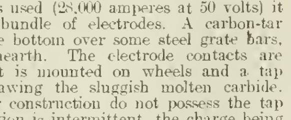


FIG. 3.—CARBORUNDUM FURNACE.

Carborundum (SiC).—The chemical reaction resulting in the formation of carborundum is generally represented to be $SiO_2+3C=SiC+2CO$. Tone, of the Carborundum Co., however, claims it is to be formed in the following manner, from the silicon and the carbon monoxide vapours that are present: $3Si+2CO=SiC+SiO_2$. It probably is formed in varying degree by both reactions. In addition to the production of carborundum, monox (SiO), silicon, siloxicon ($Si_m\ C_n\ O$) and graphite are formed under suitable conditions. All of these reactions are reversible.

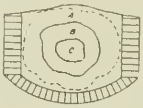
$$SiO_2+2C=Si+2CO$$

$$SiC\quad =Si+C\ (\text{graphite})$$

$$SiO_2+C\ =SiO+CO.$$

The carborundum furnace charge is generally represented to be (in percentage parts by weight) thus:—

Sand 51.2 per cent., coke 35.4 per cent., sawdust 10.6 per cent., salt 1.8 per cent. The sand is ground silica 99.5 per cent. pure. The sawdust is used simply to give porosity to the charge in order to allow the carbon monoxide an opportunity to escape freely. The salt reacts with some of the impurities, forming volatile chlorides. Coke, or ground material from a previously used charge, is used as a conducting core around which is packed the new charge. The core and charge are built up on a permanent foundation with replaceable sides of brick. Connection between core and electrodes is made by means of finely ground coke powder.

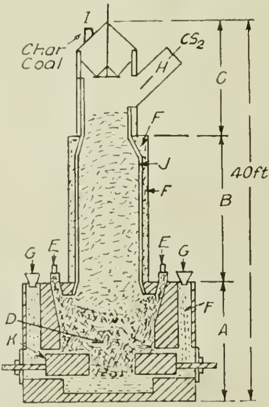


A, uncrystallised carbide; B, carborundum; C, carbon core.

FIG. 4.—TRANSVERSE SECTION OF FURNACE SHOWING RELATIVE POSITIONS OF CONTENTS AFTER RUN.

The standard furnace consumes some 2,000 H.P. It requires about 250 volts at the start, but at the end of a run only 75 volts, when it takes 20,000 amperes. The temperature of the core may reach 3,000 deg. C., but the zone in which the carborundum is formed (next to the core) should be between 1,820 and 2,220 deg. C., the temperatures at which the carbide begins to form and to decompose. The largest furnaces are 30 ft. long, and yield about 7½ tons of carborundum. After a furnace run, the products of the reactions are found located in the order and approximate proportions as represented in figs. 3 and 4.

The siloxicon compounds are inferior to carborundum in quality, and do not find very extensive applications. They are formed in the furnace in the annular zone outside of the carborundum, where the temperature is not high enough for the formation of the carbide.



A, hearth; B, shaft; C, head; D, charge of charcoal; E, opening for feeding broken carbon to serve as conductor; F, sulphur; H, opening for conducting off carbon bisulphide gas; J, annular space filled with sulphur; K, carbon electrodes.

FIG. 5.—CROSS-SECTION OF THE TAYLOR CARBON BISULPHIDE FURNACE.

Silicon.—While it is possible to manufacture silicon in a resistance furnace, as indicated in the carborundum furnace reactions given above, the method is not practised commercially. Instead, a furnace of the arc type, using a charge of sand (SiO_2) and coke (C) is used. $SiO_2+2C=Si+2CO$. The Carborundum Co. taps a 650- to 900-lb. pig every few hours. The grades made contain from 90 to 97 per cent. Si. The furnace is built of fire brick with a carbon lining, and consumes about 1,200 H.P.

Graphite.—Graphite is made in a resistance furnace, very similar in form to the carborundum furnace. The present furnaces for graphitising carbon in bulk possess a central core, surrounded by the charge mixture of granulated coke, or of anthracite, or of petroleum coke, together with the catalyser, iron oxide. In some cases, the ash from the anthracite or coke will catalyse the reaction. At least 1 to 2 per cent. of Fe_2O_3 is required.

A great proportion of the Acheson graphite is made into electrodes. These are graphitised from the molded mixtures of carbon binder and catalyser, compressed into shape under high pressure. The carbon electrodes are loaded in a series of piles in the furnace, spaces between piles being filled with ground coke to increase the resistance.

In the conversion of the bulk graphite about 90 per cent. of the charge is changed over. All of the charged electrodes are converted. The furnaces compare in size with the carborundum furnaces, the largest consuming 1,000 h.p. At the end of the run (20 to 24 hours) about 9,000 amperes at 80 volts are passing. The product resulting from the high temperature treatment is quite pure (99.9 + per cent. C.) due to the volatilisation of the impurities.

Carbon Bisulphide (CS_2).—The electrothermic manufacture of carbon bisulphide well demonstrates the advantages of electric heat, and employs a most ingenious furnace. It is said that the original furnace was operated for the first two and one-half years with but one shut-down for cleaning. A cross-section of the furnace is shown in fig. 5. It is 40 ft. high.

The reaction consists in the union of sulphur (volatilised and highly heated by an electric arc) with incandescent coke, according to the equation $C+2S=CS_2$. The coke is fed in through the head of the furnace at I at such a rate as to keep the shaft B well filled. The sulphur is fed into the arc zone in molten condition, after being melted by waste heat of radiation in passing down the annular passages F outside both shaft and hearth. The CS_2 is cooled by heating the coke as it descends into the reaction zone, and is taken off through the furnace head at H, and condensed.

The heat is supplied by two-phase current, the arcs playing between two pairs of carbon electrodes placed 90 deg. apart. The space around and above the electrodes is filled with pieces of graphite, broken bits of carbon, &c. (D), to protect the electrodes (K), which are consequently subjected to very little wear. As the furnace walls are gas-tight no CS_2 vapours escape. About 4,000 amperes are supplied at 60 volts, and 0.52 kw.-hour per pound of CS_2 is required.

Fixation of Atmospheric Nitrogen.—Considerably more than 3,000 technical articles dealing with this problem have appeared to date. The difficulty of discussing the subject in a very few words is thus at once evident.

The methods of fixation depending upon the direct oxidation of atmospheric nitrogen are carried out in three different types of arc furnaces, all of which are in commercial operation. Though the furnaces are all of different types, there is no great difference in the yield of NO gases obtained.

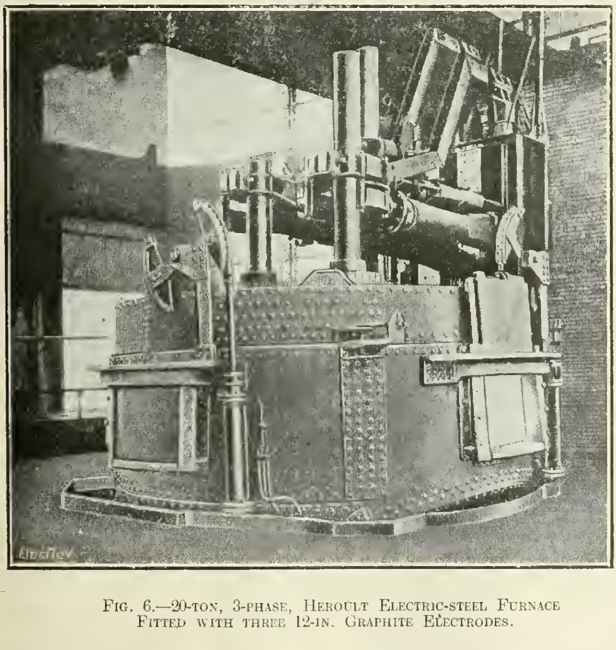


Fig. 6.—20-ton, 3-phase, Heroult Electric-steel Furnace Fitted with three 12-in. Graphite Electrodes.

The Schonherr furnace gives the highest concentration of NO, but the Eyde furnace gives a little higher output of NO per kw.-hour. The electrode wear is very rapid in the Pauling furnace, and the slowest in the Eyde. The power factors are close on 70 per cent. for all furnaces.

Two other processes may be mentioned that are really chemical rather than electrochemical, although electric heat is used at points in each process, not because exceedingly high temperatures are required, but because temperature control is essential. The Serpek process fixes nitrogen through inter-action with alumina and carbon. The nitrogen comes from the air, the alumina from bauxite, and the carbon from coal which is heated with the bauxite to calcine it. The reaction temperature lies between 1,800 and 1,900 deg. C., and the reaction itself is $Al_2O_3+3C+N_2=2AlN+C3O$. The aluminium nitride is convertible into ammonia through treatment with steam, and the ammonia may be converted into nitric acid.

The Haber process causes nitrogen and hydrogen to unite directly through the agency of some catalytic agent, according to the reaction $N_2+3H_2=2NH_3$.

Leland L. Summers's comparison of power consumptions for the several processes is as follows:—

	Per lb. of N.
Direct oxidation of atmospheric N at 5 per cent. efficiency	30.0 kw.-hour
Cyanamid process—carbide 66 per cent. and cyanamid 99 per cent. efficiency ...	7.5 kw.-hour
Serpek process	5.5 kw.-hour
Haber catalytic process	0.7 kw.-hour

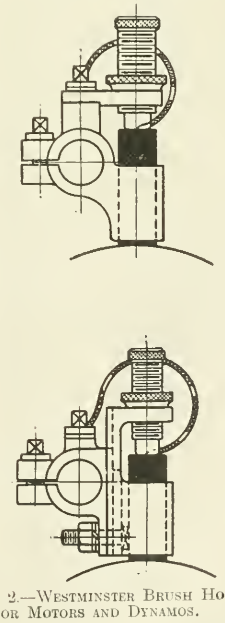
The reaction which results in the formation of NO, from O and N, is a reversible one, so that the concentration of the NO (which is small at best) is rigidly dependent upon the temperature, in accordance with the equilibrium law.

At the equilibrium temperature the oxide is decomposed as rapidly as it is formed above the equilibrium concentration. If the oxide once formed can be removed rapidly enough and cooled to 1,500 deg. C., further decomposition is slight. The commercial arc furnaces are, therefore, all designed to permit of the removal of the gases from the zone of high temperature as rapidly as possible. A rapid movement of air through the arc is reqnired, resulting in the maximum temperature of the arc being unobtainable and a low efficiency for the process.

CARBON BRUSH-HOLDERS.

By J. O. Girdlestone, M.I.E.E.

I do not think it necessary to make any apology for again bringing up the question of brush holders for motors and dynamos. It is just one of those details, frequently overlooked, which make all the difference between satisfactory running and the reverse. Motors of quite excellent design are often fitted with faulty brush holders, and the whole machine may be condemned for this imperfect detail.



Figs. 1 & 2.—Westminster Brush Holders for Motors and Dynamos.

It might be expected that with the large experience gained by makers, and the hundreds of thousands of machines in use, some standard pattern would have been evolved, but this is not so, although I am inclined to think that there is a distinct tendency to gravitate towards the type described below, which has now been in successful use for some years.

During the last eight or nine years many thousands of these holders have been supplied for all kinds of machines, from large turbo dynamos and alternators to small motors, and I do not know of any one case where they have been a failure. They can be made to suit practically any machine, but owing to lack of uniformity, cannot very well be stocked in standard sizes, and so have to be made up to suit requirements. The only dimensions required when ordering for any particular machine are: Diameter of brush spindle, distance from centre of spindle to surface of commutator, number of holders required, and size of carbon brush.

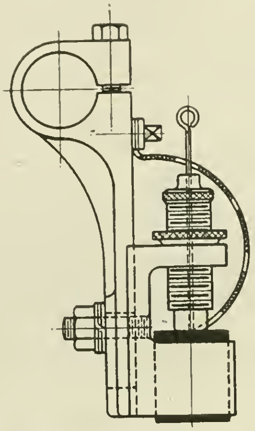


Fig. 3.—Heavy Brush Holder for Turbo-Generators.

It is advisable that the brush box be as close as possible to the commutator, allowing the brush to project about ⅛ in. only. With the old type of swinging-arm brush holder flash overs were frequent, but there is much less risk of this occurring with the holder illustrated, the brush being but slightly in advance of the spindle.

In the holder as shown the brush is kept in intimate contact with the commutator by the spring enclosed in the tubular screw. A light pressure is found sufficient to prevent any tendency to jump, even when the commutator is slightly out of truth, a condition fatal to most types of brush gear. The holders should be inspected at intervals to ensure that the brush is working freely in the box.

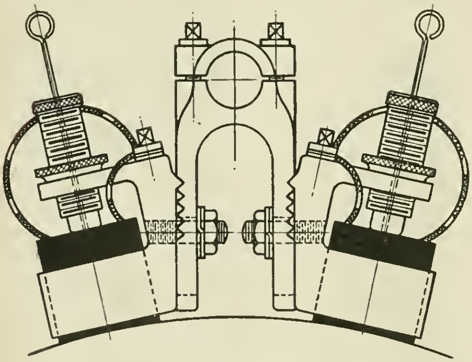


Fig. 4.—Brush Holder for A.C. Slip-rings.

The illustrations show four brush holders made by the Westminster Engineering Co., Ltd.

Fig. 1 shows the ordinary type of holder for motors or dynamos; it consists of a gunmetal casting, the box part made an easy fit for the brush. The pressure is applied directly over the centre of the brush by means of a spiral spring inside the plunger which is itself a sliding fit in the adjusting screw. The spring is thus entirely enclosed and the pressure is exerted in a line passing directly through the centre of the brush.

Fig. 2 shows a similar holder, but with the box portion adjustable to allow for wear of the commutator. The sliding portion is secured to the fixed part by a nut and spring washer, and can be moved down as required.

Fig. 3 shows a heavier type of holder as supplied for turbines. The wire passing through the adjusting screw and spring permits the spring tension to be accurately measured by means of a spring balance. This holder is most substantially made, the plunger being generally of mild steel.

Fig. 4 illustrates the type generally used for A.C. slip rings, which type also has vertical adjustment. This pattern has been applied to a number of machines previously using copper brushes, with most satisfactory results. A copper-carbon brush is generally used in such cases.

CARBON BRUSHES: CONSIDERED IN RELATION TO THE DESIGN AND OPERATION OF ELECTRICAL MACHINERY.

At Birmingham, on December 18th, 1918, Mr. P. Hunter-Brown's paper (an abstract of which appeared in our issue of December 27th) was read and discussed before the South-Midland Centre of the Institution of Electrical Engineers.

Mr. A. T. Bartlett, in a written communication to the discussion, said he was much interested in the author's theory of air suction being the cause of the increase in the coefficient of friction at lower speeds; with perfect laboratory conditions it was quite conceivable that there might be a measure of "optical" contact, as it were, between the brush and the commutator, but this was not likely to be obtained in practice. He suggested another reason for the shape of the friction curve, which was that in practice brushes were not really in good contact all the time; at the higher speeds this imperfect contact was increased. He described an experiment he made some 12 years ago, when engaged on the commutation difficulties of direct-current turbo-generators. A commutator with all its segments connected to a common ring was mounted on a special shaft. The common ring was connected to a slip ring, so that current from an outside source could be passed into the commutator, and leave at the brushes pressing on the commutator in the normal manner. Very special attention was given to truth, surface, and balance of the commutator at full speed, and also to the bedding of the brushes. Readings were then taken with the following result:—One brush was first put down and loaded up to its normal current density, the drop was measured, which could be represented by unity. A second brush was then put down, and the current doubled in order to eliminate any effect of change of current density. The drop was then rougtly one-seventh. A third brush was put down with less change, the figure being then about one-fifth. He thought the only explanation was the one he had given, viz., that brushes were off the commutator for a considerable time, and this caused the retarding effect of the brush to be decreased. No doubt copper "picking" was due to electrolysis, but he thought that an irregular current distribution was more often the larger factor. Electrolysis, or a pseudo-electrolytic effect, undoubtedly occurred; he came across a really definite case some ten years ago. A heavy-current low-voltage generator was fitted with copper graphite brushes with a large copper content. On its trials, after running about 10 hours the commutator developed a salmon-coloured matt surface, and the brushes, if not the commutator, began rapidly to be transferred in the form of powder to the bed-plate and machine generally. The trial had to be stopped, and afterwards a careful examination of the brushes and commutator was made. The surfaces of the positive brushes were quite metallic and bright, whilst the negative brush surfaces looked as though they had been painted with dead lamp black. No trace of the copper content was visible; it had apparently been transferred to the commutator exactly as in normal electrolysis. The negative brushes were replaced with graphite brushes, and the machine then ran most successfully.

Mr. M. Kahn, in a written communication, said the following indicated the physical explanation of how current was transmitted from the brush to the collector. The voltage drop between collector and brush was comparatively constant over a large range of current density, and showed a minimum value below which no current passed. If one compared the curve for the drop in the author's fig. 1 with corresponding curves of electric arcs one found a great similarity. Another indication was the phenomenon called copper picking. On the face of it, this feature looked like an electrolytic action. A similar action was also found in the electric arc, the material of one electrode being carried in the direction of the flow of current to the other electrode. A third indication was the difference of contact drop between the positive brush and the collector and the negative brush. Mr. Hunter-Brown had not gone into that question. The phenomena mentioned showed that the flow of current from a carbon brush to a collector differed entirely from the conduction of electrical energy along a metallic conductor. It seemed to take the form of a large number of minute electric arcs which were not visible to the eye. With increasing voltage between brush and collector, the energy in such arcs increased very much more than the voltage, as could be seen from the author's fig. 1. An increase from 2 to 2.5 volts doubled the current in the contact surface. An increase of voltage of 24 per cent. produced, therefore, an increase of energy of 250 per cent. The arcs became visible when the voltage between brush and collector was increased beyond a certain limit; they were, however, always present, although they might not be visible, wherever current passed between brush and commutator, and might cause wear, copper picking, and disintegration, even though the machine might appear to collect perfectly. It followed that the phenomenon of sparking depended on the voltage drop at any point between brush and collector, which could easily be proved by measuring that drop when sparking occurred.

Mr. W. N. King said he noticed that no reference had been made to a well-known property of carbon which had an important bearing on the subject under discussion, viz., the negative temperature coefficient Two prominent examples of this effect had come under his observation in large direct-current generators, one of 1,500 kw., and the other of 1,000 kw. capacity. In each case trouble was experienced with commutation at full load and over. Severe sparking, flashing, and overheating of the brushes occurred. One brush after another in a row would take more current than the others, and became red hot with cumulative effect due to the negative temperature coefficient, until the brush or flexible lead burned away. In one of the cases mentioned the trouble was eliminated by substituting Morganite "Link 3" for carbon brushes. It would be interesting to know whether the temperature coefficient of the Morganite brush was negative, and how it compared with carbon.

Mr. W. F. Higgs said the author referred to atmospheric conditions in one or two places in the paper. The speaker knew of a 25-h.p. motor, 460 volts, the peripheral speed of the commutator being about 3,000 ft. per min., which was installed on two girders, 8 ft. above the floor, about two years ago. The brushes would run about 10 days, and then collapse all at once. Many different qualities of brushes were fitted, with no improvement. The commutation with regard to sparking was perfect, and it was a machine of which he had made dozens of the same construction, mechanically and electrically. The machine was taken off its girders and put on a concrete foundation in the same shop, but the trouble still continued. It was moved into another shop, and had been running satisfactorily, with the same brushes, for 12 months. A second machine was installed where the first one was taken from, an exact duplicate, and the same trouble occurred. He thought he was right in putting the trouble down to atmospheric conditions.

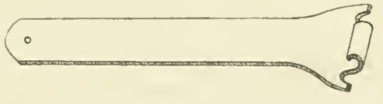
Mr. W. Lawson hoped that such an exceedingly practical and valuable paper would come under the notice of all manufacturers of electrical machinery. In his opinion it rested with the manufacturers to provide their machines with brush gear so designed that when fitted with a specified form and grade of brush a much higher degree of immunity from brush troubles than had so far been obtained would accrue. Unfortunately, these troubles could not always be detected on test, they frequently did not arise until after the machine had been in service for some time, and it was left to the purchaser to determine by experiment how best he could get over the trouble. That was not as it should be, and he believed the paper would lead to a closer study of the question, and would ultimately result in the elimination of most brush troubles. Until that happy state arrived, the question of standardisation should be approached with the utmost caution. In the paper, the excessive wear sometimes produced on the top of the brush by the pressure finger was ascribed to electrical rather than mechanical effect. It was difficult to account for it in that way, as the greater part of the current passed along the flexible connection. In none of the cases that had come to the speaker's notice had there been any evidence of electrical effect. The experiment which was described as proving the existence of some kind of electrolytic effect was extremely interesting and important, but it called for further investigation. He had noticed an analogous effect, and one that was not explained, or even referred to, in text-books, in meters of the mercury-motor type. In this case there was an amalgamated copper disk immersed in mercury. Two copper conductors amalgamated at the ends made contact with the mercury, and the current passed from one conductor through the mercury and the copper disk, and out by the other conductor. Under certain rare conditions electrolytic action took place; one of the copper conductors was eaten away, and a heavy deposition of copper by transference took place on the copper disk. He had never known of such a thing happening with a meter of less than 50 amperes capacity, so that it appeared there was a critical value of current below which no deposition could take place. Had the author observed a similar characteristic in the electrolytic effect which he mentioned? Further investigation might establish an analogy between these two effects, and also throw some light on the possibility of there being some relation between the speed of the conductor and the strength of the current determining the condition under which electrolytic effects could take place.

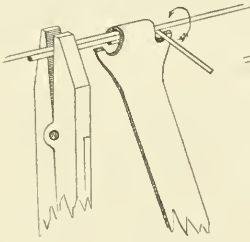
NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Wire-Splicing Tool.

Mr. C. H. Willey describes in the American *Electrical Review* the tool shown in fig. 1, which is found suitable for splicing small wire which is too stiff to be readily bent with the fingers; it is about 8 in. long, and at the widest part is approximately 3 in. wide. The curved head or holding part is about 1½ in. wide. This head is bent to form a semicircle having a diameter of about ¾ in. The grooves in the flanges on each side should be deep enough to hold the wire without slipping out and the shoulder of the flange should be low enough to permit the wire to be grasped easily. The operation of the tool can best be explained by the illustration as shown in fig. 2. One of the wires to be spliced should be bent at right angles and the tool placed over it at the bend. The other wire is then put in position and both wires are held in place with a pair of pliers. By turning the splicing tool, as shown in fig. 2, the wire to be bent can be wound tightly around the other wire. After this the other wire can be bent, and the operation repeated, except that the tool must be turned in the opposite direction. One distinct advantage which a tool such as this possesses is that the finished joint is free from the usual outstanding ends which very often cut through the insulation after being in service a short time.





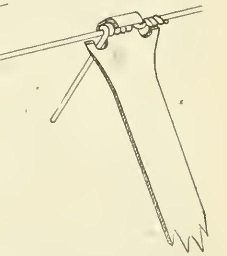


Fig. 1.—Handy Splicing Tool (Top).

Fig. 2.—Method of Starting Splice (Left).

Fig. 3.—Finishing Splice (Right).

Spark Recorder Used in Testing Apparatus.

In the *Electrical World*, Mr. F. W. Springer describes a portable recording instrument shown in the accompanying illustration (fig. 4) which was designed and built in the electrical engineering department of the University of Minnesota some time ago for recording the readings of any indicating instrument. Its principal use is in testing electric cars, elevators, and starters or controllers used with various types of a.c. and d.c. motors.

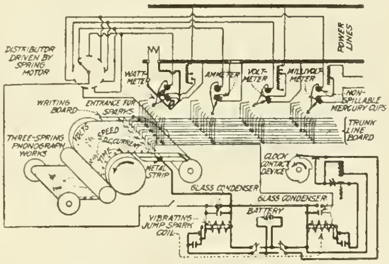


Fig. 4.—Apparatus for Recording Simultaneous Readings.

Edison three-spring phonograph motors operate the paper reels and drums and the spark distributor. A laminated board holds 80 bare copper wires uniformly spaced, and laid in suitable slots. The distributor is driven by one of the shafts of the spring motor, although it could be driven by a special electric motor connected with a storage battery if desired. An H-slot gear-shift is provided, which, together with the centrifugal governor on the spring motor, allows a paper speed of from 2 in. to 4 ft. (5 cm. to 1.2 m.) per minute. The slow speed is used for railway work and the high speed for testing A.C. motor starters and the like. A common two-cell automobile lighting and starting battery is a satisfactory source of energy for the spark coils. The battery should be insulated in order to avoid unnecessary and dangerous differences of potential between the recording instruments and the neighbouring lines and earths. In case of railway tests the apparatus should be connected with the line on the earth side, or the apparatus and operator should be placed on an insulated platform to be considered as an artificial earth of the line being tested. Three-phase tests may be made by using a polyphase wattmeter, but as most tests for which such a recorder might be used are either single-phase or balanced three-phase systems, a single-phase wattmeter only is provided. The current coil is cut in on one line leg and the potential coil may be connected to an artificial neutral. In A.C. work, of course, the shunts are replaced by one current transformer. In D.C. tests the wattmeter spark is usually cut off. The outfit is equipped with a 5-amp., 150-volt, single-phase Weston wattmeter, a Weston millivoltmeter with shunt, and a D.C. voltmeter and millivoltmeter of the same type. Pin switches are used for controlling the sparks to the individual instruments. A vibrating jump-spark coil is connected successively to the various broom-straw insulated instrument pointers by means of the distributor and the non-spillable iron mercury cups and binding posts. The millivoltmeter is connected through an adjustable resistance to a suitable D.C. magneto for recording speeds.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

20,921. "Electrical controlling apparatus for aircraft." T. F. Brewster. December 16th.

20,957. "Lever-operated change-over switches for telephone exchanges, &c." M. B. Richter. December 16th. (Germany, December 17th, 1917.)

20,960. "Electrically-operated abrading machines." N. G. Olson. December 16th.

20,961. "Electrical connectors or terminals for stranded conductors." British Westinghouse Electric & Manufacturing Co. and R. Brooks. December 16th.

20,965. "Electric arc lamps." H. B. Grylls & W. Heape. December 16th.

20,976. "Automatic starting and short-circuiting device for asynchronous motors." Y. U. F. Andersen & A. F. B. Fuerson. December 16th.

20,988. "Electric accumulators." H. F. Joel. December 16th.

20,989. "System of telegraphy and apparatus therefor." E. A. Davis. December 16th.

20,999. "Electromagnetic apparatus for recording signals." E. S. Carey. December 16th.

21,009. "Means for attaching and coupling magneto-electric machines to engines." S. L. Bailey, W. W. Douglas & Douglas Motors, Ltd. December 17th.

21,017. "Electric motor construction." F. Foster. December 17th.

21,018. "Armature cores." J. B. Bushnell & Bushnell Magneto Co. December 17th.

21,020. "Electric switch." W. Joice. December 17th.

21,022. "Reverse electric motor." C. Douglas & S. Holloway. December 17th.

21,030. "Means for supporting lamps, shades, &c." H. M. Macnaughton Jones. December 17th.

21,033. "Means for illuminating magneto compasses, scientific instruments, &c." C. F. Ryland. December 17th.

21,052. "High-tension insulators with metal hood." Fabbrica Isolatori Livorno & J. E. Pollak. December 17th.

21,053. "Insulators." Fabbrica Isolatori Livorno & J. E. Pollak. December 17th.

21,109. "Wheel for collecting power from overhead electric wires or cables and wire-carrying wheels." W. H. Powell & E. W. Waggett. December 18th.

21,110. "Electrical switches." R. T. Norton. December 18th.

21,115. "Sparking plugs for internal-combustion engines." Castle Motor Co. & P. Greensmith. December 18th.

21,139 "Visual electrical indicators for collieries, &c." J. King. December 18th.

21,158. "Starting switches for electric motors, &c." G. J. Money. December 18th.

21,177. "Ignition systems." Dayton Engineering Laboratories Co. December 18th. (U.S.A., December 22nd, 1917.)

21,229. "Magnetos." E.I.C. Magnetos, Ltd., & W. T. Turner. December 19th.

21,252. "Telephone switchboards." J. H. Taylor. December 19th.

21,269. "Electric bell or buzzer." C. W. H. Honor. December 19th.

21,281. "Glands for electric cables, shafting, &c." G. A. Ashworth. December 19th.

21,283. "Electric switches." V. E. Joyce & Park Royal Engineering Works, Ltd. December 19th.

21,285. "Production of high-frequency electric currents." F. J. Brougham & M. Deutch. December 19th.

21,288. "Telephone boxes, &c." D. Daponte, T. F. Newman & E. Tonet. December 19th.

21,290. "Electric switches." H. W. F. Ireland & H. Lucas. December 19th.

21,298. "Apparatus for electrically controlling railway signals." A. Monard. December 19th. (France, December 20th, 1917.)

21,307/8/10. "Insulators for high-tension electric cables." Fabbrica Isolatori Livorno & H. Wade. December 19th.

21,309. "Means for fixing electric cables to insulators." Fabbrica Isolatori Livorno & H. Wade. December 19th.

21,311. "Magnetos." Compagnie Generale de Magnetos. December 19th. (France, July 12th.)

21,363. "Electrical generators and electrical motors." J. Shepherd. December 20th.

21,373. "Lamps for vehicles, &c." E. G. Camelinat. December 20th.

21,391 "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) December 20th.

21,407. "Apparatus for electrically controlling railway signals." A. Monard. December 20th. (France, May 28th.)

21,417. "Electromagnetic transmission and reception arrangements." W. E. Barber. December 20th.

21,435. "Connection of flexible cables or leads to electric lampholders, &c." C. A. Miller, F. J. Miller & E. A. Sanders. December 21st.

21,457. "Commutators for dynamo-electric machines." E. J. Harman and E. le Bas. December 21st.

21,458. "Dynamo-electric machines." E. J. Harman & E. le Bas. December 21st.

21,466. "Measurement of alternating-current power." Ferranti, Ltd., and G. Wall. December 21st.

21,467. "Electric starters for internal-combustion engines." A. H. Midgley & C. A. Vandervell & Co. December 21st.

21,477. "Raising frequency of alternating currents." B. Cluzeau. December 23rd. (France, February 15th, 1916.)

21,489. "Dynamos." H. Leitner. December 23rd.

21,490. "Means for obtaining single-phase alternating electric currents from three phase or *vice versa*." A. M. Taylor. December 23rd.

21,506. "Electric arc lamps." A. G. Way & Westminster Engineering Co. December 23rd.

21,541. "Electric furnaces." D. F. Campbell. December 23rd.

21,547. "Electric cooking or heating vessels, &c." C. H. Lauth. December 23rd.

[Patent No. 20,285, mentioned in the Electrical Review for December 30th, p. 616, was the joint application of E. H. Whittall & B. J. Rees, not of the former alone, as stated in our list.]

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

3,394. Regulating or controlling systems for electric motors. Electric and Ordnance Accessories Co. & J. Etchells. March 7th, 1917. (121,138.)

13,225. Apparatus for the reception and utilisation of electric current impulses and suitable for wireless or other telegraphy and telephony. W. J. Lyons & Selective Signal Co. September 14th, 1917. (121,144.)

15,505. Electric muffle furnaces. W. F. Junes. October 25th, 1917. (120,944.)

15,821. Test sheath joint for electric cables. C. J. Beaver & E. A. Claremont. October 30th, 1917. (120,948.)

16,154. Cells for electric accumulators or batteries. Etablissements de Dion-Bouton Soc. Anon. January 11th, 1917. (112,927.)

17,410. Electric igniting torch. A. E. Long & H. Seal. November 26th, 1917. (120,960.)

17,431. Electric cables. W. T. Henley's Telegraph Works Co. & H. Savage. November 26th, 1917. (120,962.)

17,471. Engine starters. V. Bendix. November 26th, 1917. (121,155.)

17,675. Commutators for dynamos or motors. H. C. H. Smyth & Tredelect Engineering Co. November 29th, 1917. (120,982.)

17,823. Starting mechanism for magnetos of internal-combustion engines. L. Johnson & J. T. Roberts. December 1st, 1917. (121,168.)

17,849. Dynamo-electric machines. Bruce Pebbles & Co. & H. E. Webb. December 3rd, 1917. (121,170.)

17,871. Electric speed-changing mechanism. J. Carlier. December 3rd, 1917. (120,987.)

17,941. Leading-in wires or conductors of incandescent electric lamps, high-vacuum apparatus, and the like. F. Hoge. December 4th, 1917. (121,173.)

18,043. Ignition starting apparatus for internal-combustion engines. Soc. d'Electricite Nilmelior. March 2nd, 1917. (115,801.)

18,057. Magneto impulse devices for starting purposes. B. Lawrence. December 5th, 1917. (121,181.)

18,102. Wood separators for secondary electric batteries. Chloride Electric Storage Co. & B. Heap. December 6th, 1916. (121,188.)

18,349. Electrical separation of suspended particles from gaseous bodies. H. A. Burns. December 11th, 1917. (120,994.)

18,490. Electrical instruments of the recording type. E. Fawssett. December 13th, 1917. (120,999.)

18,495. Engine starters. V. Bendix. December 13th, 1917. (121,000.)

18,954. Testing of insulated electric cables, wires, and the like. P. M. Bennett, J. F. Watson and Callender's Cable & Construction Co. December 21st, 1917. (121,204.)

19,098. Sparking plugs for internal-combustion engines and the like. J. E. Gimbert. December 27th, 1917. (121,008.)

1918.

31. Electric heating elements. L. G. Caunter January 2nd, 1918. (121,210.)

386. Electrically-propelled vessels. F. Ljungstrom. January 7th, 1918. (121,211.)

557. Silencing pads from telephone or speaking-tube earpieces and earstoppers. A. C. Brown. January 9th, 1918. (121,016.)

1,031. Electric heating apparatus. Automatic Telephone Manufacturing Co., C. H. Archer & G. W. Simister. January 18th, 1918. (121,214.)

1,567. Plunger-type brush-holders for dynamo-electric machines. Phœnix Dynamo Manufacturing Co. & A. H. Bennett. January 26th, 1918. (121,217.)

1,690. Cooling or ventilation of dynamo-electric machines. G. A. Juhlin and J S. Peck. January 29th, 1918. (121,218.)

1,942. Wireless valves. C. J. Blue. April 22nd, 1918. (121,220.)

2,040. Air-cooled sparking plug. J. H. Chapman. February 5th, 1918. (121,222.)

2,912. Electrically-operated friction clutches. M. Walker & H. T. Boothroyd. February 19th, 1918. (121,229.)

3,283. Electric controllers of the barrel type. Veritys, Ltd., & W. G. Pipkin. February 25th, 1918. (121,041.)

3,478. Attachment of telegraph wires to the insulators of telegraph poles and like supports of aerial wires. W. A. Davis. February 27th, 1918. (121,044.)

4,275. Electrical condensers. W. Dubilier. January 16th, 1918. (121,050.)

5,110. Electric motor controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 22nd, 1918. (121,057.)

5,286. Dynamo-electric machines. W. F. Higgs. February 13th, 1918. (Divided application on 2,573/18.) (121,058.)

5,322. Circuit-breakers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 26th, 1918. (121,059.)

6,707. Machine switching telephone exchange systems. Western Electric Co. & L. Polinkowsky. April 20th, 1918. (121,247.)

10,769. Electromagnetic relay for railway signalling and like purposes. Tyer & Co. and F. W. Leake. June 29th, 1918. (121,088.)

11,230. Electromagnetic relays. British Westinghouse Electric & Manufacturing Co. August 7th, 1917. (118,603.)

15,306. Devices for detachably connecting electric conductors to the terminals of magnetos and other electrical apparatus. G. F. Joseph and A. G. Harding. September 20th, 1918. (121,105.)

15,701 Ignition dynamos. C. T. Mason. June 28th, 1917. (Divided application on 9,305/17.) (121,106.)

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. JANUARY 17, 1919. No. 2,147.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

ELECTRICAL ENGINEERING IN THE ARMY.

SOME time ago we took occasion to comment on the shortcomings of the military authorities at the Front in connection with the supply of electricity to our various consuming departments—such as hospitals, workshops, offices, &c.—which was usually effected by means of innumerable little petrol-electric sets dotted about, instead of properly designed central installations put down for the purpose of meeting all the local requirements. Such installations might have been of quite a temporary character, capable of being transported to any position where they were needed and quickly set in operation; but apparently every department had to shift for itself in this respect, and the only method of doing so known to them was that of setting up a miniature supply system for each one. There appears to be a decided gap in the organisation of the Royal Engineers and in their training at this point; they are not taught, like the French Engineers, industrial technology, and while, as we most gladly bear witness, they are unexcelled in the arts of military engineering proper, they have not appreciated the fact that there is now no line of demarcation between military and civil engineering—the whole is one and indivisible, and until they master the principles of electrotechnology on modern lines, they cannot claim to have completed their training.

As a matter of fact, electrical engineering is, or ought to be, a very important branch of training for military purposes; for want of an adequate knowledge of this subject, there has been waste and loss on our side that must, in the aggregate, have run into millions of money, and must have greatly diminished the efficiency of our fighting forces, with the inevitable result of inefficiency in war—the loss of many precious lives.

We mentioned, in the earlier stages of the conflict, that the part played by electricity in the war appeared to be very circumscribed—confined, apparently, to telegraphy and telephony, local lighting, and searchlights—and that was, in fact, the case *on our side of the lines;* but what about the uses to which it was put by the enemy? Now that we have been able to inspect his handiwork, we find that he attached the greatest importance to the use of electricity for lighting and power, and that his work was marked by a very high degree of technical skill and able administration. No haphazard methods were allowed, and it was not left to each unit to devise its own little supply system; on the contrary, the work was carried out methodically and thoroughly, on economical lines, and with great rapidity when an advance was made. But the most striking and significant feature of the work is the fact that the supply was transmitted over great distances from large generating stations, at high pressures; while we have not been able to obtain particulars of the system in detail, we understand that literally thousands of miles of high-pressure overhead lines were installed by the Huns for the supply of all requirements for lighting and power. The three-phase system was employed, and the transformer substations were established in farms, dug-outs, and other places where their presence was not likely to be suspected. Apparently the electrical staff worked independently of any other unit, and carried out its work on practically permanent and up-to-date methods; and so complete was the system and ample the supply of electricity, that even civilians in the occupied districts were allowed to share in its benefits.

So far as we are able to ascertain, the use of overhead transmission and distribution on our part of the Front was a negligible quantity, though our French Allies adopted it freely and systematically. Moreover, we have heard that even when our lines were advanced in the wake of the departing Huns, no use was made of their electrical system; incredible as it may appear, we gather that the same old "system"—save the mark!—of dumping down a little petrol-electric set wherever a few lights were wanted was still practised, although the elaborate enemy installations were practically intact and crying out to be used! Sad tales have come to our ears of valuable electrical apparatus—including large generators and transformers, probably looted from French or Belgian undertakings—left rotting in the rain, without even a waterproof cover over them, owing to the inability of our military authorities to appreciate the value of the goods; and of stores of smaller electrical apparatus abandoned to the ravages of the civilian population, who, with a livelier intelligence, did not let slip the opportunity. Such incidents, while they horrify the civilian engineer, bear out our contention that in future electrotechnology in the broadest sense ought to form an essential part of the training of a Royal Engineer officer.

According to our information, the electrical work of the Huns in the regions which they have now evacuated was so thoroughly well done, and so admirably thought out, that it would constitute a valuable object-lesson to our own electrical engineers, and it would be well worth while for a party of the latter to visit the districts in question and make a careful investigation of the methods and apparatus which have been so efficiently employed by our enemies. We submit the suggestion to the Council of the I.E.E., with the warning that the opportunity should be taken while it serves.

Electric Supply—Why National?

The Board of Trade Electric Power Supply Committee's Report has resulted, since it was first published, in a plentiful crop of criticisms, technical, commercial, social, and political. The discussional potentialities of such a report are, of course, unlimited. We do not, however, propose to exploit any further fields of detailed criticism at the moment, but merely to draw attention to the one broad principle which constitutes the *raison d'être*, as it were, of the scheme recommended in the report, and which will, perhaps, tend to become obscured under the mass of indiscriminate controversy. The scheme proposed is a comprehensive one, of a "National" character, and if it cannot be carried out by private enterprise, the project is to be financed out of the public exchequer. As such a proposal involves a serious charge on the country, it is important to keep in mind the justifying principle upon which alone the Committee puts forward the scheme—namely, that it is of National importance that there should be available a supply of cheap power adequate for the expansion of existing industries and for the encouragement of industries altogether new. The "National importance" of the scheme is *limited* to its industrial aspect. The text of the report in this respect runs as follows:—

> That when British industry is subjected to the test of keen international competition after the war, its success will depend upon the adoption of the most efficient methods and machinery, so as to reduce manufacturing costs as much as possible.
>
> That a highly important element in reducing manufacturing costs will be the general extension of the use of electric power supplied at the lowest possible price, and it is by largely increasing the amount of power used in industry that the average output per head, and, as a consequence, the wages of the worker, can be raised.

Now when the Bill, which the Board of Trade will introduce to give effect to the recommendations of this Report, comes to be argued out in the Committee stage, it is of the utmost importance that this governing and limiting principle shall be kept prominently in the foreground. Almost everyone agrees with the soundness of the governing principle here enunciated. It is a truism to insist that the future of the country is bound up with its commercial development and prosperity in the few years immediately ahead of us. This is the end to be achieved; and, as the Board of Trade Committee's Report clearly shows, the object of the scheme there put forward (in fact, the only justification advanced for putting forward a scheme at all) is this alone. When, therefore, the project in detail is laid open in the Bill, it must be checked point by point by this principle, and whatever alternative suggestions may be evolved during the progress of the Bill, they must be judged solely by their adequacy to attain this end. State trading, State financing, State control are, *per se*, none of them principles under this Report, but merely possible means towards an end—namely, industrial development. Further, the principle logically provides a limitation to the proper extent of the scheme.

We have emphasised the necessity of keeping this principle clearly in mind, in view particularly of the way in which the daily Press has raised a cry of cheap electricity for everybody, which will tend, perhaps, to become increasingly suggested as the real purpose of the scheme. The cry is an echo from the London County Council scheme of 1914, when particularly inviting prospects were held out to the London householder. It is interesting to note that, in justification of the scheme then prepared for London, the Council's consulting engineers (Messrs. Merz and McLellan) put forward mainly the "domestic" argument, mentioning the "industrial" aspect as incidental.

The Coal Conservation Sub-Committee reported somewhat expansively on the domestic side, but the Board of Trade Committee wisely included domestic uses only as of secondary and subordinate consideration. It cannot, therefore, too clearly be borne in mind that the Board of Trade does not propose any State finance or support to the end that private householders should have cheap electric cooking, heating, vacuum cleaning, and so forth, none of which, however desirable, can be claimed as of national consequence in the same sense as cheap and universal electric power. In fact, if the Board of Trade had committed itself to the proposition that it was so necessary that the country should use electric cooking and electric heating that even State aid should be invoked for that purpose, it would have landed itself in the dilemma that it was catering either for the luxury of the few or for the necessities of everyone—the latter case leading to the inference that the Government considered it of pressing national importance that every gas stove and gas cooker should be scrapped at the earliest possible moment! This, however, was not the intention of the Board, which has done well in basing its Report on a clear and unequivocal principle.

That the supply of electricity for domestic uses will be greatly cheapened and extended, and that important economies of fuel will result, together with other well-known benefits, goes without saying; but these are incidental advantages, and should not be mistaken for the main purpose of the scheme.

THE GERMAN ECONOMIC SITUATION AND TENDENCIES IN BRITAIN.

Germany, whether repentant or unrepentant for the misdeeds of those who caused and waged the world war, is to-day paying part of the penalty that Prussian militarism has imposed upon it. There is now no faltering in the relentless tread of Nemesis. Our own newspapers tell us from day to day of the struggles that are taking place in Berlin and other places in which the "Government" and the extremists respectively strive for supremacy. The former appears to stand for orderly revolution, while the latter seek to feed the fires of Bolshevism. While it is impossible for anybody to forecast what will be the ultimate issue of things in Russia, or what form the new order will take either there or in Germany, it is certain that industrial revolution is in full swing in both countries, the consequences of which will be felt there, and, indeed, practically everywhere for long years to come. The developments that have occurred in this country in the course of the last few months would in pre-war days have been regarded as a revolution; but large and sweeping as they have been here, they have been effected without violence save to the ideas of men. It may be said that the reasons why our own changes have been brought about in comparative quiet are found in the fact that we have won the war, while Germany and Russia have both lost it; that in both those countries the people have suffered years of serious privation; that the influence of Tsarism and Kaiserism has left the millions smarting under a sense of wrong imposed by authority; and that the prospective burden of the future is insufferably heavy. We must add to these an important factor, namely, that in England during the period of the war the lesson has been brought home in season and out of season, that if industry is to continue to be carried on for private profit the employés must labour under more humane or civilised conditions and receive better wages. The transition period has brought many problems up for settlement already, and we cannot expect to pass through the inevitable period of disorganisation and unemployment and the progress of demobilisation without further marked changes occurring. If we believe that the German people will before long come to see that their safety, whatever their burden of liabilities, lies in a sane policy of industrial security, we certainly are more entitled to hold that the sound common sense of the British race will guide us all, whether as employers and employed, or as classes and masses, in the right direction. There is, happily, little room for doubt that, given harmonious relations, there is plenty of work awaiting us in this country as soon as we can reverse the machinery of organisation from war to Peace. But, as Mr. Wardle, M.P., remarked last week, what we need, in order to secure content and prosperity, is industrial unity; "industrial Peace" he described as merely negative. "Industrial unity" is a constructive and active policy which means not mere quietness, but the making in quietness of progress toward a state of things in which industry is made to yield a proper return to all the interests concerned with it.

We have been greatly interested in the views expressed in many of the German newspapers during the past month or two concerning some of the movements that are proceeding in German industry, and we think they might be considered with advantage by those who are responsible for influencing or leading the thought of those connected with similar matters in this country. The demands of the workers in all countries are very much alike—in some the violent seek to take the kingdom by force, and the battle sways sometimes uncertainly. We have in our own midst those who openly avow that peace along the lines of the Whitley Report is not what they desire; unity between Capital and Labour is the one thing that they do not seek: they wish to abolish the masters and the capitalists once and for all, and if we promote friendliness at this juncture the realisation of their hopes will be deferred, perhaps, never to recur under such favourable circumstances. We do not believe that this element is one of great strength numerically, but the peculiar thing about it is that some of them are described as clever and cultured, with which combination there also appears a willingness to be as ruthless as any Prussian militarist, if by such means their end can be attained. We believe that history, if it deigns to take note of their efforts, will condemn them as being equally short-sighted, and altogether wrong in their calculations.

The events that have been taking place in Germany may be described briefly by our giving a summary of a few outstanding matters. In December last the Thuringian Industrial Union called for the restoration of economic security and stability. It referred to the extraordinary rise in the cost of production that must follow on the satisfaction of the demands then made by workers in all fields of employment. The home demand for all kinds of goods was reasonably to be expected to fall, owing to the rise in prices, and the industries would be unable to compete in the foreign markets with countries which did not have to cope with such increases in wages. The Union pointed out that the suggested control of industry would only make matters still worse, owing to the lack of technical knowledge and commercial experience on the part of the workers. Some leaders in Germany are not slow to point out, as leaders of Labour and social reform here have foreseen also, that nationalisation of industry can only be gradual, and requires decades to be carried out. Mr. Arthur Henderson himself, when pinned down to the expression, "control of industry," showed that his use of it was only meant to be immediately, or at first, applicable, in the main, to public services.

We read that Geheimkommerzienrat Ventzky, of Graudenz, is said to have handed over the control of his business to his employés in return for an interest of 3 per cent. being paid on his capital. Herr Walther Rathenau, of the A.E.G., whose views were printed in our last issue, is reported to have handed over his private fortune of a million pounds to the State. These, and other similar occurrences, are, no doubt, concessions to the demands of the mass of workers who are determined to have better wages, and who look chiefly to the profits of the capitalists to yield them without working out the simple sum which would show the smallness of the share of the individual worker. But why do they demand higher wages just now? Chiefly to meet the increase in the cost of living imposed upon them by reason of the war which their leaders have brought upon them. The one demand due to necessity, made while they are in anger with authority, leads them to make other demands which they consider will mend matters permanently. But what are the hard facts of the situation right up against which they are now brought? Germany has to pay the cost of the war. How is it to be done?

One proposal under discussion is State Bankruptcy. The cancellation of loans would, "at a stroke," free Germany of one-half of her liabilities; but it is said (*Weltwirtschaft Zeitung*, December 13th) that such a step would be a monstrous injustice to citizens who have helped to finance the war. One Ferdinand Rinkel, of Cologne (in *Kölnische Zeitung*, December 7th) estimates that the national wealth of Germany is now less than half what it was before the war. "The State obligations exceed the whole national wealth, and it needs no gift of prophecy to foretell an approaching catastrophe." He calls for appropriate economic measures to be clearly stated, in order to dispel prevailing uncertainty, or there will be disaster. He hears out of the welter of economic clamour three phrases:—"Death to capital—eight hours' working day—higher wages." He finds fault with the authorities who are in power because they do not make the situation of impending national bankruptcy clear to the workers, and persuade them to accept lower wages, instead of inciting them to further demands. Industrial and other undertakings will be unable to pay heavy taxation, and the State will, therefore, lose part of its revenue. Even threats alone to burden capital with heavy imposts depreciate the value of shares, &c., to such an extent that "the State will be unable to impose heavy duties on capital, for the simple reason that only part of it is left." He instances a manufacturer who six months ago had made a million marks by the war, which he invested in Stock Exchange securities, with the result that he now only possesses, at most, a property worth 250,000 marks. One writer advances, as a measure for increasing the national revenue, the imposition of high taxes upon the goods to be sold by producers. This would mean that the cost of production would be increased by the entire sum of the taxes, and the selling price would be raised accordingly. And where would the consumer be then, who already finds the cost of living so great that he makes heavy demands? This same writer advocates improved production as the best method of increasing the efficiency of the economic system. He would eliminate all concerns working at a loss—possibly, in the natural course of things, may we suggest, they would eliminate themselves—he would reduce the cost of transport to a minimum (still paying transport workers high wages and running shorter hours?) and would obtain the highest possible yield with the lowest possible outlay "by concentrating and systematising business concerns." "In this way increased revenue and decreased revenue will be available for the payment of interest, *so far as they were not required for increased wages for labour.*" He is unable to determine whether this increased economy of working is to be obtained from nationalisation of the means of production or by means of State-controlled syndicates of private business concerns."

We notice that a certain Prof. Franz Eulenburg, of Aix-la-Chapelle, favours a levy on capital, yet he says that "Germany's position and credit abroad would be endangered for all time if she failed to recognise the validity of her war loans." He says that popular opinion is decidedly in favour of the burden of debt being partly redeemed by a levy on capital, instead of shifting that burden on to shoulders of future generations, especially as vast accumulations of capital have resulted from the profits made in the war. As we have several times suggested German manufacturers may yet wish that they had been required to pay Excess Profits duties during the war.

One George Bernhard, however, has been expressing a totally different view from that held by Eulenburg, holding that a levy on capital to any extent, even if it only affected reserve funds, would lower the capacity of production of all undertakings carried on in the form of joint-stock companies, and would have a restrictive effect on the entire economic system. If a very considerable part of the capital of the business man and manufacturer is taken away from its owner "the growth of capital is checked, and with it the possibility of any extension of industry and trade, and, at the same time, a heavy blow is struck at the producing capacity of the nation." "The provision of new machinery, and especially the extended application of new processes, and also the speedy changes necessary in the case of new costly methods of production, demand unlimited possibilities in the way of providing the requisite fund."

So much for taxation questions in their relation to industry. Returning to the wage question, it is protested that inflated wages are being paid in German shipyards by order of the Government. The Government is itself paying a proportion of what are described in the German Press as "ridiculously high wages," and it is deplored that ships cannot be built as cheaply as in other countries under such circumstances. Another criticism of the wage situation is that there is hardly a perceptible difference between the wages paid to skilled and unskilled workers. This may mean that a skill which hardly differentiates between incapacity and efficiency will crowd workers into employments which require little knowledge, and cause a shortage of labour for work which demands special qualifications, and, consequently, is used to command higher remuneration.

But notwithstanding all that international statesmen and others are saying about the increased wages and the better conditions that must henceforth prevail—with which we, and, indeed, everybody, must agree up to a certain point—we believe it to be an economic inevitability that excessive wages must fall and abnormally short working hours must eventually be lengthened, unless something in the form of universal international understanding is arrived at so that the same drawbacks confront all competing peoples. The man who asks for, and receives, higher wages is adding to the cost of the necessaries of life for himself if all men are out for the same advances. There can be little satisfaction in handling £5 a week in place of 50s. if you have to spend double. This seems to be—with, of course, exceptions in certain trades—what must certainly happen unless there is a universal will to work harder, with the improved opportunity of doing so with less fatigue that more efficient machinery and methods will present. Of course, we all expect, after the experience of war time, that shorter working hours will improve the individual efficiency if the change is adopted in the right spirit, and if the movement is not carried too far; but, unfortunately, as we have seen in the recent 47-hour disturbances, there is a disposition to raise new obstacles at almost every turn, and to gain some new point at the employer's—or may we say industry's?—expense. There is a will to agitate for better conditions and higher wages without calmly looking to the end which lies beyond it all. We seem to lack either the ability or the willingness to see beyond the ends of our noses. It seems as though men are indifferent as to where it will all lead them ultimately, so long as in the present they can secure what they want. We feel that whatever course events take, violently revolutionary or otherwise, the present tendency is only temporary, and that abnormal or unreasonable advantage secured by any mass of workers out of present peculiar conditions, will in a few years disappear. But we are all walking in the dark just now, feeling our way as we go, stumbling and then recovering; but there are at work economic forces which will decide whether we shall fail to recover after one of our stumbles. Many statements are made by our public advisers, which are acceptable because they reflect our desire to make things better for the millions of workers whose lives have been very drab and uninteresting in the past. We all yearn for a general improvement, and sometimes we are told that no industry should be allowed to continue unless it can yield to those employed in it a living wage and humane conditions. Perhaps in actual working it might appear that the closing down of a works and the sacrifice of capital would mean the unemployment of thousands of workers. Never mind that say our advisers—such a business should not be allowed to continue. We used to say that half a loaf was better than no bread — not so now. We repeat that we are as anxious as anybody to see wages higher and hours shorter if these things can be secured without killing the goose that lays the golden eggs. As Mr. Hichens recently suggested, let us not be "off and away" before we have thought whence we are going. Has the Government plans for securing permanent well-being of the nation as a whole before it steps in and decides that this, that, and the other change must be introduced on a specified date? And have the Trade Unions, which ought to have the well-being of the industrial life of the nation so largely resting upon them, given a sufficient thought to permanence and stability of industry, and to the inevitability of the effect of high wages on the cost of living? A moderation of their own demands might conceivably make for their own ultimate advantage. Have they also thought that the return on investments, upon which tens of thousands of comparatively poor people depend is reduced by half, as in the case of the value of wages?

We are undoubtedly only at the beginning of our discussions of the problems of industry. They will become more and more general in the coming months, and more and more acute as millions of men return and want to find industry prosperous enough to absorb them at the satisfactory wages that non-fighters have been receiving. We shall require to develop our trade to the utmost that lies within our power; we shall require to operate as efficiently as possible—capital, organisation, and labour; but we shall have to act in co-operation—in "Industrial Unity," or much that we have will be lost, and some things that we aim at will never be achieved.

Germany has her own problems to settle. We have ours. Perhaps we shall be assisted in our own deliberations by studying such enemy experiences and opinions as we have endeavoured to set forth above.

There are two German pre-war sayings that occur to us as we write: "Hope is the poor man's bread," and "Laughter is the poor man's plaster covering up each dire disaster." But "hope" and "laughter" will not meet the case of any of the peoples to-day. Koth, the German Chief of Demobilisation, recently said, "Hard work is the only salvation of the German people." But it is not only true in the case of Germany. Every Briton has got to put his shoulder to the wheel, and if he determines to push it for so many fewer hours a week, and receive so many shillings a day more, he must push all the harder.

BRITISH ELECTRICAL TRADE IN CHINA.

I.—The Opportunities.

By PROF. MIDDLETON SMITH, M.Sc., M.I.Mech.E., Hong-Kong.

The alert Editors of the Electrical Review have evidently been thinking about the markets of the Far East, at the beginning of the fifth year of the war, despite the anxieties and difficulties of the people in Great Britain in general, and of those responsible for trade publications in particular.* They have been wisely anticipating and preparing for the period of reconstruction. "England expects" in these times of her engineers and manufacturers not only that "this day" they will do their duty, but that before the day of demand they will prepare for the duty demanded of them, if it comes next year or even the year after. In all of our engineering work there is the period of planning; the drawing office stage of the business. We have to think things out, to collect all of the data possible, to make up our minds as to the best methods to be used in translating the designs into practical work, before the ideas are crystalised into the lines and instructions which go from the drawing office. It is in the hope of supplying some suggestions to electrical manufacturers and other readers of this journal that the invitation of the enterprising Editors is accepted. As the Americans say, they want "to make wise" their readers concerning "our" chances in China, and they ask for information that will help the trade in Great Britain. That is the object of this contribution.

For more than six years the writer has been working with the Chinese for most of the year, travelling about the Far East in the long vacations, writing to all who are connected with engineering work out here, meeting some of the most prominent Britons and Chinese, making notes on this great problem of trade in China. The subject of British trade prospects in the Far East has been a matter very much in mind. Seeds were sown many years ago in Birmingham by that remarkable man, Mr. Joseph Chamberlain, and the Far East has developed them. In a never-to-be-forgotten conversation before the days of the Tariff Reform crusade, Mr. Chamberlain talked of the engineering trades, the future of the Empire, and overseas markets to a young demonstrator in the University which he had created. He was practical, if a visionary. Like an architect who plans a structure he saw the building, even the details of the materials for the building long before there was anything more tangible than thoughts. He was, beyond all else, an organiser. He realised that each year would make engineering products more and more important as articles of commerce.

"*Does it Pay?*"—"What do they know of England," cried Kipling, "who only England know?" Yes, if you want to appreciate the land of Magna Charta, the land of Newton, Watt, Faraday, and those others who have done things which will leave a mark on the pages of history for all time, leave your England and travel round the world. You will not forget those of your countrymen mentioned above; but you will learn about others. You will find the trace of the British engineer and administrator from Vladivostock to Singapore from Shanghai to Cairo. You will not gain a cubit in stature, but you will hold yourself more erect; you will find a new fibre stiffening your thoughts; you will, if you are connected with engineering work, recognise that you are in a profession or trade which is "cleaning up" the Universe, which is doing something great. You will see the striking contrast between the way of the Anglo-Saxon and that of the men of other nations—especially the Orientals. You will become so proud and confident of the men of your own race that you will cease to show any traces of aggressive pride about them. You will accept it as you accept other works of Nature—as something almost inevitable. But it exists.

If you visit China you will, indeed, realise what has been done, and the possibilities of what can be done. Just as there is a new Europe, so is there a new China. Nothing is more striking than the complete change in outlook of the whole nation concerning machinery and modern industry. The attitude of the Chinese to-day when compared to that of 20 or even 10 years ago is astonishing.

They have asked about all of this modern apparatus the question that the keenest traders of the world would naturally ask. They said, "Does it pay?" and the answer has come from Japan, Hong-Kong, Shanghai, and even inland China. Always the answer has been, as the politicians say, "in the affirmative." In that mysterious manner of the East, of which we understand little, but which is as effective as a newspaper with a circulation of millions, the story that it does pay, the examples of how it did pay, have sped through China. The keen trader is, of course, naturally suspicious of being "let in," and on more than one occasion the Japanese drummer has let him in. Yet he is still keen, and he wants to make money. They talk about the almighty dollar in the United States. In China the dollar is super-almighty. And the Chinese of to-day are beginning to think that Western science manufactures and multiplies the super-almighty dollar. They are aanxious to find out how it is done.

British Assets.—There is no doubt that the Chinese have a very great respect for the British nation. The history of the British in China is too long to discuss here, but the most influential Chinese do realise what the British have done, not only for China, but in the Straits Settlements, Hong-Kong, and Shanghai. "It is our honesty that keeps us going," said a shrewd British official to me, a few days ago; "the Oriential respects the Englishman because he gets justice and the square deal from him." It is also our energy that keeps our trade going.

Perhaps the most remarkable piece of administrative reform work ever carried out was that of the Chinese Maritime Customs. It was the work of Britons, Sir Robert Hart being chiefly responsible. Sir Edward Grey has proposed it as a pattern for the administration of backward countries. It has been recently copied for the organisation of the Salt Gabelle, in China, by Sir Richard Dane. These two Departments are the only two revenue-producing, or official sources of national income, free from corruption in China.

The first British Chamber of Commerce was founded in Canton about 80 years ago, and there are now many other similar institutions—about 20—in China. These are determined to help British trade.

The Chinese Consular Service of Great Britain has a splendid reputation for everything but business training. Its servants have been men of high character; some of them have been great sinologues. One of them, Sir Harry Parkes, was a Great Englishman, "a man of push and go," who did wonders for our interests in China 40 of 50 years ago. The Chinese, be it understood, respect our Consular Service for its honourable tradition and the scholarship of many of its members.

The British have always had most of the external trade of China in their hands. They have opened up the country to steam; they have introduced machinery; they initiated and carried out the steam shipping trade of the rivers and the coast. They have provided the largest bank in China. Actually a British bank determines each day for China the vital question of exchange—how many dollars in China go to the pound sterling; in the four years of 1913-17 that number fluctuated from about 9 up to 13; and three months ago it was down to 5½. Those figures give some idea of the importance of exchange as well as of British interests in China.

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* These articles were written just before the war ended.—Eds. E.R.

Beyond all else the most valuable asset of the British in China is their reputation for the square deal. "The Chinaman's word is his bond" was the boast of the old days when the British practically held a monopoly in trade in China. Hundreds of thousands of pounds' worth of business was carried on between British and Chinese traders, and never a bond, but the word of each. The times have changed, but the old reputation remains. There are British firms in China whose verbal word is accepted for millions of dollars, and whose paper is like that of the Bank of England in London.

The local share market in Hong-Kong reflects British prestige. This Colony is the headquarters of at least one hundred British companies trading out here, including "the Princely House" and "the Bank." The largest insurance company in the British Empire has its headquarters and its board of directors in Hong-Kong. Its shares were worth about £10, some 30 years ago—the local quotation to-day in Hong-Kong is more than $120; at the rate of exchange that is about £150. The Chinese rush to invest money in British companies, or in property in Hong-Kong, or in the treaty port Settlements, managed by the British. The most famous mining administration in China is managed by the British—its Chinese shareholders are delighted with their dividends. No other nation has such a wealth of experience with the trading Chinese as our own. The Chinese are demanding Western machinery and applied science; the British have valuable assets in China, as enumerated above. Will they supply the bulk of the machinery needed in China? The opportunities are magnificent. Yet there are difficulties. They will be discussed in the next article.

METHODS OF "EARTHING" THREE-PHASE SYSTEMS. *

By C. L. BROWN, A.M.I.E.E., Lt. R.E.

It is now recognised as advisable to "earth" the neutrals in all but small systems, in which cases it is optional; the advantages being:—

The voltage between any phase and earth is reduced to 58 per cent. of the volts between phases.

A fault to earth on an unearthed system would be most certain to develop into a short circuit between two phases.

An earthed system lends itself more readily to protective gear, an earth or leakage being at once located.

On an earth occurring on one phase it must be immediately attended to, so avoiding delay, with possible serious trouble as a consequence.

Preferable where electric furnaces are on the system, where lengthy and heavy short circuits are liable to occur.

In many cases the neutral points of generators are earthed direct, but it is recommended that, where machines run in parallel, a neutral bus-bar be installed and earthed in place of each generator separately: the question of currents due to triple-frequency harmonics circulating between machines is of no great importance as far as this is concerned, and, if objection were raised on this account, small resistances could be placed between each generator neutral point and the neutral bus-bar. The methods of earthing are:—

1. Direct to buried earth-plate.
2. Through metallic or carbon resistance.
3. Through transformer.

The I.E.E. rule *re* size of earthing conductor for connecting between neutral bus-bar and earth, also between generators and neutral bus-bar, should be adhered to—*i.e.*, 1/14 s.w.g. wire, or equivalent sectional area in smaller wires, per 50 amperes working current; it is usual in large installations to use copper tape, say 1 in. × $\frac{1}{8}$ in.

1. This simple method is well known, and consists of connecting the earth wire or tape from neutral bus-bar, or generator neutral, if the former is not provided, direct to the earth plate or cone; the former may be a copper plate up to 6 ft. square (for large plants, say, 120,000-kw. capacity), this plate being surrounded by coke and sunk about 6 ft. in damp ground; a perforated metal cone may be used as a substitute. In addition, it is strongly advisable to earth on to the circulating-water pipe system, thus providing a precautionary measure at small cost without disadvantage.

All copper earth wires or tapes should be zinc or lead-sheathed, and run in pipes for protection; here it would be well to point out that careful periodic examination of earth wires is necessary, and resistance tests may conveniently be carried out from time to time.

2. In this case the connection from the neutral bus-bar or generator is on to a metallic or carbon resistance, and through this resistance to the earth plate or cone and duplicate to water pipe, exactly as stated above; the carbon resistances are preferable, as they appear to withstand sudden loads better; in any case, the resistances for large stations should be capable of dealing with heavy currents of short duration according to the capacity of the station and the nature of the loads. The carbon resistances may consist of units in series-parallel, and may be arranged so that it is a simple matter to add to them if necessary, say, when increasing the capacity of the station; when loads consisting of electric furnaces are added, it will sometimes be found necessary to amplify the earthing arrangements.

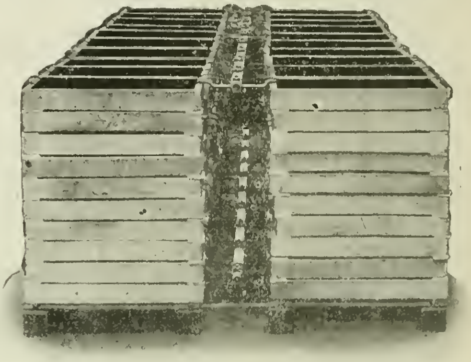
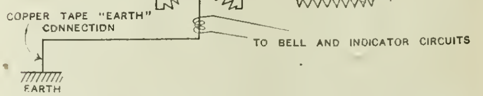


Fig. 1.—Carbon-Powder Type Resistance.

The resistance shown in fig. 1 is of the carbon-powder type; in this instance it is built up of 200 units, the total being of about 500 amperes' carrying capacity on an 11,000-volt, 3,000-kw. system; the capacity of such resistances may be roughly found from the formula:—



120,000-KW. STATION BUS BARS. 3-PHASE
FUSES
50-KW. TRANSFORMER
PRIMARY STAR WOUND
SECONDARY DELTA WOUND
COPPER TAPE "EARTH" CONNECTION
TO BELL AND INDICATOR CIRCUITS
EARTH

Fig. 2.—Method of Earthing Through a Transformer.

Capacity in amperes

$$= \text{kw. (of station)} \times 1{,}000 \times \sqrt{3} \div \text{volts},$$
$$= 1{,}730 \times \text{kw.} \div \text{volts}.$$

It must be remembered that as carbon possesses a negative temperature coefficient, the current will not rise above a value which is just sufficient to open the circuit-breaker, with a consequent minimum of shock on the system and a correspondingly less chance of heavy surging; with the resistances having a positive temperature coefficient, their total resistance must naturally be less than in the case of carbon; more current must pass to ensure the circuit-breakers operating immediately, and before the resistance increases due to heating sufficiently to prevent the breakers working, the result being a prolonged overload and probable burn-out; therefore, where metallic resistances are installed, they should be designed so that the current to earth would be greater than in the carbon type, in spite of having to break a heavier current and a greater chance of surging. The careful setting of time lags on the breakers will assist in overcoming the difficulty.

3. The method of earthing through a transformer is quite in favour; fig. 2 is a diagram showing a typical arrangement. A 50-kw. capacity transformer of the bus-bar voltage is connected to the main bus-bars through fuses, the latter being advisable to guard against a burn-out, should a very heavy short not clear itself in time. The transformer primary is star wound, the secondary being delta or mesh wound on open circuit; the neutral point of the primary winding is connected to a substantial earth-plate, as pointed out in (1), also to water-pipes. In addition, a small coil may be fixed round a convenient part of the earth wire, which would become energised on an earth current or leakage of predetermined value passing, thus ringing a bell, which may be fixed in the engineer's office. This may be improved upon by fixing the coil wires to an instrument indicating the strength of the current to earth.

EXHIBITION OF BRITISH SCIENCE PRODUCTS AT MANCHESTER.

The instructive exhibition held at King's College last summer,* the purpose of which was to indicate to the public, and more particularly to manufacturers, the great services British science rendered to British industry during the war, has very properly been transferred to Manchester, where for the past fortnight it has attracted a large and appreciative local public. The exhibition was organised by Mr. F. S. Spiers under the auspices of a local committee, presided over by Principal Garnett, and it was held in the College of Technology, three floors of which were utilised for the purpose. The exhibition was not an exact replica of that held in London, and while in some respects, notably chemical glassware and optical instruments, it fell short of the parent one, in other respects, dyes, textiles, and thermal apparatus may be instanced, the exhibits were both more numerous and more representative.

The electrical section illustrated principally the notable advances made in the production of magnetos, insulating materials, lamps, carbons, electric heating apparatus, and instruments—machinery had to be excluded. In all these cases we were largely, and in some instances entirely, dependent upon Germany, and the efforts made, under the stress of war conditions, by our manufacturers aided by our men of science to render this country, so far as possible, independent of foreign supplies will form an impressive chapter in the history of British industrial effort.

With regard to the individual exhibits, we need here only make brief mention of such as were not shown in London. The collection of magnetos and magneto parts, illustrating the whole complex process of magneto construction, was a remarkable one—quite the most complete that we remember having seen. In addition to the splendid and "live" collection shown by the British Ignition Apparatus Association, and contributed to individually by each of the ten firms constituting that Association, separate exhibits of great merit were shown by Messrs. Vickers, Ltd., Simms Motor Units, Ltd., and a local firm, the Runbaken Magneto Co., Ltd.

In carbons, a wide variety, made of high-grade carbon, was exhibited by the Morgan Crucible Co., Ltd. Besides the well-known Morganite brushes, these included magneto carbon for the distributors and slip-rings of aeroplane and automobile magnetos, battery carbon rods for pocket flashlamps (since 1914 this firm has produced a hundred million of these rods), carbons for electric welding arcs, and telephone carbons for transmitters and receivers. This firm also now makes electro-graphitic electrodes for use in electric furnaces. For many purposes these are preferable to—their life is longer than—the ordinary amorphous carbon electrodes. All of these accessories came from the Continent or from America before the war.

Most of the present types of electric heating elements were shown by the British Electric Transformer Co., Ltd., and the Edison-Swan Electric Co., Ltd. The former exhibit included the electric gun heaters for keeping lubricating oil from freezing in Vickers and Lewis guns when used on aeroplanes. Electric heating apparatus for medical and other purposes was shown by Messrs. E. M. Evans & Son, Ltd., of Manchester.

A splendid collection of scientific instruments, both for works and laboratory practice, was exhibited by Messrs. Chas. W. Cook, Ltd., of Manchester. The collection included the various electroscopes designed and used by Sir Ernest Rutherford for the accurate measurement of α, β, and γ rays, and a massive electromagnet, also used by Sir Ernest, with a capacity of 16,000 gauss. The workmanship and finish of this firm's apparatus is beyond praise. Pyrometers and electrical instruments were also shown by the Foster Instrument Co., Ltd., the Record Electrical Co., and the Cambridge Scientific Instrument Co., Ltd. The Cambridge firm exhibited, among other things, an electrical distance thermometer outfit for centralising and reading temperatures from any number of positions, and an aeroplane radiator thermometer for taking temperatures of cooling water. Mr. A. E. Moore, of the College of Technology, had on view his concentric standard dynamometer watt-meter for heavy currents, described in the Electrical Review of June 8th, 1917.

The Fuller Accumulator, Cable & Carbon Works showed in connection with their batteries and lamps a charging rack for replenishing the accumulators of miners' lamps. The Wardle Engineering Co., Ltd., of Manchester, had on exhibit many types of reflectors designed to meet varying industrial requirements. In every case a polar curve recorded the characteristic distribution of light.

Messrs. W. T. Glover & Co., Ltd., among other examples exhibited a six-core "Diatrine" paper-insulated and lead-sheathed cable, suitable for an 11,000-volt circuit, provided with Glover's patent test sheath, by which injurious effects from outside and leakage from inside the cable are bound to be intercepted by the test-sheath conductor.

The exhibit which perhaps attracted most attention was the ingenious winding machine—used principally for the fine coils required in wireless work—shown in operation by the Igranic Electrical Co., Ltd. In this machine the fine insulating cotton yarn is interwoven between the layers of concentrically-wound wire, and the two are wound simultaneously. By an ingenious cam mechanism the yarn also builds up insulating end cheeks, so that the coils are self-supporting. The machine is provided with automatic fault-detecting and indicating devices.

THE RONTGEN SOCIETY.

At the meeting of the Röntgen Society on January 7th. Dr. H. S. Allen, D.Sc., gave an address, accompanied by many experiments, on electrical changes produced by light. He said that according to the modern view matter was assumed to be built up of discrete electrical charges. With the negative electron they were all acquainted, but as to the ultimate positive charge they were still in ignorance. Yet there was no doubt that there was an ultimate positive charge, and that matter itself was composed of these positive and negative electrons; so that any electrical change might include a whole series of chemical changes, and, in fact, it was difficult to see whether any change with which they were acquainted in connection with matter was not an electrical change. Photo-electricity was a wide term, but it might be restricted to signify the liberation of electrons by light, a phenomenon which first began to be noticed more than 30 years ago. Dr. Allen went on to show that a body which was positively charged retained the charge when illuminated by ultra-violet light, but when the charge was of the opposite sign, there was immediately a discharging action on exposure to such light. In the case of wave-lengths of light longer than the characteristic frequency of the metal sodium, corresponding to the green light of the spectrum, there was no emission of electrons at all, but with light of shorter wave-length than this—that is to say, from green on towards the blue and violet—electrons were emitted. With regard to the phenomena of luminescence, he said that these were divided into two classes according to the length of time for which the luminescence continued. If the luminescence ceased with the cessation of the exciting cause, the term fluorescence was used, and if it continued after the stimulus had been withdrawn it was known as phosphorescence. Luminescence was due to some electrical action. The theory was that the exciting light produced photo-electric separation of the electrons, which in some cases returned almost at once to the parent atom, and on their return brought about emission of light of somewhat longer wave-length, which was known as fluorescence, while others did not return immediately, being entangled for a time in the surrounding molecules of the substance, and these on their more tardy return to the original support gave rise to phosphorescence. There was also such a thing as delayed phosphorescence, which implied that the electrons had become attached to foreign atoms and remained there pending some fresh stimulus, the explanation of the latent image of the photographic plate might be found in this theory.

In the course of the discussion, Dr. Leonard Levy said that if two preparations of zinc sulphide were prepared in exactly the same way, save for the variation of one little factor, while both samples would fluoresce brilliantly when exposed to green light, yet when exposed to red light, in the one case the fluorescence would be undiminished, and in the other case practically extinguished. It was difficult to see why so small a difference in preparation should cause such radical difference in behaviour in one respect and not in others.

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* Elec. Rev., August 16th, 1918, and subsequent issues.

Prof. A. W. PORTER thought that probably no pure substance ever did fluoresce. It was a statement hard to prove, but it was borne out by the fact that the fluorescent property of any substance seemed to depend upon the presence of traces—even extremely minute traces—of impurity.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Need for Co-operation Among the Smaller Manufacturers.

I trust you will find space for a reply to Mr. Siddeley's letter in the current issue of your paper on the subject of co-operation.

Mr. Siddeley's remarks are, on the face of them, quite unexceptionable, but I think it is advisable to look a little further, and consider what is likely to be the effect on the national character of carrying out the policy of specialised production and combination which he advocates.

I would ask you two questions:—What enabled us to beat the Boche? and Why was America so slow in getting started? I think the answers to these questions are complementary. We beat the Boche by directing to a common end the intense individual initiative of each British man or woman. The Americans were so slow in getting to work because, owing to specialised production on a large scale, they lacked the training which alone can produce this individual initiative and expert knowledge. In this country there was an immense number of small firms, each with its technical staff, and each capable of enormous expansion. Each little firm provided a nucleus from which radiated the ever-widening circles of increased production.

It is notorious that the Americans suffered from lack of skilled men, and that they are the slowest nation in the world to get going in anything that is not their standard production.

Our national system has produced, in fact, a people who could catch up, and pass, in an astonishingly short time the nation which had planned and organised war for 40 years. In spite of the warning which America had, and the experience of the other nations who had been at war for more than two years, they not only made many of the same mistakes, but many additional ones, and had not, in their first 12 months, produced anything comparable to the efforts of Britain or France.

If you turned the national capacity for manufacturing in this country into a few gigantic concerns, you would gradually lose what really constitutes the genius of our people, namely, the individual capacity of each man. This is what has occurred in America. These arguments apply to every field of endeavour, industrial, financial, or military. It is not true to state, as you did in your leading article of January 3rd, that the immense output obtained during the war was due to co-operation between different concerns. It was due to the enormous expansion of manufacturing capacity. Each individual has produced per head (with the exception of the managing staffs) a great deal less per day during the war than in peace-time. Further, it is a great mistake to imagine that the large firm produces cheaper: in fact, the limit of economical labour cost is very soon reached, and it is only in supervision, tools, &c., the cost of which can be spread over a larger number, where economy may be secured. For instance, any individual man working his whole time on one job will produce at the same cost, whether he is one of two, or 20, or 200.

In the direction of supervision, one foreman can only look after so many hands, so that if 100 is the limit, there is nothing to be gained by having 200 men and two foremen.

I think that the following statements are generally true:—

1. The industry of this country has been built up, and is even now carried on, chiefly by small concerns.
2. Standing charges are generally heavier in comparison to output with larger firms than with small.
3. Each individual of the staff of a small firm is more efficient and does more work.
4. Small firms are more flexible and adaptable.
5. Small firms make a larger average profit on their turnover than large ones.
6. In quick delivery and promptness in every department, a small firm scores all along the line. The only direction in which a large firm scores is in its advertising and selling departments.

Combinations without capital fusion have not proved satisfactory in electrical concerns. The number of articles would differ so greatly in design that unless you can completely eliminate a large proportion, you will get no economy in supervision and designing staffs to set against the cost of the central management which is super-imposed on the original ones.

Another vitally important advantage possessed by the small firms is the relation between the management and the men. I think it will be found to be true that the cases of trouble with the men in the smaller firms during the war are extremely rare, and the output per head of the manual workers has been much larger.

Again, excessive standardisation is against improvement and progress. Every firm knows the temptation not to introduce improvements when it involves scrapping standard patterns. The whole fact of the matter is that, having to turn out millions and millions of articles all alike has sent the country quite mad on organisation and standardisation. I should very much doubt if the actual output of all the electrical firms, of purely electrical machinery and accessories during the war, has largely been increased. Engineering products are not like wheat, or pipes, or other articles in universal use, which are not likely to change in character. The successful large combinations such as cotton spinners, cotton thread, and linseed oil have not been instrumental in lowering prices, but, on the contrary, have been successful because they have kept the prices up, due to a practical monopoly of production.

The large electrical concerns in this country have been notoriously unsuccessful compared to the smaller ones. The Government interference with engineering industry merely increased production, and prevented the use of materials and machinery on goods not connected with the war, and has not produced any economy, but rather the reverse. It was chiefly of use in providing unlimited capital for the expansion of concerns. The large firms are, in their unwieldy character, red tape, and in general inefficiency very like the Government. I do not wish to suggest that there is not room for vast improvement, but it seems to me that the directions in which our efforts at improvement should be made are in improved education and training of individuals, increased efficiency in our factories, and co-operation between the masters and the men due to common interest. Once you educate the men to see that they can only maintain a higher standard of living by increased production, and when they are given an interest in the profits of the firm for which they work, we shall soon begin to secure more efficient production. The danger of losing the British characteristics of initiative and tenacity by vast combinations and inefficient State control are, to my mind, most serious.

Apologising for the length of this letter,

E. N. Bray.

London, N.E., *January 11th*, 1919.

The Westinghouse Manager and Engineering Output.

I read the note on the above subject in your issue of December 27th with interest in the most vital points mentioned by Mr. Mensforth, in his reference to the future of our engineering industry. I agree that there must be years of ample trade ahead, as we must manufacture to carry on and pay our dues. Referring, however, to his remarks *re* Ca' Canny methods and restrictions, I agree from personal experience that both have been very much in evidence for some time, but Mr. Mensforth does not make any remark as to their cause, though he knows a deal, having such close touch with his own employés, through the medium of his Works Improvement Committeemen. As the average artisan knows so little of how departments or factories have to be handled to make them pay, the remedy is to take the employés in hand somewhat on the same lines as he did with his own foremen, and teach them a little of what it is necessary for them to know; let him understand what his faults cause, and how loss or waste time reflects on the profitable side of any business. To get attendance at these meetings would be a big job, I suppose, unless they were made attractive. Perhaps the shop stewards being elected up and down the country, or workshop committees, could assist.

Referring to customers placing orders, was not an order sent abroad some years ago on account of the employers forming the Electrical Engineering and Allied Trades Association? Now the workers are watching the number of firms who are linking up from time to time, and wondering how it will affect them later on. Regarding the skilled men's Union, I do not believe any instruct or advise restrictions on output, but they do realise that maximum output is the employers' interest, but, in many cases, not the skilled men's interests, as the number of men who are in receipt of wages in excess of the standard *minimum* rate is very small. But if the employer will put down modern machinery and pay more on individual ability than he has done, the same as America, as he mentions, then I believe the 47 hours and the dividend of employers would be assured. I say: Clear the mists from the Unionist's eyes, and let him see things more clearly, and understand why, and demarcation, another serious obstacle, may be removed. I might also add: Keep their gates more open to other firms, so that firms can always be kept up with the latest improvements, as has been done during the development of munition manufacturing.

An Old Foreman who Benefited Some by H. M.'s Lectures.

Electric Pressure Regulators.

We are inclined to think that your correspondent, "Engineer," will not find an automatic voltage regulator successful with the class of turbine he describes.

Our own experience has been wholly unsatisfactory. We first installed a Tirrill regulator, and kept to hand governing, the turbine attendant keeping the speed normal within about 2 per cent. with a periodicity indicator to guide him; this arrangement worked very well with a load that was previously giving us considerable trouble. After the war started we had to adopt automatic governing, owing to shortage of men, and we installed one of Messrs. Gilkes's turbine oil-pressure governors; this governor is quite useful, but we have tried about every combination of adjustments that is possible on these governors, but cannot get it to work with the Tirrill regulator in circuit, or, shall we say, it works far more than is needed.

It is only fair to Messrs. Gilkes to add that the alternator-rotor does not provide more than about one-half the fly-wheel effect that is really needed, nor have we a relay relief valve on the turbine; on the other hand, Messrs. Gilkes's engineer mentioned that in another installation they had to abandon the electric regulator owing to the turbine hunting.

Fixed up as we are now, we depend entirely on the governor for those portions of the day when the load is not subject to rapid changes, but on other occasions we have to come back to hand governing and the Tirrill regulator, a very poor makeshift, as when the governor would be of the greatest service to us we are unable to use it.

With an electric pressure regulator in circuit the speed of a machine will vary to a greater extent for a given load change than without one in circuit, as the turbine makers say the variation in speed is out of all proportion to the change of load, and the governor deals with it as a heavy load change when in fact the change of load may not exceed, say, 1 or 2 per cent.; the consequence is excessive and continuous hunting.

It appears to us that the only condition that will meet the case is the addition of a fly-wheel at least double the weight that would be used normally. We know there are cases where governors controlling high-pressure jet turbines are working very well with electric pressure regulators in circuit, but our turbines are like "Engineer's," with heavy gate gear to operate, where the speed can vary considerably before the governors can correct it.

Lynton & Lynmouth Electric Light Co., Ltd.
P. T. Kimmins.

Lynton, *January 11th*, 1919.

The "Taylor System."

The iron heated by Major Pells in your current issue should be struck while it is hot.

Too little is known about Fredk. Winslow Taylor's work in this country, and if we are to have our share of the world's work in the future we have to catch up, not only America, but France, too, in the matter of scientific management.

The Taylor system was introduced into France 10 years ago at one well-known automobile works, and others promptly followed suit, until—two years before the war—Taylor himself was invited by the French Government to advise them as to the organisation of one of their principal arsenals.

Compare with this the prevailing impression here that the Taylor system is a sort of "glorified card index" (I have heard it so described by a leading engineering manufacturer), and the fact that until recently—if not still the case—it has been introduced into only one English works.

In conclusion, my object is to suggest the formation of a "Taylor" club or society for study and propaganda purposes.

F. Maurice, Sec.-Lt., K.L.R.

Hendon, N.W. 4, *January 13th*, 1919.

Fault Localisation.

What is the best method of localising a break on one conductor of a twin underground telephone cable with *no earths—i.e.*, sound insulation?

January 13th, 1919.

Ajax.

Engineers' Salaries.

"Wanted by leading insurance company, Electrical Engineers. Must have experience of A.C. and D.C. machinery, and workshop training. Commencing salary £150 per annum plus £35 war bonus, with increases according to merit."

I should like to point out that stokers under me are in receipt of over £200 per annum, and are now applying for 8s. 6d. a week increase! I think that the money offered above for the qualifications asked for would disgrace a Hebrew moneylender, let alone a "leading insurance company," and, personally, I would rather work on a farm for 30s. a week.

A. J. Abraham,
General Manager.

Electricity Works, Aberdare, *January 10th*, 1919.

Moisture in Low-Grade Fuel.

In many generating stations and works where mechanical stokers are in operation (especially so in the case of those of chain-grate type) it is the practice to burn very low grades of fuel, in many cases the residue of coal-washing plants. These low grades are delivered to the consumer in a more or less saturated state, and are thereby the cause of a not inconsiderable amount of loss.

Let us take for illustration a case where fuel contains 5 per cent. of moisture, *i.e.*, in every pound of the mixture delivered there will actually be .95 lb. coal and .05 lb. water. Suppose the calorific value to be 12,000 B.TH.U. per lb. (dry coal); then as each pound of the mixture will only contain .95 lb. of coal, the calorific value will only be 11,400 B.TH.U., giving a heat loss of 600 units per lb. of the mixture, 1,344,000 units per ton.

Again, the moisture fed into the furnace will have to be evaporated, which will entail a further loss of heat units. We will assume that the temperature on entering the furnace is 50 deg. F., then each lb. of water will require 212+966−50=1,128 units for evaporation at atmospheric pressure. We have seen that the mixture contains 5 per cent. moisture, *i.e.*, each ton will contain 112 lb.; therefore 112×1,128=126,336 units expended in evaporating moisture present in a ton of the mixture, neglecting the further loss in superheating the steam generated.

Collected losses =

By loss of weight	1,344,000 units.
By evaporating	126,336 units.
Total loss per ton ...	1,470,336 units.

There is, therefore, roughly a loss of 5½ per cent. which might be partly recovered, to say nothing of extra cost of handling this type of fuel, danger of holding up in bunkers and choking of hopper feeds, and also corrosion to ironwork in heated localities.

The question is, does the low first cost of this type of fuel justify its use in preference to fuel of a higher grade, having a higher calorific value and smaller percentage of ash, thereby being also cheaper to handle? If so, would it not pay to install some method of saving the loss of evaporation by extracting the moisture before conveying the fuel to the furnace? The moisture would have to be extracted by evaporation or mechanically, and evaporation should be favoured, as waste heat could be used. It is very doubtful if the saving would justify the expenditure of heat necessary to operate a mechanical process, such as, for instance, the process used for drying grain, where centrifugal force is used. Perhaps a combination of the two methods would be successful, heat being brought into contact with the fuel while it was kept moving on a form of conveyor belt, the latter being designed to allow the passage of hot gases through the body of the fuel. Of course, care would have to be exercised to prevent the fuel being conveyed to the bunkers at a temperature liable to facilitate spontaneous combustion.

Leonard P. Morinan.

Cardiff, *January 13th*, 1919.

Electricity on Board Ship.

A paragraph at the top of page 30 in your issue of the 10th inst. reminds me that, over 30 years ago, I carried out successful experiments at Sheerness and Shoeburyness with gun-training gear which was tested and approved by the War Office, who ordered platforms for heavy guns at Dover and Spithead forts to be provided with fittings for motors and other apparatus, designed by me; but a fresh man was appointed to Woolwich, and, as he preferred compressed-air, the electrical scheme was shelved.

The Admiralty was informed of what had actually been done by electricity at Shoeburyness with its own 35-ton turret-guns; but the gunmakers favoured hydraulic machinery, and so there was "nothing doing" for me!

As I am not financially interested in any one method of ship propulsion, will you allow me to record my disagreement with your view that "the electrically-propelled battleship . . . . marks an engineering advance"?

Wm. H. Massey.

Twyford, Berks., *January 12th*, 1919.

My attention has been drawn to the interesting leading article appearing in your issue of the 10th inst. on the subject of the electrical propulsion of the U.S. battleship *New Mexico*.

As the inventor of the polyphase alternating-current system of ship propulsion used on the *New Mexico*, and for which "system" patents were granted to me in no less than 19 countries, long before the American engineers even dreamed about the new ship propulsion methods, I must respectfully protest against the statements of Secretary Daniels when he states, before the American Senate, that it is due to American intelligence and invention that the world owes this much more efficient means of warship propulsion and handling, together with all the many advantages which come in the train of evolution.

All the advantages which the *New Mexico* has undoubtedly shown as regards economy in fuel, handling, and military improvement were pointed out by me before the large meeting of Naval Engineers at Chatham in 1909, at which meeting my friend Mr. Purser Fletcher (now Assistant Director of Electrical Engineering at the Admiralty) took the chair.

The only difference was that I estimated that there would be a saving in fuel in the case of a battleship installation of my "Paragon" system of 26 per cent.; I was not far out, as it now appears that the actual saving in fuel, compared with the old-fashioned steam turbine-driven ships, has proved in the *New Mexico* to be no less than 25 per cent.

It was to my office in Bush Lane, in 1909, that my friend Mr. Hobart (now consulting engineer to the G.E.C. in America, who have supplied the machinery for the *New Mexico*) came with his assistant, to learn all about the "Paragon" system, as he said he was amazed at the claims which I was then making concerning my invention. He was, however, perfectly satisfied with the explanation which I was fortunately able to give him, thanks to my foreign travels in connection with steam turbine tests (then kept a great secret in this country).

Although the American engineers should get great credit for their excellent work, which I, for one, will grant both Mr. Emmett and Rear-Admiral Griffin, both of whom are well acquainted with my claims as inventor of this original ship propulsion system, and although many letters have been received by me from many foreign countries recognising me as such, I note with regret that no mention is made of my work in this connection, even although I have successfully contested patent applications for my system; the result of the last case was published in the Electrical Review on August 1st, 1913.

In my opinion, it is the lack of knowledge of modern polyphase alternating-current work in the British Navy which is the reason of the slackness in the adoption of these new ideas, coupled with the fact that builders of the ships are looking after their own interests, because they think that they will lose orders for the plant which would otherwise be made in their own shops.

William P. Durtnall.
Late Lieut., R.N.V.R.
H.M.S. *Vernon.*

London, S.W., *January 11th*, 1919.

THE NAVIGATIONAL MAGNETIC COMPASS CONSIDERED AS AN INSTRUMENT OF PRECISION.*

By M. B. Field, O.B.E., M.Inst.C.E., M.I.E.E.

The problems involved in the mariner's compass are of great variety; we have, for example, problems of an essentially practical nature in mechanics and mechanical construction, the wear and tear of materials, the effects of vibrations of an exceedingly complex character; considerations of fluid friction, viscosity, and fluid motions; terrestrial magnetism; the magnetism of iron and steel; the fields of force and systems of magnetic potential due to complicated arrangements of magnets or the equivalent; and so forth.

Ordinarily, we expect a magnetic needle to tell us the direction of the magnetic force in the region in which it is placed. If the field in question is the undisturbed field of the earth we may expect any well constructed and suitably supported needle to give us correctly the direction of the meridian. Its precision will depend upon the accuracy of workmanship, and freedom from pivot friction, and its error may be reduced to the same order as the error of unaided observation.

In the case of the navigational compass very much more is required. In the first place, the ship itself is magnetic, and the magnetic force at any selected station not only differs in direction from the meridian, but as the ship swings round the force undergoes cyclic changes, both in magnitude and direction. Further, the amount of the deviation of the magnetic force from the plane of the meridian not only depends upon the course the ship may be steering at the time, but also upon her absolute geographical position.

Again, the ship's shape and proportions, the locality in which she was built, the direction of her head while under construction, in short, her past history, and particularly her recently past history, are all factors that influence her magnetic state.

Thus, the duty we require the compass to perform is no easy one; surrounded as it is by disturbing influences, we require it to ignore every misleading suggestion and to point unhesitatingly to the magnetic north.

If we annul by magnets, or otherwise, the effect of all the magnetism of the ship, and this annulment remains effective on all courses, with the ship upright or listing, and at all parts of the earth, we obtain complete compensation; or, again, if we neutralise the east-westerly component of the ship's magnetism, and the neutralisation is effective under the above conditions, the compass is completely compensated.

In practice, we annul some of the components of the ship's magnetism, and neutralise the east-westerly force of others, in such a way that the compensation is very nearly complete on all courses, no matter whether the ship be upright or not, and the correction remains good at all parts of the earth—provided the so-called permanent magnetism of the ship remains permanent, and the so-called induced magnetism is strictly proportional to the inducing force, and vanishes when the inducing force is withdrawn.

Unfortunately, we find that the permanent magnetism is not *permanently* "permanent," and the induced magnetism is not *instantly* "transient," and our *complete* compensation is to this extent incomplete.

Much of the permanent magnetism said to be "hammered" into the ship in the course of building is "shaken" out of her during her first few voyages, while magnetism of a semi-permanent character is "picked up" by a ship sailing for days together on a given course, and is only gradually lost, it may be over a period of hours, or even days, when the course is materially altered.

Further examples of permanent magnetism being "shaken" out of a newly-built ship are furnished by the great change in the magnetic character of a new warship when undergoing gun-firing trials.

The precision of the navigational compass is, therefore, not only dependent upon the accuracy with which its "correctors" perform their function of compensating for the ship's normal magnetism, but it is also dependent upon what Lord Kelvin called "unpredictable irregularities due to variations of the permanent magnetism, and to retention of some of the transient magnetism when the inducing influence is past."

No instrument is altogether immune from unpredictable irregularities, and just as the painstaking observer is ever on the alert to detect an aberration, to measure its amount, and to trace its origin, so the careful navigator will be on the watch for changes of the magnetism of his ship, and will regularly avail himself of opportunities afforded of taking sun, moon, or star observations for the purpose of checking the readings of his compass.

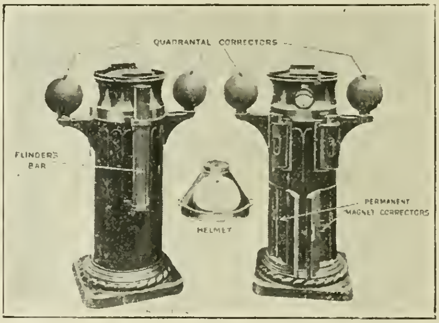

Fig. 1.—Compass Binnacle, showing Correcting Devices.

Lord Kelvin became intensely interested in the mariner's compass; he began an article in "Good Words" in 1874, and after dealing with the historical portion of the subject, the article stopped—to be continued only after five years. When he broke off his article he had arrived at the conclusion that the mariner's compass, as used in iron ships, ought to be an instrument of precision, but was not, and he set himself the task of devising a new compass which might fairly lay claim to be an instrument of precision. In concluding the article, he described the improvements in the construction of the mariner's compass and its accessory apparatus which he had devised during the intervening five years.

In 1839, Airy (later Sir George Airy), Astronomer Royal, wrote a paper on the deviations of the compass in iron ships, and propounded means for approximately correctly compensating a compass (with short enough needles, and small enough magnetic moment) for errors which arose, due to the ship's magnetism. Airy's method was quickly adopted in the iron ships of the merchant service. Certain difficulties, however, soon became manifest to expert compass adjusters, arising from the use of magnetic correctors, and it was found impossible in certain cases to obtain a correct compensation.

Errors of two kinds were introduced by the design of compass employed, one depending upon the length of the needle, the other upon its magnetic moment.

When selecting a suitable place for a compass station on board ship, due care is taken that the nearest iron is at a relatively great distance, so that if magnetised, it gives rise to a magnetic field at the compass station which may be regarded as uniform over a region considerably larger than that swept out by the compass needles when rotated on the card pivot. Moreover, the nearest iron must be sufficiently remote to ensure that there is no sensible attraction of the needles due to magnetism induced in the iron by the needles.

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* Abstract of lecture delivered before the Institution of Electrical Engineers, London, January 9th, 1919.

When these conditions are duly observed, the position of equilibrium of the uncompensated card does not sensibly depend upon whether the needles be long or short, or whether their magnetic moment be large or small, but merely upon the direction of the resultant magnetic field acting at the compass station.

The compensation of the compass by Airy's method is effected by placing magnets and masses of iron near the compass in positions calculated to produce magnetic forces in the region swept out by the card needles, which exactly counter-balance the deviating forces, due to the magnetism of the ship's ironwork. In order that the system may not become unwieldy and impracticable, it becomes necessary to place magnets and iron masses of considerable size very near the compass, in fact they are incorporated as part of the compass binnacle (see fig. 1).

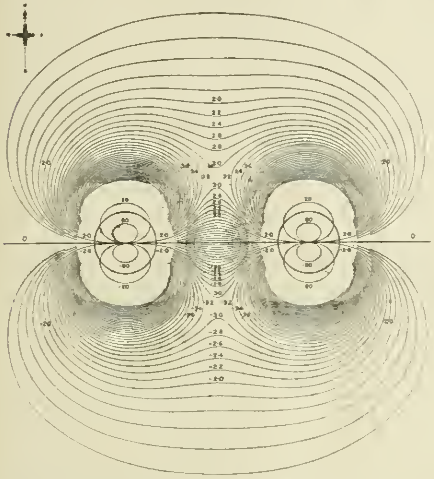

Fig. 2.—Equipotential Lines in Neighbourhood of Compass, Ship on N.-S. Course.

Now, the magnetic fields to which these give rise are by no means uniform over the region swept out by the needles of a long-needle card, with the result that a short needle will have a different position of equilibrium from that of a longer needle.

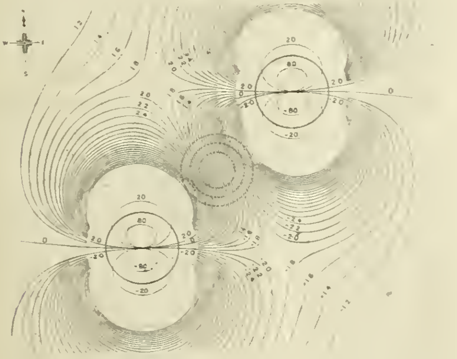

Fig. 3.—Equipotential Lines, Ship on Quadrantal Course.

For example, it is usual to employ two cast-iron spheres attached to the binnacle for the correction of one of the effects of ship's magnetism, viz., the quadrantal effect. These spheres may be 8 in. diameter, placed on either side of the compass at about 12 in. from the card centre, and level with the card. They become magnetised by the earth's field, and behave, so far as external points are concerned, as extremely short magnets of definite magnetic moment always pointing along the line of resultant magnetic force.

Now, we may draw the lines of magnetic force and lines of equal potential-values due to such a system. Equipotential lines are exhibited in fig. 2 for the case where the line joining the centres of the spheres is E.-W. (magnetic); it will be seen that this field is by no means uniform. A uniform field would be represented by a family of straight, parallel, and equidistant equipotential lines. We thus employ a non-uniform field, such as that shown in fig. 2, to correct the compass for the deviation produced by a perfectly uniform field arising from some effect of ship's magnetism.

Fig. 3 shows the equipotential lines due to the magnetisation of the globes when the ship is steering a quadrantal course.

Fig. 4 represents the effect when the ship is on an easterly or westerly course. In all cases, 2, 3, and 4, the interesting part of the field is where the dotted circles are drawn; this is the position of the compass card. The smallest dotted circle represents the area swept out by needles 4 in. long; the intermediate circle corresponds to 6-in. needles, the largest circle to 8-in. needles.

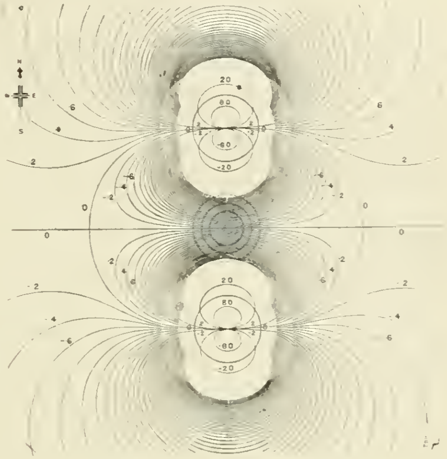

Fig. 4.—Equipotential Lines, Ship on E.-W. Course.

The un-uniformity in this region is sufficient to account for appreciable secondary errors when using needles of considerable length.

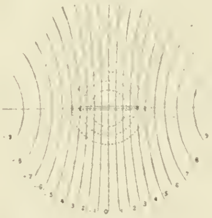

Fig. 5.—Equipotential Lines in Plane of Card 50 cm. above Magnet.

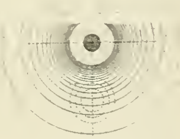

Fig. 6.—Equipotential Lines Due to Flinder's Bar.

Fig. 5 illustrates the family of equipotential lines in the plane of the card due to a corrector magnet placed 20 in. below the card. In this case the field of force is very nearly uniform over the region in which we are interested.

Again, another effect of ship's magnetism is compensated by what is termed the "Flinder's bar," a long, straight, vertical bar 3 in. in diameter, perhaps 16 in. long, and only 10 in. from the card centre, the upper end being usually nearly level with the card.

Such a bar becomes magnetised by the vertical component of the earth's field, and gives rise to lines of equal potential in the plane of the card, as represented in fig. 6, again a field of force very far from uniform.

Further, these iron correcting masses are sufficiently near for a needle of large magnetic moment to induce magnetic effects in the correctors, which, reacting upon the needle, will sensibly affect its position of equilibrium.

We have then to remember that correctors, while introducing magnetic forces which neutralise those due to the ship, introduce additional forces which may produce deviations, depending on, (*a*) the length and arrangement of the magnetic needles, (*b*) the magnetic moment of the needles.

(To be continued.)

BUSINESS NOTES.

Italian Companies.—There has been formed at Turin the Società Idroelettrica Valle del Liri, with a capital of 100,000 lire, for the development of certain water rights. The company is an offshoot of the Società delle Cartiere Meridionali.

The Società Anonima Ligure Piedmontese di Elettricità e Gaz has removed its offices from Turin to Genoa.

The Società Meridionale di Elettricità has decided to increase its capital from 50,000,000 to 80,000,000 lire, with eventual augmentation to 100,000,000 lire. The scope of this company's operations embraces the Provinces of Calabria, Basilicata, and Puglia, and will eventually extend to Lybia and the East.

In order to improve and enlarge its installations at Vizzola and Turbigo, the Società Lombarda per Distribuzione di Energia Elettrica, of Milan, has increased its capital from 26,000,000 to 32,500,000 lire, which sum is eventually to be increased to 52,000,000 lire.

Applications for British Trade Marks.—Appended is a summary of the recent applications for British trade marks in connection with the electrical industries:—

Brook (word combined with design). No. 386,004, Class 6. Electric motors. E. Brook, Ltd., Empress Works, St. Thomas Road, Huddersfield. November 9th, 1918.

Aurun. No. 385,347, Class 6. Electric accumulators and batteries. Johanne M. Cornelis, trading as the Bell Battery Co., Laburnham Grove, High Road, Ilford. September 27th, 1918.

Cosmos. No. 378,826, Class 6. Stationary dynamos, motors, controllers, electric-brake mechanism, and stationary magneto-electric machines and their parts. British Westinghouse Electric and Manufacturing Co., Ltd., Norfolk Street, London, W.C. July 4th, 1918 (to be associated).

Chromel. No. 385,155, Class 8. Electric resistance elements. The Hoskins Manufacturing Co., Lawton Avenue, Detroit, U.S.A. September 11th, 1918.

Edison Everything Electrical (and design). No. 385,519, Class 13. Electric lamps, fittings, sparking plugs, fusible cut-outs, switches, and electrical accessories. Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, London, E.C. October 9th, 1918 (to be associated).

Weldrics. No. 385,561, Class 13. Electrodes for welding purposes and electrical fittings. W. H. Boorne, Bush Lane House, London, E.C. October 11th, 1918.

E. and E. Magnetic Arc-welding System (and design). No. 385,425, Class 16. Electric arc-welding plant. The Equipment and Engineering Co., 2-3, Norfolk Street, Strand, London, W.C. October 3rd, 1918.

Autogen. No. 385,800, Class 48. Adhesive tapes for electrical insulating purposes. David Brown, jun., 45, Hope Street, Glasgow. October 25th, 1918 (to be associated).

Our Letters from the Forces.—Among our correspondence from men with the Forces this week, is a letter from a "Staff-Sergt., R.E.," in Scotland, in which the writer says:—"I wish to thank you for so kindly sending me a copy of the Review regularly each week. The Review is much appreciated in this office, and helps to keep one in touch with electrical matters whilst on Active Service. Until one's return to professional duties the Review is proving itself to be a valuable link between the 'military engineer' and the electrical engineer in civil life; but will service in H.M. Forces be recognised by those who have the settling of appointments in their hands?"

Early Door.—According to an article in the *Sheffield Daily Independent* on the Sheffield workers' demands for a shorter working week, the decided unpopularity of a 5.30 p.m. finish is due to the consideration that staying at work the extra half hour after five o'clock means to many men that they cannot get home, have their teas, and dress up in time to get to first-house amusements, or even to other gatherings and entertainments that start at a later hour. "There is reason to believe that a solid attempt will be made sooner or later, and probably in the not distant future, for a 44-hour week."

Of course, we all agree that "All work and no play makes Jack a dull boy." It has been found in cases profitable to close a works on Saturday, so that the employés could devote themselves unreservedly to football or cricket. Let us close early at night, so that they may go to the theatre or the kinema! What else matters?

Dissolutions and Liquidations.—Mirfield Garage and Electric Works, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Appleyard, Market Place, Dewsbury. Meeting of creditors, January 22nd; claims by February 7th.

Leitner Electrical Co., Ltd., Maybury, Woking.—First meetings of creditors and contributories, January 21st, at Carey Street, W.C.

Trade Announcements.—Mr. F. W. Atkins, who has been discharged from the Army, has commenced business as an electrical engineer at Harford Road, Lampeter, Cardiganshire.

Mr. J. Pain, electrical engineer and contractor, having been released from the Forces, has resumed business at 101, High Street, Hythe, Kent.

Mr. E. F. Brett, electrical engineer, having returned to Doncaster, has resumed business at the back of 144, St. Sepulchre Gate.

Mr. J. P. Coats, electrician, having been released, has resumed business at 17, East Street, Okehampton, Devon.

Export Restrictions Relaxed.—The *London Gazette* for January 10th contains a notice of further relaxation of export restrictions.

Pottery Electrical Men's Wages.—By an award of the Court of Arbitration, the wages of the Electrical Section of the National Society of Pottery Workers at Hanley have been increased to 60 per cent. over pre-war wages. The workers wanted the 12½ per cent. and 7½ per cent., which are now merged into the 60 per cent., to be granted in addition thereto, as they contended that these bonuses were granted to encourage good time-keeping.

The Exportation of Magnetos.—The Board of Trade announces that magnetos and component parts thereof have been removed from List B (export prohibited to countries outside the British Empire) to List C (export prohibited only to neighbouring enemy countries).

The Juvenile Munitioner Changes Over.—It is a condition for receipt of out-of-work pay that demobilised munition workers of from 15 to 18 years of age should attend at specified educational centres for a certain period per day. There are 10 of these centres open in London, and by the end of next week there may be 16 or 17. A good deal of very useful, and at times more or less interesting and not unexciting, work has been in progress at some of these centres for several weeks past. The rough-and-ready young munition worker finding his or her occupation, like Othello's, taken away, does not consider it the most congenial change in the world to attend "at school" and become "a child" again after earning several pounds a week and living in comparative affluence. Sense of independence has grown, restraint been thrown to the winds, and with a year or two of growing importance, these war-workers have developed into a new element in society which if not wisely guided might be, in these volcanic times, a little troublesome. You cannot put old heads on to young shoulders, and it is excusable if these young people feel flattered by the artificial value that has been placed upon their services during the war and by the action of the Government in assuring them of out-of-work pay. If they can only be brought to see that there is a bottom to the public purse as well as to their own, and to understand that the payment of these donations is an act of national generosity rather than of obligation, something may be done to gradually bring them to examine where their real interests lie, and to induce a fair proportion of them to spend their days of enforced idleness in improving their minds and in other ways fitting themselves for the permanent occupations of life. It is inevitable that the years of munition-making should leave a marked impression upon their habits and characters, but the undesirable parts of the impression may be modified or even turned to good account under capable leadership. It was remarked at an Educational Conference in London on Monday that the work is in many ways the continuation school problem. That may be, but those responsible for it have a duty which at this moment is more important even than that, and requires patience, experience, and tact.

The German Economic Situation.—In our article on another page to-day we quote a German authority as reproving the Government for favouring the excessive demands of the workers. The *Daily Mail* states that demands for extravagant increases in wages have reached such a stage that the Socialist Government of Prussia has issued an official and drastic rebuke to the working classes. It sets forth that wages, especially during the war, climbed to such a level that the moment is now rapidly approaching when expenditure will exceed income in such trades as the mines, railways, and allied industries. Workers are warned that if they continue to press for still higher wages German industry will collapse and universal ruin spread through the land.

The Shorter Hours Movement.—The *Times* of Tuesday contained a useful review of the "Shorter Hours" agitation that is now spreading throughout most industries of the country. It is written by our contemporary's Labour Correspondent, and concludes thus:—

"The question of hours, of course, is bound up with the thorny question of wages and trade union 'safeguards,' and both of these questions have a vital bearing on the possibility of securing that enlarged output which, according to accepted theory, is the key to industrial prosperity. Already, in the engineering and shipbuilding industries, the reduction of the working week from 54 hours to 47, without interference with the wages of men paid at a weekly time rate, has created dissatisfaction among the men in those branches of the trade where piece-rates are paid, and they are calling for an adjustment of their rates to counter-balance the decrease in hours. This problem, and the kindred question of the restoration of trade union conditions, are too large to be discussed here, but, in the case of the trades which have to face foreign competition, though not to the same degree in the other cases, they are inseparable from the question of hours, and should therefore be tackled concurrently. The spirit in which they are faced by all parties, and the speed and smoothness with which they are solved, will have an important, if not a governing, influence on the industrial outlook of the coming months."

Mr. George Steel, the works manager of Messrs. C. A. Vandervell & Co., Acton Vale, suggested to the staff that they should hold a secret ballot on the 47-hour week. The shop stewards, in conjunction with the management, supervised the voting, which resulted in the 7.30 to 5 p.m. scheme being selected by a very large majority. Not a single paper was spoiled.

Fuller Social Welfare.—The second concert and dance of the season arranged by the Works Social Welfare Committee of the Fuller Accumulator Co., Ltd., Chadwell Heath. E., was held at the Canteen, Woodland Works, on Tuesday, January 7th, Mr. E. G. Lind presiding. The programme was entirely provided by the employés. So far, the interest taken in these events by the workers has been very keen, so that both of the entertainments have been a great success. The somewhat difficult question of funds to cover the cost of any entertainment, &c., which might be arranged, was solved by the workers themselves, who suggested that a collection be made at any entertainment, and this method of covering out-of-pocket expenses has been perfectly successful. The Fuller Social Welfare Committee has been in operation for about two months, and is not only arranging for concerts, dances and entertainments, but any employé can put before the Committee suggestions for the improvement of the working and social conditions, with full confidence that questions thus brought forward will receive every consideration. When the Committee was first formed representatives from various departments of the works were elected to represent the workers on the Committee. The Committte has already been the means of arranging improvements in certain factory conditions, and is negotiating with the local authorities respecting improved services to the works, which will not only benefit the factory in particular, but the community in general. The directors of the company have very considerately met any proposals that have been advanced, and they have materially helped in negotiations with the local authorities.

D.K. Recreation Park at Preston.—Messrs. Dick, Kerr and Co., Ltd., of Preston, have purchased the Ashton Park Estate, Preston, which consists of about 90 acres, with a view to developing a portion as a recreation park for their employés. It is possible that a part may be utilised for providing housing accommodation on garden city lines.

Belfast Electrical Men Want 44-Hour Week.—The electrical workers of Messrs. Harland & Wolff, Messrs. Workman & Clark, and other big Belfast firms, have sent deputations to these firms in connection with proposals for a 44-hour week.

Patent Application.—Steel Utilities (Inc.) has applied for restoration of Patents 22,067 and 22,068 of 1913, granted to T. P. Payne for "Improvements in metal punching machines."

Patent Regulations.—The acceptance of complete specifications delayed under Paragraph 18 B of the Defence of the Realm Regulations will commence in March next, when cases dated 1915 and earlier will be accepted ; cases dated after 1915 will be dealt with in April and onwards.

The Patent Office undertakes to supply weekly, as published, all specifications allotted to any particular class or heading. For this purpose a selected list of headings must be supplied, and a deposit account opened.

Notifications and documents relating to foreign patents, designs, and trade marks, which are unable to be forwarded abroad, may now be deposited in the Patent Office (Room 27), with the object of recording the intention of the depositor to do any act or file any document on a certain date at any foreign patent office. No guarantee is given that such procedure will be of advantage to the parties concerned.

Photographic copies of documents, &c., in the Patent Office Library may be obtained at the following rates :—Half-sheet, (13 in. × 9 in.), negative, 1s. ; positive, 2s. Whole sheet (13 in. × 18 in.), negative, 2s.,; positive, 4s. Applications cannot be accepted which would infringe copyright unless the consent of the owner of the copyright is obtained.

Calendars and Diaries.—Now that the paper restrictions have been to some extent relaxed, we suppose electrical firms will be placing their orders for calendars, diaries and pads. Otherwise, their friends will feel that something is wanting throughout the year. An artistic calendar has been received from the Buffalo Forge Co., Ltd., Buckingham Gate, Westminster, S.W. The bewitching charms of "Doris" will temporarily pacify us for the lack of other calendars this year.

The Sun Electrical Co., Ltd., of 118, Charing Cross Road, London, W.C. 2, are unable to send out refills for their desk memo. calendar this year, owing to paper restrictions. Instead thereof, for this occasion they have sent out a very acceptable wall calendar, with small monthly slips beneath, "A World of Beauty," printed in colour. It does not bear their name, a fact which will be quite sufficient to impress upon the recipient's mind from whom it was received.

Messrs. Thermit, Ltd., of 675, Commercial Road, London, E. 14, have, as in previous years, sent us one of their pocket memoranda books, containing the usual matter relating to their system and calendars for 1919 and 1920.

Messrs. Pirelli, of 144, Queen Victoria Street, London, E.C., have produced an excellent wall calendar in their usual form, with a block of daily date slips placed beneath a coloured picture of the Allied Colours being speeded on to success on a Pirelli tire.

We have to thank Messrs. Johnson & Phillips, Ltd., Charlton, for a very useful desk blotting-pad and diary, with memo. slips, &c., providing for a variety of wants in a very convenient way.

Munition Plants for Sale.—The Ministry of Munitions is offering for sale a considerable quantity of plant of various descriptions which has been used in the manufacture of munitions but may be useful for ordinary trade purposes ; also the national projectile factories at Renfrew, known respectively as "Ypres" and "Aisne."

Turbo-Alternator Contract.—Messrs. Dick, Kerr and Co., Ltd., have recently secured a contract for the supply of a 3,000-kw., 3,000 r.p.m., turbo-alternator set, together with condensing plant, to Messrs. Cammell, Laird & Co., Ltd. The turbine will be of the Willans-Zoelly type, to operate on steam at 160 lb. pressure, superheated to 650° F., and the condensing plant of the surface type, with the Willans rotary system of air extraction, the circulating, ejector, and extraction pumps being driven by an auxiliary turbine which will exhaust into a feed heater. The turbo-alternator, by Messrs. Siemens, will supply three-phase current at 3,300 volts, 50 cycles, and will be fitted with an overhung exciter.

Trade Union Restrictions.—The *Times* Labour Correspondent states that the Bill for redeeming the Government's pledge that Trade Union rules and workshop customs shall be restored, has been drafted by the Ministry of Labour, and will come before the new Parliament at an early date. He says that the Bill, as drafted, requires that employers shall restore the *status quo* as and when required by the Trade Unions concerned, and the Government will presumably be armed with powers to coerce any evasive employer. He adds later that the Unions are disinclined to enter upon discussions or negotiations until the Government pledges are legislatively confirmed. Our readers, however, will remember that Mr. Barnes, in some of his speeches, has advanced proposals for a bargain in which the restrictions are to be sacrificed by the men in exchange for shorter hours and other improvements in conditions. But the men, who are stated to demand legislation before negotiation, have not waited for legislation before they have embarked upon a widespread and growing movement for shorter hours.

Bankruptcy Proceedings.—R. E. Connold, late electrician (now a member of the R.N.A.S.), Canterbury.—Last day for receipt of proofs for dividend January 25th. Trustee, Mr. J. O. Morris, O.R.'s Office, 68a, Castle Street, Canterbury.

Roger W. Wallace, barrister-at-law, for many years a director of London electricity supply and other companies, applied for his discharge from bankruptcy on Tuesday last. The Receiver had referred to bankrupt's rash and hazardous speculations. The discharge was suspended for three years.

Chas. Mayfield, electrical engineer, Clifton, Bristol.—Creditor's petition filed, December 18th. Receiving order made January 10th.

Book Notices.—"How to Deal with Different Kinds of Fires." By Sidney G. Gamble, F.S.I., A.M.Inst.C.E. January, 1919. Pp. 50. London : The Committee, 8, Waterloo Place, Pall Mall, S.W. 1. Price 3s. 6d.—Those generally in charge of works and property cannot be expected to have either the necessary experience or knowledge to enable them to handle advantageously, or deal efficiently with, an outbreak of fire, especially if the materials are not the ordinary combustibles. For this reason the British Fire Prevention Committee has issued this "Red Book," No. 201, in the preparation of which it has had the co-operation of Mr. Sidney G. Gamble, late second officer of the London Fire Brigade, who has had a life-long experience of handling fires of every description. The first part of the book gives general information on the subject and the effect of water, steam, chemicals, &c., applied from different forms of fire appliances. Fires of frequent occurrence are dealt with in this part. The second part of the book takes numerous materials and kinds of fire in turn alphabetically from a, alchohol, to z, zoological collections, including many chemicals, explosives, &c. Useful scientific data have been added, with an appendix on spontaneous combustion, and a list of enactments bearing on the fire question. A limited number of copies can be obtained from the offices of the Committee.

Must we Trade in Tenths? By A. Watkins. Hereford : Watkins Meter Co. Price 3d.—In this brochure the author advocates "octaval," in preference to decimal, coinage. He finds fault with our present coinage, and insists on the merits of binary division, for which he thinks the Anglo-Saxon race has an instinctive affection. The proposed octaval coinage consists of the sovereign, divided into eight half-crowns, which in turn are sub-divided into eight groats (of 3¾d. present value), and these again into eight "cents" ($\frac{15}{32}$d.). Needless to say, a special arithmetic is required to deal with this coinage, as the digits 8 and 9 are not used except for full sovereigns. To pursue the matter further would be to waste space.

"Annual Report of the Director of the Bureau of Standards." Year ended June 30th, 1918. Washington : Government Printing Office.

"Science Abstracts." Sections A and B. Vol. XXI, Part 12. December 31st, 1918. London : E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

No. 3 of the *Crown Journal* has been issued by Messrs. Higgs and Hill, of Crown Works, South Lambeth Road, S.W. ; it contains a full account of the extensive public building works activities of the firm—huts, hospitals, aerodromes, gun and searchlight stations and of the employés' war funds, canteen arrangements, Roll of Honour, &c.

Social.—The employés of the Siluminite Insulator Co., Ltd., spent a pleasant evening at a New Year party. A number of ex-employés of the Southall factory were present, and hearty appreciation was shown of the arrangements made by Mr. Dowton, works manager, and Mrs. Jordan, manageress.

Football.—The match between the Magnet F.C. and Claremont F.C., played at Tulse Hill last Saturday, ended in a victory for the latter by 6 goals to 2. The ground was in a very bad condition.

The Change-Over in Germany.—The Heddernheim Copper & South German Cable Works Co. states that the change over from war to peace work in itself has not been very difficult, as the matter has chiefly concerned the production of semi-finished manufactures for peace purposes instead of for war work, necessitating the output of fine instead of coarse work. The adoption of the 8-hours day would greatly increase the cost of production in the long run. The directors of the Voigt & Haeffner A.G., of Frankfort-on-Main state that although very considerable army orders have been cancelled the transition to peace work has been compelled easily, as an urgent demand prevails for the company's manufactures in connection with central station requirements. This fact applies not only to the home market, but a demand also exists from Holland, Switzerland, and Scandinavia, although this business is said to be endangered through the interference of the Allies with the German export trade.

Enemy Restoration of French Machinery.—The *Daily Telegraph* correspondent at Paris quotes a German wireless as saying that all was ready on Monday in Germany for the delivery of plant, machinery, and implements for the destroyed factories and works in the North and East of France. These include 6,440 electric machines of 117,000 H.P., and 300 other machines, and at the depôt of Bremen 4,500 machines and implements, valued at 20,000,000 marks, of Swiss origin, which can be placed at the disposal of the Entente as compensation. Besides this, there are 400 tons of leather belting, 100 tons of similar textile fabrics, and 60,000 other articles in leather for special industries. All these can be placed immediately in the hands of the Entente Powers. If the situation remains unchanged in Upper Silesia 40,000 tons of zinc can be given over without delay.

Our contemporary quotes General von Winterfeld as saying:—"The German Government declares itself prepared to restore that machinery which was removed from the occupied territory which can be returned forthwith, and also that machinery which was sold to German war industry, the repurchase of which is possible in accordance with agreement with its rightful present owners. The preliminary work for the giving back of that machinery has already been commenced. . . . In all circumstances, refusal must be made to the demand that machines which were carried off shall be replaced by the giving up of machines which are absolutely essential to German industry, for thereby the economic war deprecated by President Wilson would be carried on in another form, and within measurable time Germany would be excluded from the world's markets.

Eight-Hour Day in Iron and Steel Works.—A meeting of employers and workmen from the Midlands, Shropshire, Lancashire, Yorkshire, and Derbyshire was held in Birmingham on Monday to consider the eight hours question. About 85 iron and steel works were represented, and after a long discussion the principle of an eight-hour day was agreed upon, and a committee was appointed to work out details. Work under the new system will begin on the first Monday in February. There will be a re-arrangement of wages.—*Daily Chronicle.*

Non-Ferrous Metal Industry Act.—The issues of the *London Gazette* for January 10th and 14th contain further additions to the list of licences granted under the Act.

Australian Trade Commissioner in London.—Lieut.-Colonel Hurley has been appointed a Trade Commissioner to represent the interests of the State of New South Wales in London.

LIGHTING AND POWER NOTES:

Arbroath.—Street Lighting.—The Lighting Committee has postponed until next season a proposal to light the streets with electricity.

Ardsley.—Street Lighting.—The U.D.C. has invited the Electrical Distribution of Yorkshire to quote terms for lighting the public lamps adjacent to the mains.

Ashton-under-Lyne.—Wages.—An increase of 5s. per week is to be paid to the employés of the Corporation electricity department, in accordance with the recommendation of the Association of Lancashire and Cheshire Electricity Undertakings.

Athy (Co. Kildare).—Proposed E.L.—The U.D.C. has decided to apply for a loan for an electric lighting scheme.

Australia.—Sydney.—The E.L. Committee has recommended the City Council to authorise Messrs. Preece, Cardew, Snell & Rider to obtain tenders for boilers, coal and ash handling plant, &c., required at the electricity works; the estimated cost is £85,000.

E.L. Schemes.—The residents at Yeronga (Q.) have requested the Stephens Shire Council to distribute electricity within their area. The N. Fremantle (W.A.) Council is obtaining a loan of £4,500 for the distribution of electricity, which is to be obtained in bulk. The Merredin (W.A.) Road Board is inviting applications for the right to install an E.L. scheme in the town of Merredin.—*Tenders.*

Banbridge.—Proposed E.L.—The U.D.C. is to consider the question of applying for an E.L. prov. order at its next meeting.

Ballymoney.—Proposed E.L.—A company, with a capital of £8,000, has been formed for the purpose of establishing an E.L. scheme in the town, and a site for the power station is under consideration.

Belfast.—Mains Extensions.—Subject to satisfactory agreements as to the price to be charged for energy, and to the advice of Sir John Snell, the Electricity Committee has decided to extend the mains to the Montpottinger district.

Bovey Tracey (Devon).—Street Lighting.—The U.D.C. has accepted the offer of the E.L. Co. for public lighting, at £2 10s. per lamp per annum.

Bradford.—Proposed New Plant.—The Electricity Committee has recommended that application be made to the L.G.B. for sanction to borrow £295,125 for additional plant at the works at Valley Road and Bolton Road, as follows:—Turbo-generator, complete with condensing plant and auxiliaries; three boilers, fans, chimneys, pipes and boiler-house extension; four forced-draught cooling towers; extensions to suction ash plant; three rotary converters at Bolton Road works; cable-ducts from Bolton Road works to Valley Road works; portable coal elevator.

Dartford.—Battery Maintenance.—The U.D.C. has decided not to agree to the increased payment applied for by the Premier Accumulator Co. for the maintenance of the battery at the electricity works.

Douglas (Isle of Man).—Proposed E.L.—A proposal before the T.C. to consider the question of purchasing the E.L. plant at the Knockaloe P. of W. Camp for municipal purposes was defeated.

Dublin.—The E.S. Committee has accepted the guarantee of Dublin Shipbuilding, Ltd., North Wall, to take a supply of electricity for a period of 10 years, in accordance with arrangements with the Admiralty. A site for a sub-station at North Wall has been obtained.

Loan Sanction.—The Committee has obtained L.G.B. sanction to a loan of £32,000 for extensions and the provision of new plant.

Electric Light in the Arctic.—The *Journal of Electricity* states that Mr. MacMillan and his party of explorers took a marine generating set with them into Crocker Land on their last expedition. It was installed at their lodge, and proved to be a splendid fortification against the six-months-long nights. A headlight over the front door threw its beams 10 miles over the ice, and the electric globes inside were an improvement over the murky gloom of their old stand-by, the blubber lamp.

Glasgow.—Proposed Extensions.—The estimated costs for the erection of new plant and additions to existing plant for the T.C. electricity department are as follows:—Waterloo Street, £15,000; Possilpark, £5,000; Polmadie, £5,000; Linthouse, £4,000; Dennistoun, £3,000; and Springburn, £3,000.

Hospital Lighting.—The gas and electricity engineers are to report to the T.C. on a proposal to supply electric light at Belvedere Hospital, in place of gas.

New Sub-Station, &c.—The Electricity Committee has recommended the transference of ground from the tramway department at the Whitevale depôt for the extension of the electricity sub-station, and at the Kinning Park depôt for the erection of a new sub-station; also that the Partick destructor works be transferred from the Cleansing to the Electricity Department.

Gravesend.—Proposed Extensions.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £25,000, for the provision of a 2,000-KW. generating set at the electricity works.

Haslingden.—Year's Working.—There was a gross profit of £1,313 on the working of the Corporation Electricity Department for the year ending March 31st last. The net profit was £100, against £298 in the previous year, and this has been carried to the renewals fund, which now amounts to £991.

Heywood.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £11,000 for the completion of the bulk supply scheme and the provision of new E.H.T. mains.

Houghton-le-Spring.—Street Lighting.—Owing to the increased charges for gas, the U.D.C. has asked the E.L. Co. to tender for street lighting.

India.—Water Power.—The Maharajah of Gwalior has sanctioned an investigation into the Sindh hydro-electric scheme, and a special survey division is being organised, which it is hoped will be in a position to submit the necessary data to the Durbar for approval within six months.—*Indian Engineering.*

Limerick.—Price Increase.—The Corporation has increased the price of electricity from 8d. to 9d. per unit. The pre-war price was 5d.

Londonderry.—New Sub-Station.—The electrical engineer has reported that, owing to the overloading of the main cables, it will be necessaay to provide a sub-station in the Carlisle Square district.

Liverpool.—In an article on reconstruction problems in Liverpool, Sir Andrew Petrie recommends the construction of a new electric power station at Garston and the extension of the tramway system.

Manchester.—E.L. Failure.—An underground explosion in Albert Street, last Saturday, damaged an electric cable and severed about 600 telephone wires. The electric supply was temporarily cut off in the district.

Wages —At a meeting of the T.C., last week, Councillor Dagnall, in asking for permission to make a rearrangement in the payment of bonuses to officials of the Electricity Department, remarked that there was a great deal of unrest among the electrical workers of the Corporation, and some officials were leaving for better and more remunerative work elsewhere. The Council agreed to send the question back for further consideration.

Oldham.—Bulk Supply.—The Electricity Committee has decided to quote for a supply of electricity in bulk to Rochdale Corporation.

Proposed Extensions.—At a meeting of the T.C., last week, it was stated that, at its next meeting, the Council would be asked to sanction the borrowing of about £250,000 for the extension of the electricity undertaking.

Peterborough.—Year's Working.—During the year ended March 31st, 1918, 999,541 units were sold by the Corporation electricity department, against 915,142 in the previous year. One-fourth of the output was used for lighting purposes and three-fourths for power. The load factor was 19·05 per cent., compared with 18·99 in the preceding year and about 15 per cent. before the war. The total cost was 2·666d. per unit, including working costs, 1·523d., and capital charges, 1·143d. The financial result was a net loss of £551.

St. Helens.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £2,000 for the extension of the electricity mains to the new works of Messrs. Vickers, Ltd.

Stretford.—Loan Sanction.—The T.C. has received L.G.B. sanction to a loan of £26,100 for electricity purposes; £1.125 is for the purchase of a site for a sub-station; £3,500 for the erection of a sub-station; £12,725 for rotary converters and switchgear; and £8,750 for mains.

Swansea.—Price Increase.—The Electricity Committee has increased the charges for electricity by a further 12½ per cent., a total of 25 per cent. over pre-war charges.

Walsall.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £11,000 for electricity purposes, including transformers and switchgear, £2,322; mains extensions, £5,537; services, £363; and a rotary converter, £2,778.

Watford.—Proposed Loan.—The U.D.C. has decided to apply for a loan of £15,000 for the installation of a 1,250-kw. set.

Whitstable.—Proposed Municipal Control.—The U.D.C. has decided to ascertain whether the Electricity Co. is prepared to dispose of its undertaking to the Council.

Wolverhampton. — Mains Extensions. — Subject to L.G.B. consent to the necessary loan, the electricity mains are to be extended, at a cost of £4,755.

Worthing.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £16,392 for the extension of the mains and the provision of a Diesel engine and a transformer, and a loan of £7,293 for the extension of the electricity supply to Broadwater.

TRAMWAY AND RAILWAY NOTES.

Argentina.—Strike.—Owing to the general strike, all railway and tramway services have been suspended; several tramcars have been burnt by the strikers.

Belfast.—A Six-day Week.—The Corporation has granted the tramway employés a six-day week, in place of the seven days worked at present.

Blackburn.—Strike.—The strike of tramway employés threatens to spread over the whole of Lancashire. It originated over some employés, who were not members of the Tramway and Vehicle Workers' Union, working on Christmas Day. These men, who belong to a different Union, are still working, and a 50 per cent. service is being maintained. The Colne branch of the Union has voted in favour of a strike. A one-day strike took place at Accrington, consequent on the through-running of the Blackburn cars; the men returned to work on the understanding that no Blackburn cars should run into Accrington until the dispute was settled. The 33 Lancashire and Cheshire branches of the Union have been asked to take a ballot on the question of a general strike, and are said to be generally in favour of a strike. The time-limit fixed by the T.C., in which employés would be reinstated if they returned to work, expired at noon on Monday, but only three men had then returned. The strikers expressed their determination to hold out until it was made a condition of employment with the tramway department that the men should join the Union.

Blackpool.—Tramway Purchase.—The Bill promoted by the Corporation for the purchase of the undertaking of the Blackpool and Fleetwood Tramroad Co. contains proposals for linking-up the system with that of the Corporation, at an estimated cost of £15,000. The total price is £284,000, including £4,000 compensation to the directors as five years' fees, and £10,000 to Mr. John Cameron, the secretary and manager of the company. The sale took effect from January 1st last, but the company is carrying on until Parliamentary sanction to the transfer is received.

Bradford.—New Tramcars.—The Tramways Committee has given authority for a trial car to be built, 6 in. less in height than the present cars.

Track Renewals.—The Tramways Committee proposes to inform the L.G.B. that the relaying and doubling of the tramway track from Tyrrel Street to Listerhills Road is urgently necessary.

Brazil.—Proposed Electric Railway.—The Chamber of Deputies is considering a petition for a concession to construct an electric railway from Cascalheira to Oyapock.—*Financier.*

Chile.—Strike.—Men employed by the Chilean Electric Tramway Co. at Santiago are still on strike. General labour unrest is evident throughout Chile.—*The Times.*

Continental.—Italy.—The Societa Elettrica Bresciana proposes to increase its capital from 25,000,000 lire to 34,000,000 lire for the purpose of extending its electric railway network in the Province of Brescia.

France.—Owing to the River Seine overflowing and flooding the streets, the tramway service in several districts of Paris had to be suspended last week.

Cumberland.—Proposed New Railway.—It is proposed to construct a railway along the Cumberland coast, from Silloth to Maryport.

Glasgow.—Goods Traffic.—The Tramways Committee has inaugurated a parcel service on the Glasgow-Uddingston route.

Gloucester.—Wages.—The T.C. has increased the war bonus of technical assistants employed by the tramway department to 28s. 6d. per week, and of all other employés from 18s. to 24s.

Grimsby.—Strike.—The strike at the municipal electricity works came to an end on Monday, last week, and the naval contingent, which had maintained the supply, was withdrawn. The new agreement is for a 47-hour week, with one break daily for meals.

Haslingden.—Year's Working.—For the year ended March 31st last, the gross profit of the Corporation tramway department was £2,386, against £933 in the previous year.

Leeds.—Goods Traffic.—The facilities on the Corporation tramway parcel delivery system have been extended, and a through service has been established between Leeds, Bradford, Halifax, and the heavy woollen district.

Accident.—Tramway traffic was greatly disorganised by fog on Monday. An unknown man was knocked down and killed by a tramcar.

Lincoln.—Surface-Contact System.—Owing to the burning out of an underground cable, part of the Corporation surface-contact tramway system became electrified on January 6th. Several persons had narrow escapes, and a horse was killed before the pressure could be cut off.

London.—Central London Railway.—The B. of T. has extended the time for the completion of the enlargement of the tunnels and for the exercise of certain financial powers authorised by the C.L.R. Act, 1914, by one year from July 8th, 1919.

Threatened Strike.—Owing to the refusal of the Railway Executive Committee to extend to them the 47-hour week granted to the railway, the workers at the Chelsea power station threatened to strike at 5 p.m. on January 9th, but on the chairman of the Committee (Sir Herbert Walker) agreeing to meet the representatives of the E.T.U. on the 13th inst., the strike notice was withdrawn. The strike would have affected all the London tube railways, with the exception of the Central London.

At a conference on Monday between the E.T.U. and the Railway Executive Committee, it was agreed to establish a 47-hour working week for day workers on all railways as from January 1st, and a 48-hour working week in all generating and sub-stations in the United Kingdom, to come into operation on February 1st. Wages are to be adjusted on existing rates.

Manchester.—New Tramcars.—The Tramways Committee has commenced the construction of 100 new tramcars.

Musselburgh.—Proposed Extension.—A scheme is on foot for the extension of the tramway system to Tranent.

Newcastle-on-Tyne.—Accident.—Traffic was much impeded by dense fog on Monday; a merchant's trolley was run into by a tramcar and cut completely in halves. The driver and horse of the trolley were injured, but not seriously.

South Shields.—Proposed Extensions. — The Tramway Committee proposes to proceed with an extension scheme sanctioned in 1915, and the sanction of the Treasury to the necessary loan is being sought.

Stockton.—Proposed Extensions.—The R.D.C. has decided to oppose the Bills of the Stockton and Middlesbrough Corporations to construct tramways in the parish of Billingham.

Southport.—Year's Working.—The report of the Corporation tramway department for the year ended March last, shows receipts ot £32,582. including £4,513 from three months' running of the Southport Tramway Co.'s undertaking, which has now been acquired by the Corporation On its own system the receipts showed an increase of £3,310, and constituted a record. The gross pront of £10,263 was the highest ever reached ; but after paying the whole of the capital charges, there was a net loss of £103. The total car-mileage was 573,998. Passengers carried on the Corporation system increased from 5,020,088 to 5,808,960, and 520,492 units were used, or ·927 per car-mile.

TELEGRAPH AND TELEPHONE NOTES.

A Police Wireless Installation.—The *T. and T. Age* gives an outline of the work done by the wireless telegraph branch of the New York Police Department. It shows that merchandise estimated to be worth $100,000 and at least 25 lives have been saved, in the two years the department has been in operation. The wireless tower is on the roof of the police headquarters, and the sea-going end on board the police boat *Patrol*, which covers the harbour. Two thousand messages have been handled, the headquarters being able to receive messages from a distance of 1,500 miles, and to transmit them 300 miles.

Automatic Telephones.—An automatic exchange is to be opened shortly at Stockport. This will be the twelfth in the Provinces since the first, at Epsom, the nearest to London, was opened in May, 1912.

New London Exchanges.—According to the daily Press, several new telephone exchanges are to be opened shortly in London, several of which will be automatic exchanges.

Snowstorms.—During the snowstorm at the beginning of last week the telephone exchange at Hipperholme caught fire owing to broken wires coming into contact with overhead tramway wires.

A detachment of R.E.'s helped to repair the broken telephone and telegraph wires at Manchester.

Owing to the heavy fall of snow and consequent breakdown of the block telegraph wires in Lancashire, Yorkshire, and Derbyshire, there was considerable delay to passenger trains.

United States.—The Federal Court dismissed the suit by the Commercial Cable and Commercial Pacific Cable Companies to restrain the United States Postmaster-General (Mr. Burleson) from taking over the cables, on the ground that it had no jurisdiction in the matter.—*Financier.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Department. Five-ton tipping wagon for coals. Electric vehicle preferred, but not essential. See "Official Notices" January 10th.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney. A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Melbourne.—March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

Aylesbury.—B.C. 200 to 400-kw. internal-combustion engine and dynamo complete. See "Official Notices" to-day.

Belfast.—February 24th. Electricity Department. One 50-ton overhead travelling crane, one 5-ton overhead hand crane, and two 3-ton travelling electric cranes; two 24-in., one 5-in. and one 3-in. electrically-driven centrifugal pumps; five cast-iron water storage tanks.

Halifax.—The Electricity Committee has instructed the Electrical Engineer to obtain quotations for the supply of a coal conveyor.

Hammersmith.—B.C. The Electricity Committee reports that Messrs. Cory Bros. & Co., Ltd., the coal contractors, notify that owing to the increase in the cost of lighterage, their prices will be advanced all round 3d. per ton from December 1st, bringing the total cost of coal as follows: Hucknall 27s. 10¼d. per ton: G.T.H. peas 30s. 2½d. : G H H slack 25s. 2¼d. ; Aberclwyd 30s. 3¼d. : G.H.H. peas 31s. 2¼d.

The Committee reports that on the question of the diversion of coal supplies the Coal Controller states that the necessity for the diversion arose out of the national emergency, which left the Department no alternative but to suspend deliveries to those undertakings more favourably placed, to assist in maintaining in the public interest the continuation of the requisite light and power in the districts affected, and it was anticipated that any inconvenience or additional expense thereby caused to those undertakings and Corporations who were in a position to render this assistance, would be accepted as inseparable from the gravity of the national situation.

Leeds.—The Tramways Committee has been authorised to accept a tender for a negative booster for the Crown Point generating station, at a cost not exceeding £2,600.

Sheffield.—Corporation Water Department. Two 3-ton steam locomotive cranes and one 5-ton electric locomotive crane, D.C., 460/500 volts. See "Official Notices" January 10th.

Spain.—The municipal authorities of Bunol (Province of Valencia) have lately invited tenders for the concession for the electric lighting of the town during a period of five years.

Uxbridge.—January 21st. U.D.C. 25-h.p. A.C. motor for the sewerage works. Mr. W. T. Harvey, Clerk, 63, High Street, Uxbridge.

Warrington.—January 28th. Electricity and Tramways Committee. One 300-kw. and one 500-kw. rotary converter. See "Official Notices" January 10th.

CLOSED.

Battersea.—B.C. The Electricity Committee recommends that the price of coal supplied by the contractors, Messrs. Rose, Smith & Co. and Messrs. Foster & Co., be further increased by 3d. per ton, in consequence of the increased wages granted to dock workers, &c., by the Committee of Production.

E.H.T. switchgear, £420. General Electric Co., Ltd. (accepted).

Bradford.—Electricity Committee. Accepted :—

Steelwork for air filter house.—Redpath, Brown & Co., Ltd.
Switchgear.—A. Reyrolle & Co., Ltd; Bertram Thomas.
Battery booster set.—Mather & Platt, Ltd.
Building transformer chamber.—T. Obank & Sons.

Tramways Committee. Accepted :—

Three Venturi water meters.—G. Kent, Ltd.
Cast and steel crossings.—Hadfields, Ltd.
Copper rail bonds.—Britannia Lamp & Accessories Co., Ltd.
Rail planer blades.—Taylor & Parsons.

Gillingham (Kent).—T.C. Charging plant for electric dust carts :—

General Electric Co., Ltd.—A.C. and D.C. control gear or separate panels (accepted), £409.
British Thomson-Houston Co., Ltd.—Ditto or one panel, £383.

Heywood.—The Corporation has accepted the tender of the Rail Welding Co., London, for the repair of 230 rail joints on the tramway system. The work will cost about £1,000.

Southport.—The Tramways Committee has recommended the acceptance of 18 standard 4-wheel trucks, at £180 each, 21 30-h.p. car motors. at £165 each, and three open toast-rack car bodies, at £480 each.

Swansea.—The Corporation Electricity Committee has accepted the tender of the Stirling Boiler Co., for two water-tube boilers, price £22,440. The pre-war cost it was stated would have been about £10,000. The tender provides for the removal of the present four old Lancashire boilers.

Wolverhampton.—T.C. :—

Two 300-k.v.a. transformers, £839, plus £81 for contingencies.—British Electric Transformer Co.
Stanchions for carrying boiler flues, £69.—Gibbons Bros.
Gangways, ladders and railways, for the new boiler house, £114.—Hebertson & Co.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, January 17th. At 5.30 p.m. At Albemarle Street, W. Lecture on "Liquid Air and the War," by Prof. Sir Jas. Dewar, F.R.S.

Junior Institution of Engineers.—Friday, January 17th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Recent Improvements in Electric Lamps," by Capt. R. S. Mullard, R.A.F.

(North-Eastern Section).—Tuesday, January 21st. At the Mining Institute, Newcastle. At 7.15 p.m. Paper on "Design of Heavy Switchgear," by Mr. F. A. Orchard.

Illuminating Engineering Society.—Tuesday, January 21st. At the Royal Society of Arts, John Street, Adelphi. At 8 p.m. Discussion on "Modern Practice in Office Lighting," to be opened by Mr. A. Wise.

Industrial Reconstruction Council.—Wednesday, January 22nd. At the Saddlers' Hall, Cheapside, E.C. At 4.30 p.m. Lecture on "Industrial Reconstruction in Government Departments," by his Honour Judge Edward Parry.

Institution of Electrical Engineers.—Thursday, January 23rd. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Lecture on "Planning a Works Research Organisation," by Mr. A. P. M. Fleming, O.B.E.

(Students' Section).—Friday, January 24th. At 7 p.m. At the Northampton Polytechnic Institute, Clerkenwell, E.C. Paper on "A General Outline of Telephony," by Mr. H. T. Body.

Institution of Mechanical Engineers.—Friday, January 24th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Electric Welding," by Mr. J. T. Heaton, and other papers on oxy-acetylene welding.

Greenock Association of Electrical Engineers.—Saturday, January 25th. Visit to Messrs. A. F. Craig & Co.'s Engineering Works, Paisley.

Manchester Association of Engineers.—Saturday, January 25th. At 6.30 p.m. At the Grand Hotel. Discussion on "The Past, Present and Future of Electricity Supply," to be introduced by Mr. S. L. Pearce.

THE ELECTRICAL TRADES BENEVOLENT ASSOCIATION.

The following is a first list of contributions for amounts of 10s. and over received in response to the appeal made on behalf of this Institution by Mr. Hunter, the Chairman :—

	£	s.	d.
East London Rubber Co.	1	1	0
Arthur H. Allen		10	0
C. Franklin Tubbs ...	1	1	0
V. Delebecque	1	1	0
Fred. Crane Chemical Co., Ltd.	1	1	0
Christy Bros. & Co., Ltd.	1	1	0
W. Lawson		10	0
W. N. Warrilow	1	1	0
E. S. Byng	10	10	0
T. W. Smith		10	0
A. W. Kimber	10	0	0
Handcock, Dykes and Trotter	1	1	0
W. H. Willcox & Co., Ltd.	3	3	0
W. Sisson & Co., Ltd. ..	1	1	0
A. E. Gott	1	1	0
F. W. Parks	1	1	0
Reynolds & Bradwell ...	2	2	0
Guy Burney	2	2	0
S. D. White	5	5	0
Theodore Settle	2	0	0
Lawton & Sons	1	1	0
V. G. Middleton	1	1	0
W. H. Patchell	1	0	0
P. Atkins	1	1	0
H. Snowdon	1	1	0
G. T. Baxter		10	6
J. S. Child	2	2	0
L. Vandervelde	2	2	0
Chiswell & Co.	1	1	0
O. H. Bishop	1	1	0
H. G. Trust	1	0	0
C. J. Phillips	1	0	0
Carless, Capel & Leonard	1	1	0
Metropolitan Rly. (General Manager's Office, Baker St. Station) ...	2	2	0
T. P. Shilston, B.Sc. ...	1	0	0
John Ashby	1	1	0
R. Paul	10	0	0
H. P. Girling, M.I.E.E.	1	1	0
Carter & Harrison ...	1	1	0
B. H. Jenkinson	2	2	0
Selson Eng. Co., Ltd. ...	2	2	0
Farrow & Jackson, Ltd.		10	0
C. E. Foster		10	6
Economic Elec. Co. (T. E. Jones)	1	1	0
Benjamin Elec. Co., Ltd.	10	10	0
R. P. Wilson	5	0	0
W. H. Fletcher	2	2	0
The London Elec. Firm	2	2	0
T. J. Digby	2	2	0
C. Langdon & Son ...		10	6
E. Dixon	1	1	0
G. Braulik	1	1	0
D. Shanks & Co., Ltd. ...	2	0	0
Cressall Mnfg. Co.	5	5	0
Kaleb Hendin	1	0	0
R. J. Natlin	1	0	0
Simplex Conduits, Ltd.	2	2	0
American Hard Rubber Co.	2	2	0
A. R. Tudman	1	1	0
J. W. Jachman & Co., Ltd.	2	2	0
H. White & Co.	1	1	0
Barlow & Alden, Ltd. ...	1	0	0
J. H. Fonell	1	0	0
Lacy, Hulbert & Co. ...	2	2	0
A. J. Wright, Ltd. ...	2	2	0
E. Mathews & Co.	2	2	0
Basebe, Sadler & Co., Ltd.	1	1	0
W. E. Bradshaw		10	0
F. Chase	1	1	0
Baugham & Co., Ltd. ...		10	6
T. Francis & Son		10	0
H. Marryat	10	0	0
Cramner & Cheshire ...	1	1	0
J. W. Yalesley	1	1	0
T. Ludgate	1	1	0

	£	s.	d.
Osram-Robertson Lamp Works	21	0	0
W. Canning & Co.	1	1	0
J. Macintyre & Co., Ltd.	3	3	0
L.P.S. Electrical Co. ...	1	1	0
A. Hawkins & Sons ...	1	0	0
A. West & Partners ..	1	1	0
Dubilier Condenser Co., Ltd.	10	0	0
Rouch & Penny	1	1	0
Gilbert Carpenter	1	1	0
F. Smith & Co. (Manchester)	2	2	0
Cunningham, Ltd.	1	1	0
E. B. Ellice Clark ...	10	10	0
R. Wilson Smith	1	1	0
E. G. Byng	10	10	0
L. G. Byng (Exors. of late)	100	0	0
F. A. Hill & Co.	2	2	0
Jackson & Boyce	1	1	0
W. O. Rooper	1	1	0
A. Graham & Co.	10	10	0
Mrs. H. Ayrton	2	0	0
W. J. P. Orton	1	0	0
M. Deacon, J.P.	5	0	0
A. Seward & Co., Ltd. ...	1	0	0
J. R. Hewitson		10	0
Walsall Hardware Mnfg. Co.	5	5	0
Phœnix Electric Co. ...	3	3	0
Smith & Croft	2	2	0
T. W. Lench, Ltd. ...	2	2	0
F. A. B. Lord	3	3	0
G. E. Hood	2	2	0
L. Hurburgh	1	1	0
Pope's Elec. Lamp Co., Ltd.	1	1	0
T. S. Watney	2	2	0
J. J. Roche & Co.	1	1	0
Julius Sax & Co., Ltd. ...	1	1	0
G. Stephen Corlett	1	1	0
H. McDarrah	1	1	0
Neil McLean		10	6
Elec. & General Works, Ltd.	1	1	0
Norman Dickson, Pringle and Co.	1	1	0
Wholesale Fittings Co., Ltd.	2	2	0
Dussek Bitumen Co. ...	1	1	0
Eustace Thomas	1	1	0
H. W. Smith & Co. ...	10	0	0
T. Wardrobe	1	1	0
H. W. Kefford	1	1	0
Fuller Electric & Mnfg. Co.	2	2	0
D. Assersohn	1	1	0
Dowsett & Jenkins, Ltd.	1	1	0
J. C. Gilkes		10	0
J. Findlay	1	1	0
E. C. de Segundo	1	1	0
H. G. Solomon	1	1	0
Caskell & Grocott	1	1	0
Calmont, King & Co. ...	2	2	0
Locke Lancaster and W. W. & R. Johnson and Sons, Ltd.	2	2	0
J. M. Doughty	1	1	0
Duram, Ltd.	10	10	0
Hugh Mountain	2	0	0
J. H. Heathman		10	0
J. Scrivener	1	1	0
W. Frain	10	10	0
Alex. Laurie & Co. ...	5	5	0
David Kirkaldy & Son ...	1	1	0
British Ever-Ready Co. ..	5	5	0
Major Wm. Parker ...	1	1	0
Pearson Bros.	1	1	0
S. Wolf & Co., Ltd. ...	1	1	0
W. M. D. Pell	2	2	0
Best & Lloyd	10	0	0
Oliver Pell Elec. Mnfg. Co., Ltd.	2	2	0
J. A. Ritchie	1	1	0

SHORTER WORKING WEEK FOR EMPLOYÉS IN ELECTRICITY UNDERTAKINGS.

We have received from Mr. W. J. Webb, London District Secretary of the Electrical Trades Union, a copy of an agreement between the electricity undertakings of London on the one hand, and the Electrical Trades Union, the National Union of General Workers, the Workers' Union, and the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers on the other, in respect of a shorter working week for men employed in electricity undertakings. We have also received a copy of the agreed rates for a 47-hour week for day workers. In the case of shift workers, the rates to be paid are on a 56/48 basis. Practically the same agreement has been come to in respect of the railways in the United Kingdom, except that the 47-hour week for day workers started on January 1st. The following are the agreements referred to :—

Re Electricity Undertakings (General), London District.

Claim by four Unions for 47-hour week without reduction in pay

Meeting between Employer and Union Representatives.
Award 2,772, Paragraph 13

Matters arising out of Meetings held on December 30th and January 2nd, 1919, at the County Hall.

The Employer and Union Representatives are willing to accept an Award of the Court of Arbitration embodying the following :—

1. 47-hour week in the case of day workers.

2. 48-hour week in the case of shift workers, subject to—

(*a*) The 48 hours being an "average" week's work where mutually agreed upon between the employers and employés of individual undertakings. In any case where details cannot be agreed the matter should be referred to a joint meeting of the employers and Union representatives (Award 2,772, Paragraph 13).

(*b*) Shift workers to interchange occupation according to shift relief.

(*c*) In the event of any undertaking not being able to put the shorter hours into operation on February 1st, 1919, through shortage of labour, the Unions will remove any restriction on their members working a longer week at normal rates up to 56 hours, or such week as at present worked, until such time as the undertaking can obtain the necessary qualified men, but the Unions desire to restrict such time to March 1st.

If sufficient qualified men are not available by March 1st, the matter to be again considered by the joint meeting of the employer and Union representatives (Award 2,772, Paragraph 13).

3. *Date for Commencement of the New System.*—Hours, rates, and conditions remaining as per Award 2,772 until —day workers, 47-hour week from February 1st, 1919; shift workers, 48-hour week from February 1st, 1919.

4. *Basic Rates. Award 2,772, Paragraph 8.*—Hourly rates under this heading to be adjusted from February 1st, 1919, as under :—

Day workers in ratio of 54 : 47.
Shift workers in ratio of 56 : 48.

A sub-committee of two on either side to revise these hourly rates for submission at an early date to the Joint Meeting of Employer and Union Representatives (Award 2,772, Paragraph 13).

Agreed Rates.

Grade.	Award 2772 rate.	Decimal rate. 54 : 47.	Agreed rate.
Fitter	0s. 10½d.	12.06	1s. 0d.
Jointer	0s. 9½d.	10.91	0s. 11d.
Plumber jointer	1s. 0d.	13.78	1s. 1¾d.
Armature winder	0s. 10½d.	12.08	1s. 0d.
Cable ganger	0s. 10d.	11.48	0s. 11½d.
Public lighting foreman ...	0s. 10d.	11.48	0s. 11½d.
Public lighting leading hand	0s. 9½d.	10.91	0s. 11d.
Public lighting attendant ...	0s. 8d.	9.19	9.2
Arc lamp trimmer	0s. 8½d.	9.76	0s. 9¾d.
Meter inspector and tester ...	0s. 10½d.	12.06	1s. 0d.
Meter repairer	0s. 11d	12.83	1s. 0¾d.
Meter fixer	0s. 8½d.	9.76	0s. 9¾d.
Meter reader	0s. 8d.	9.19	9.2
Overhead linesman	0s. 9½d.	10.91	0s. 11d.
Assistant storekeeper ...	0s. 8d.	9.19	9.2
Battery fitter	0s. 10½d.	12.06	1s. 0d.
Battery attendant	0s. 9d.	10.34	0s. 10¼d.
Conduit system :			
Leading hand	0s. 8½d.	9.76	0s. 9¾d.
Cable hand	0s. 7½d.	8.61	8.6
Fitter's mate			
Wireman's mate			
Electrician's mate	0s. 8d.	9.19	9.2
Jointer's mate			
Telephone electrician ...	0s. 10½d.	12.06	1s. 0d.
Telephone linesman ...	0s. 9½d.	10.91	0s. 11d.
Boiler cleaner	0s. 8½d.	9.76	0s. 9¾d.
Labourer, indoor	0s. 7d.	8.04	0s. 8d.
Labourer, outdoor	0s. 7½d.	8.61	8.6
Cleaner	0s. 7d.	8.04	0s. 8d.
Ash hopper & conveyer man ..	0s. 8½d.	9.76	0s. 9¾d.
Coal handling			
Coal weigher	0s. 8d.	9.19	9.2
Shunters and tippers ...			

The Channel Tunnel.—According to the daily Press, Sir Francis Dent, general manager of the South-Eastern and Chatham Railway, strongly supported a Channel tunnel as opposed to a train ferry before the Select Committee on Transport. The highest estimate, he is reported to have said, of the cost of the tunnel was 25 millions, and the working of the tunnel by electricity would be "extraordinarily cheap." He did not think the train ferry "a business proposition." It would not compete with a direct steamer in carrying perishable goods, nor could it carry anything like the proportion of passengers and quantities of goods carried by the present passenger boats. He was quite satisfied that the service could not be developed commercially nor could anything like the speed be attained.

"ELECTRICAL REVIEW" SMALL ADVERTISEMENTS: EARLIER CLOSING TIME.

Special attention is directed to the alteration in the time for receipt of small advertisements for the Electrical Review. Owing to the great increase in their number, and to enable the journal to be produced punctually to time, copy for such advertisements must be received here by 5 p.m. on Wednesday, instead of on Thursday morning, as hitherto. This notice relates to Official Notices, Patent Notices, Situations Vacant, Situations Wanted, Partnerships, Agencies, Articles for Sale, Articles Wanted, &c.

NOTES.

Volunteer Notes.—Royal Engineers Volunteers, London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 3, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Monday, January 20th, to Saturday, January 26th, drills as usual.

C. Higgins, Captain, R.E., *Adjutant.*

Nationalisation of Railways.—The Prime Minister is reported to have stated that the plans of the Government for the future control of the railways will be among the first measures to come before the new Parliament.

Gift to Promote Industrial Unity.—According to a statement made by Mr. G. N. Barnes, M.P., at a dinner of the Industrial League, Sir Wm. Dupree, of Portsmouth, has given £20,000 to the funds of the League. in recognition of the importance of its work in encouraging co-operation between employers and employed.

Institution and Lecture Notes.—Irish Water Power.—Mr. J. Challoner Smith, in a paper read at the Institution of Civil Engineers in Ireland, on the question of Ireland's water power, said that the fluctuations in the volumes of the flows rendered it extremely unlikely that the large continuous powers necessary for great electrometallurgical or kindred plants could be obtained within the limits of reasonable outlay. Many sites existed, however, at which useful powers for lighting, milling, &c., might be provided, under skilful design and supervision.

Electric Steel Furnaces.—Mr. H. Etchells, of Sheffield, read a paper on "The Function of the Electric Furnace in Modern Engineering Practice," before the members of the Birmingham Metallurgical Society, on Thursday, last week. In order to appreciate the fuel efficiency of the electric furnace at its true significance, he said, one must not think only in terms of the number of electrical units per ton of metal melted or heat-treated, but this should be resolved actually into terms of the weight and quality of fuel put into the fire-grate at the generating station. When electric power was generated with 30 per cent. efficiency at the generating station, electric furnaces would compete as regarded fuel cost with other types. Mr. Etchells insisted that the electric furnace had revolutionised the science of casting. Midland manufacturers could now be assured that homogeneous, unsegregated castings, free from blow holes, could be produced in sizes varying from a few ounces up to several tons, and this would tend to cheapen production in all directions and eliminate expensive forging and pressing operations.

Fuel Economy and Health.—On January 6th, Mr. A. H. Barker opened a course of Chadwick Trust lectures on "Fuel Economy and Health," at the Royal Society of Arts. Dealing with the heat requirements of a human body, he estimated the average requirements for the well-to-do person in conditions of life similar to those prevailing at the present day as about two tons of fuel per annum. and for the poorer classes about three-quarters of a ton per annum; these quantities could not be reduced otherwise than by improving the efficiency of the plant commonly employed. To calculate the requirements of temperature and humidity in the surrounding air suitable for so changeable a mechanism as the body, was impossible, and the matter could only be treated empirically. Mr. Barker described in detail recent American experiments to determine the most suitable conditions from the point of view of comfort, and concluded that the four desirable elements of fresh air were freedom from dust and germs, from undue elevation of temperature and humidity, and from undue uniformity and stillness.

The second lecture related to the heat requirements of a house. Mr. Barker compared the different methods of warming a building, and discussed their advantages and disadvantages from the user's point of view. A radiator method of warming, he said, used only about one-quarter of the fuel required by an open fire for equal heating effect. He next discussed the appliances used for generating heat for heating, cooking, and hot-water supply, and pointed out the features which led to extravagance and economy. He stated that whereas the present domestic requirements of the entire nation required the consumption of 30 million tons of fuel per annum, the same requirements could be served by the most economical modern appliances, used in a most careful manner, by a consumption of approximately 6,000,000 tons.

The last lecture of this course will be given on Monday next.

Educational.—Loughborough Technical College.—Under the direction of the Principal (Mr. H. Schofield, M.B.E.), an Instructional Factory has been built and equipped at Loughborough for the training of semi-skilled munition workers, under the control of the Ministry of Munitions. Now that the war has come to an end, the Committee thinks that it is most desirable that the organisation and equipment should be retained in their entirety as a national institution for engineering training. With this object in view a memorandum has been prepared, showing exactly how the resources of the Loughborough College might be best utilised.

The factory forms part of the parent institution, and is operated under the Principal as general manager, with the co-operation of a works manager and works superintendent, all of whom have had a wide experience of practical engineering and scientific training. The works are run on productive lines, and at present give occupation to some 500 trainees; actual engineering contract work is accepted, and carried through from the estimating department to the inspection department. The equipment of the works is complete in all respects, with up-to-date tools and appliances. The memorandum gives full particulars of the training courses, equipment, &c.

Electric Power Supply and the War.—In a letter to municipal and private electricity undertakings, Mr. Winston Churchill says:—

"Now that the war has been won, it is my pleasant duty, as Minister of Munitions, to testify to the part that has been taken by all those who have been responsible for electric power supply throughout the war.

"The over-riding needs of the British Armies have required the output of war material on an unprecedented scale, and in every class of supply the demand has been met. But this achievement would have been impossible without the effective and ungrudging co-operation of the principal electrical undertakings of the country. The demands made upon you have been exacting, and I recognise to the full the increasing difficulties that you have been called upon to surmount in maintaining and augmenting the supply of electric power on which the great industrial centres have depended.

"I therefore desire to convey to you, and through you to all members of your staff, my sincere thanks for the valuable services you have rendered to the Ministry of Munitions."

The justice of this official tribute to the wonderful work done by our electric supply undertakings will be acknowledged by all who are aware of the extraordinary efforts that have been put forth by the managers and staffs, and the strenuous conditions under which their work has been carried on—conditions which would have been regarded in peace-time as unthinkable. We have on several occasions directed attention to the excellent record of the central station engineers in war-time, and we are glad to know that it is recognised in official quarters.

Fatalities.—"Accidental death" was the verdict returned at the inquest concerning J. Lindley (28), woollen spinner, who died from electric shock received in the hoist-cage at Lockwood Mills, Huddersfield. The evidence showed that he was attempting to open the hoist-gate by depressing the catch, and the gate had become electrified by the displacement of the lock, through which a 400-volt current was transmitted.

At the inquest into the death of Mrs. Rhoda Macnamara (23), of Oldham, killed by falling 24 ft. while oiling an electric crane at the Middleton Road goods yard of the L. & Y. Railway, the Coroner said it was questionable whether such dangerous work was suitable for a woman, and he suggested the taking of measures for more effective protection.

At an inquest at Hyde, last week, on Frank Potts (26), a miner, who met his death suddenly at Kingston Colliery, Hyde, on December 28th, it was stated that a bell wire for signalling ran just under the electric cable. While holding the bell wire he apparently received a fatal electric shock. It was stated that the signal wire was now being transferred to the opposite side of the brow, so as to avoid the possibility of contact. Verdict, "Accidental death."

Several boys were playing with a fallen telephone wire that crossed over electric cables behind the Turbine Gear Engineering Works, near the Joint Electricity Board's sub-generating station at Hyde, on Monday, when they felt electric shocks. All the lads at once let go of the wire except Ernest Wimpenny (10), son of a collier, who stuck and cried out. The other boys ran and told his parents, and shortly afterwards he was found dead.

Concert.—The Electrical Trades Benevolent Institution last year inaugurated the system of Local Advisory Committees, and appointed on the Management Committee gentlemen in different provincial towns in order that these Local Advisory Committees might be got to work. In Cardiff, Mr. Hobbs, of the General Electric Co., Ltd., who has for many years supported the Institution, was duly elected on the Management Committee, and formed a Local Advisory Committee, which includes:—Mr. W. A. Chamen (South Wales Power Co.), Mr. R. Howard Fletcher (consulting engineer), Mr. A. C. MacWhirter (MacWhirter & Sons, Ltd.), and Mr. J. P. MacTaggart (Siemens Bros. & Co.). These gentlemen organised a concert, and secured the services of the Royal Breconia Glee Singers, who on Saturday, January 11th, gave an excellent concert at the Whitehall Room, Cardiff, to a crowded house. With subscriptions and the result of the concert, practically 100 guineas will go to the Institution. We wish the Institution every success in its new policy, and trust that the example of Mr. Hobbs will be followed in other centres, so that not only will the Institution have the advantage of the increased income resulting from their energies, but it will also get into closer touch with those members of the industry who require the assistance of the Institution. Local Committees will probably get to work at Birmingham, Bristol, and Glasgow ere long.

Fuel Economy.—The Electricity (Restriction of New Supply) Order has been revoked as from January 10th.

Appointments Vacant.—Assistant engineer, for the Singapore Electric Tramways, Ltd. ($450 per month), application to company's office in London; junior assistant engineer, also wireman, for the Burnley Corporation Electricity Department; assistant electrical engineer (£360 + £75), for the Federated Malay States; assistant instructors in electrical engineering and installation maintenance and repair work for the Ministry of Pensions Training Scheme at the Croydon Polytechnic; draughtsman for the Battersea B.C. Electricity Works; chief engineer for a South Coast generating station. See our advertisement pages to-day.

Supply Station Engineers' Salaries.—At a meeting between the Standing Conference and the E.P.E.A., on the 8th inst., the following recommendation was agreed upon:—

We, the Standing Conference of Electricity Supply Associations, recommend the constituent associations to agree to an award of Court of Arbitration to pay as from March 31st, 1918, to technical engineers on the staffs of the undertakings from and including the grade of junior charge enigneers to and including the deputy chief officials (that is to say, excluding all the grades for which basis rates were settled by the award (2,772) Electrical Undertakings (General) London District) the salary paid at July 31st, 1914, plus merit and grade increases between that date and March 31st, 1918, plus 20 per cent., plus an additional sum at the rate of £90 per annum, war advances and war bonuses to be merged in the above.

This arrangement to be operative until March 31st, 1919, or such other date as may be mutually agreed, and in the meantime the Conference and the E.P.E.A. to meet and proceed to settle basic rates of remuneration for the various grades as above, pending which sectional discussions as to basic rates shall be adjourned. We understand that application has been made to the Ministry of Labour for the issue of an award in the terms of the above recommendation.

Women as Engineers.—One of the pressing problems of the demobilisation of munition workers is the finding work for the junior administrative staffs and the educated forewomen who were in special demand during the war, and whose salaries averaged about £4 a week. The present demand for skilled and unskilled women in civil industries is mainly in domestic work and in laundries, and cannot reach the class above referred to. It would appear that they are, though a smaller section, likely to be more difficult to suit than other workers. Many educated women who took up engineering to make munitions are also wonderng what they will be able to do in the future. They desire to stay in this kind of work, to which they have become accustomed, but so far there is no scheme to utilise their services. Many of them are skilled fitters, and are asking for opportunities to remain in work for which they have proved their capacity.—*Times*.

The Eight-Hour Day on the Continent.—The eight-hour day movement has been making great progress in different Continental countries during the past two months. At Warsaw a decree was published in November instituting an eight-hour day. According to the *Nowa Reforma*, the workmen in all industrial, economic, and trade industries, in all branches of communication, whether on land or water, and in all commercial enterprises, are to work a maximum of eight hours (not counting intervals for rest) except on Saturdays, when it is to be six hours. With the approval of the commune the six-hour day may be changed from Saturday to another week-day. According to *Glos Narodu* (December 2nd) the Cracow gasworks have instituted an eight-hour working day, though this will cost Kr.260,000 yearly; and have also decided to increase wages by 60 per cent., the cost to the gasworks being Kr.290,000. The sum of Kr.250,000 is to be allotted to provisioning the workmen. At Luxemburg the Government introduced the eight-hour working day system on December 1st, the measure affecting all big industrial works, including in particular the iron industry.

In Germany, according to the Government proclamation of November 12th, the eight-hour day was to be introduced on January 1st, 1919. There are to be certain exceptions, decided by the Imperial Labour Office, in the interests of certain economic and social needs of the nation. According to *Soziale Praxis* (November 28th), in Bavaria the new ministry for social welfare has been considering the best means of avoiding serious disturbance in economic matters, and has adopted the eight-hour day among other principles. Wherever, owing to technical obstacles, the introduction of more labour does not lead to increased production, employers and workers must agree to a 48-hour week, ending at noon on Saturday, any extra hours work being paid for at overtime rates. The demand for a 44-hour week is recognised and will be dealt with as soon as the difficulties of the present crisis have been overcome. Where shorter working hours already exist, no lengthening must be allowed. In general, the Government aims at shortening hours of work, in no case allowing them to exceed eight per day.

Welthandel (November 29th) says that an understanding between the trade unions and the employers' federation of the north-western group of the Union of German Iron and Steel Industries has been reached with regard to the introduction of the eight-hour day in the industry. Where circumstances permitted, this was to take place on November 25th, and where technical difficulties admit only of a gradual introduction, this is to be effected corresponding to the arrangement of the works. But, in any case, the measure is intended to be carried out completely by April 1st, 1919.

Another journal says that the metal industry in the M. Gladbach-Rheydt district has decided to adopt the eight-hour working day system and to raise the hourly scale of wages correspondingly.

Electricity on the Farm.—The daily Press states that Mr. A. T. Cock, of Ford Farm, St Clear, Cornwall, has threshed out 15 sacks per acre of electrically-treated wheat, and 12 sacks per acre of untreated wheat. The straw of the treated crop was one-fifth more than the untreated. Barley grown by Mr. T. Maye, of Charleton, Devon, gave an increase of more than one-fifth over untreated, and another crop of barley grown by Mr. A. E. Stidson, of Barton, yielded half as much again as the untreated.

The *Auckland Weekly News* states that towards the end of 1917 Mr. Birks, engineer of the Lake Coleridge hydro-electric scheme, approached the Board of Governors of the Canterbury Agricultural College with regard to more extensive use of electric power on the farm. Mr. Birks fixed up the plant for a demonstration of threshing by electric power, and in all 34 acres were threshed. The outfit required consisted of a portable transformer supplied from the H.T. wires along the roadside, a few hundred feet of insulated cable leading to the motor, and a motor on a portable sledge, strong and heavy enough to act as a base. The drive was by an ordinary belt. The transformer stepped down the pressure from 11,000 to 400 volts. The motor used was of 15 H.P., while the maximum demand indicated was 12 H.P., and the average to run the plant used for the demonstration was 9 H.P. The running cost, if 12 H.P. was used, would work out at (taking town prices) 2s. 3d. per hour, which would compare more than favourably with steam. The advantages of electric drive from the point of view of the College are the ease and simplicity of manipulation, the steadiness of the running, and the lack of tendency to shift or get out of line—the motor remaining absolutely steady on its stand.

A Modern Test for High Resistance Joints in Line Wires.—Mr. M. A. Noss, of New York, writes in the *T. & T. Age* as follows:—A bad section, fully five miles long and thirty-three miles from the testing station, was reported. Following the usual method, a lineman was ordered to walk this section, count the joints in the wire, and to cut out joints that looked bad. He removed nineteen joints; all looked bad, but there was only one that showed high resistance when brought in and measured. He then devised a special form of milliammeter having three coils connected to one + terminal, the resistances of which were 100, 10, and 1 ohms. With this instrument the lineman went over this section again, and by shunting one to three joints, or a section between poles at one time, he was able to see at a glance if the joint or section was of high resistance, and by the rule of proportion could figure the actual resistance of what he had shunted. He knew when starting out the amount of current on this wire, or he could cut the milliammeter in the circuit at any time and find out.

On the trip he removed 37 joints measuring from 1½ to 192 ohms each, or a total of over 600 ohms. While he was doing this the wire was kept in service. He neither interfered with the working of the wire nor bothered the chief for instructions. He knew what he was after and could see it when he reached it. The trouble was on an old No. 6 iron wire. The test here described reduces the normal current through the joint under test, inviting a defect to develop. This instrument may also be used for testing fuses, and as a low reading voltmeter for testing batteries or any other low-voltage tests.

Elimination of Oil from Feed-water.—In a paper read before the Department of Marine Engineers of the Royal Institution of Dutch Engineers by J. C. Dijxhoom, the importance of perfectly clean feed-water for steam boilers is dealt with. Ordinary appliances do not succeed in completely removing the oil, because it is in an emulsive state and divided into globules of less than 1/1,000 millimetre diameter which can pass through the finest filtering medium. Various precipitants are mentioned, but success depends in every case on subsequent filtration of the water through large sand filters. The tiny globules of oil can be made to coalesce by passing an electric current through the water, and the author describes an apparatus he has designed for this purpose, using continuous current at 110 volts whilst the water flows through the feed pipe. The electrically treated water is then sent through a pressure filter consisting of perforated cylinders covered with cloth and enclosed in a strong vessel provided with inlet and outlet stop valves. Such a filter has very little effect on ordinary feed water, but, as the electric process described above causes the oil-globules to coalesce, the whole of the oil is effectively retained, leaving pure water only to pass through. A pressure gauge on the filter indicates the condition of the filter cloth, which must be changed when filters. The tiny globules of oil can be made to coalesce by the pressure rises much above boiler pressure.—*De Ingenieur*.

A.S.E. and League of Nations.—The *Daily Chronicle* states that members of the Amalgamated Society of Engineers are about to take a vote on a proposed levy of 2d. per man to meet the expenses of propaganda in favour of a League of Nations.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Wigan Tramways Committee recommended that the new general manager, in succession to Mr. F. Buckley, who has been appointed tramway manager at Bury, should have a commencing salary of £500, rising by annual increments of £25 to £600. Alderman Fletcher, after referring to Mr. Buckley's valuable work at Wigan, said that if Bury, with fewer cars, could afford £500 for his services, Wigan could pay that sum to its manager. The poorest-paid manager in the tramway world was receiving £400 a year. The Council referred the minutes back.

The Northampton T.C. has presented an honorarium of £100 to the tramway manager (Mr. J. Cameron), in recognition of valuable services rendered during the war.

The Perth Corporation Electricity Committee has recommended an increase of £25 per annum to Mr. C. J. Lindsay, electricity treasurer.

General.—Mr. J. M. Kennedy, O.B.E., M.Inst.C.E., has resigned his position under the Ministry of Munitions as Superintendent of the Government Rolling Mills, Southampton, in order to rejoin his firm, Messrs. Kennedy & Donkin, consulting engineers. Mr. Kennedy was primarily engaged as chief engineer on the construction of the factory mentioned and its power house, the work being carried out by direct labour; subsequently, when the factory had been working some months, he was appointed superintendent. On the conclusion of hostilities the staff and employés, numbering over 2,000, presented Mr. Kennedy with a silver tea service, as a mark of the goodwill which existed among all ranks.

Mr. Herbert Vickers, M.Eng., has been appointed chief assistant to the testing department at Faraday House.

Mr. W. J. Terry, recently supervisor of purchases for the B.T.H. Co., Ltd., has been appointed secretary of the London Electric Wire Co. and Smiths, Ltd., London and Salford, as from January 1st, 1919, and he will also assist in the management of the London undertaking.

Mr. W. T. Bower, late of the Metallic Seamless Tube Co., Ltd., and the Metallic Electrical Engineering Co., Ltd., has accepted an appointment as managing director of the Electrical Components, Ltd., switchgear and heating manufacturers, 36, Cannon Street, Birmingham.

Captain W. Hall and Captain F. B. C. Sutthery, A.M.I.E.E., Tyneside electrical engineers, have been seconded for service under the Admiralty, with effect from September 23rd, 1918, and October 3rd, 1918, respectively.

Mr. W. Anderson, who has been with the General Electric Co. (Glasgow branch) for over 12 years, has resigned his position in order to become joint manager of Messrs. Wood & Cairns, Ltd., at their Glasgow branch.

Mr. Sidney J. Ebbutt, one of the London outdoor representatives of W. T. Henley's Telegraph Works Co., Ltd., has been released from military service, and resumed his duties with the company on 13th inst. He has been a sapper in the London Electrical Engineers, R.E. (T.) for two-and-a-half years.

Roll of Honour.—The death took place at Dar-es-Salaam, East Africa, on December 23rd, of Lieut. Geoffrey H. Wilson, R.E. Signals, of cerebral malaria. The dead officer, who was only 34 years of age, was the founder and proprietor of the Manchester Armature Co., Pendleton, Manchester. After some months of volunteer service with the French Red Cross, he received a commission in 1915, and in May of the following year was sent to East Africa.

The Military Cross has been awarded to Lieut. W. B. Cockbain, Machine Gun Corps, of Keswick, who was, prior to the war, engaged on the electrical staff at the Forge Engineering Works.

Private G. Gerrard, 1st Manchester Regiment, who died from pneumonia on December 27th, was employed by the British Westinghouse Co., Ltd., Trafford Park.

Private Alfred Ratcliffe, Trench Mortar Battery, who died whilst a prisoner of war, was formerly employed in the electricity department of the Burnley Corporation.

Sergt. J. L. Melby, R.G.A., who has died in France from pneumonia, was formerly with the B.T.H. Co., Ltd., at Rugby.

Lieut. R. F. Petschler, R.E., has been awarded the Military Cross for gallantry in the field. Lieut. Petschler enlisted in 1915, and rose from the ranks. When he enlisted he was chief estimating engineer in Messrs. Johnson & Phillips's switchgear department; previously he held positions with the British Westinghouse Co. and with Messrs. Ferranti, Ltd.

Obituary.—Mr. G. Hagger.—Mr. George Hagger, who was for 24 years secretary of Messrs. Greenwood & Batley, Ltd., and the King's Norton Metal Co., Ltd., passed away on January 12th at Whitstable, aged 74 years.

NEW COMPANIES REGISTERED.

Inventions & Research, Ltd. (152,470).—Private company. Registered January 2nd. Capital, £20,000 in £1 shares. Owners of patents, schools, laboratories, and workshops for experimental and research work, &c. The subscribers (each with one share) are:—J. R. Remer, Cunard Building, Liverpool, sawmill proprietor; R. A. Corbet, Regent Palace Hotel, W., gentleman; W. A. C. Sandford-Thompson, 4, Cambridge Place, Kensington, engineer; S. Fitzgerald, 3, Thorpe Wood Avenue, Sydenham, engineer First directors: J. R. Remer, R. A. Corbet, W. A. C. Sandford-Thompson, and S. Fitzgerald. Registered office. 4-6, Milner Street, Cadogan Square, W.

W. E. Beardsall & Co., Ltd. (152,506).—Private company. Registered January 3rd. Capital, £4,000 in £1 shares (2,000 preference). Electrical and mechanical engineers and contractors, manufacturers of railway, tramway, electrical, and other apparatus, suppliers of electricity, &c. The subscribers are: W. E. Beardsall, 130, Urmston Lane, Stretford, electrical fittings manufacturer (one ordinary share); W. E. G. Dean, 77, School Road, Stretford, purchasing agent (one ordinary share); C. A. Buckley, 2 Booth Street, Manchester, solicitor (one preference share). Permanent directors: W. E. Beardsall and W. E. G. Dean. Solicitor: C. A. Buckley, 2, Booth Street, Manchester.

Taylor & Petters, Ltd. (152,551).—Private company. Registered January 8th. Capital, £25,000 in £1 shares (12,500 8 per cent. cumulative preference). To take over the business of merchants and manufacturers of mica, micanite, celluloid, asbestos, and vulcanised fibre shades for electric and gas fittings and other goods carried on at 40, Hatton Garden, E.C., as "Taylor & Co." The subscribers are: J. M. Petters, M.Inst.C.E., 85, Palace Court, W. 2 (one preference share); Miss J. Taylor, 26, Brookfield, West Hill, Highgate, N. 8, mica merchant (one ordinary share). First directors: S. Blofield, Miss J. Taylor, H. N. Lindley, and J. M. Petters. Solicitor: P. C. C. Francis, 19, Great Winchester Street, E.C.

Harris Electro Metals Co., Ltd. (152,542).—Private company. Registered January 8th. Capital, £5,000 in 4,750 preference shares of £1 each and 5,000 ordinary shares of 1s. each. To acquire from T. R. Harris the business of certain inventions, and to carry on at or near Thornhill or elsewhere the business of electro-depositors of metals, metal extractors and refiners, mechanical and electrical engineers, &c. The subscribers (each with one ordinary share) are: T. R. Harris, Calverley Villas, Dawley Road, Harlington, engineer; J. Harris, Windsor Street, Attercliffe Road, Sheffield, chemical engineer The first directors are: W. B. Woodhouse, H. Ellison, T. R. Harris, and J. Harris. Solicitor: W. H. Clough, Town Hall, Cleckheaton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Severn Engineering Co., Ltd.—Particulars of £3,500 debentures created December 9th, 1918, filed, the whole amount being now issued. Property charged: The company's property, present and future, including uncalled capital. No trustees.

Sentinel Instrument Co., Ltd.—Mortgage on freehold premises at Byker, Newcastle-on-Tyne, to secure £2,600. Holders: F. E. Hannay and E. Hannay, South Shields.

Z Electric Lamp Manufacturing Co., Ltd.—Satisfaction in full on September 30th, 1918, of first and second debentures, dated August, 1909, and September, 1910, secured by various deeds, securing £25,000 and £10,000 respectively.

Rawlings Bros., Ltd.—Charge on company's interest in certain under-leases and tenancy agreements, and on its book debts, stock, plant, fittings, furniture, &c., to secure £8,750. Holders: Mrs. M. Rawlings and others.

City of Oxford Electric Tramways, Ltd.—Satisfaction to the extent of £1,200 on December 12th, 1918, of charge dated 1914, securing £46,000.

Oriental Telephone and Electric Co., Ltd.—Satisfaction to the further extent of £856 on December 18th, 1918, of debenture stock secured by trust deed dated 1905, and supplementary deed of acknowledgement dated 1907, securing £200,000.

Ferguson, Pailin & Co., Ltd.—Satisfaction in full on October 21st, 1918, of charge dated November 14th, 1916, securing advances by Williams Deacon's Bank.

Rhondda Tramways Co., Ltd.—Satisfaction to the extent of £4,700 on December 12th, 1918, of charges dated 1911-15, securing £250,000.

CITY NOTES.

Compagnie Générale d'Electricité.

The directors of the Compagnie Générale d'Electricité, of Paris, reporting on the year ended on June 30th, 1918, state that all the company's manufacturing works suffered from the restrictions and the transport difficulties. The establishment erected at Saint-Jean-de Brave, near Orleans, for the manufacture of rifle grenades was changed over by order to the production of other articles, whilst the erection of the Vineey works (steel plant, rolling mills, and tube plant) was stopped, except in the case of tubes, at the request of the Ministry of Armaments, although the former would be started in the new financial year. Concerning the Société de l'Accumulateur Tudor, the report mentions that on the liberation of Lille, in October, 1918, it was found that the Thumesnil works had been completely pillaged by the enemy; almost all the plant had been removed, and what remained was put out of service. The situation of the supply undertakings in which the company is interested, which was serious for most of them, became aggravated in the case of that at Amiens. The net profits are returned at £192,000, as compared with £162,000 in 1916-17, and a dividend has been declared at the rate of 10 per cent. on the ordinary share capital of £1,400,000, being the same rate as in the preceding year. M. Pierre Azaria, speaking at the recent general meeting, remarked that peace would be favourable for the company. In the meantime they had to pass through a particularly difficult period. For the moment there was no longer any war, and special manufactures were coming to an end. But this was not peace, and the directors had not at disposal yet either the framework and the specialised labour or the raw and semi-finished materials which were necessary. The tube factory, for instance, had been ready to start for weeks past, but was awaiting the delivery of coal and steel sheets. It was therefore essential that the transport crisis came to an end. The directors proposed as soon as circumstances would permit to erect a works complementing the Rai and Tillieres establishments which chiefly treated copper and aluminium and their alloys, and which were congested with work.

German Companies. *The Helios Elektrizitats A.G., of Cologne,* is still in course of being wound up, and the liquidators report for 1917-18 shows that the loss of £419,000 shows no change as contrasted with the preceding twelve months.

The A.G. fur Elektrizitats Anlagen, of Berlin, records net profits of £31,000 for 1917-18, or practically the same as in the preceding year. The dividend at 6 per cent. on the ordinary share capital of £500,000 is also at the same rate as in 1916-17.

The accounts of the *Siemens Elektrische Betriebe A.G., of Berlin,* which owns various supply works, show net profits of £97,000 for 1917-18, as compared with £83,000 in the preceding year. It is proposed to pay a dividend of 5 per cent. on the old shares as in 1916-17, and 2½ per cent. on the new shares.

The financial statement of the *Wotan Werke A.G., of Leipsig,* indicates net profits of £59,000 for 1917-18, as against £30,000 in the previous year. A dividend at the rate of 25 per cent. has been declared, together with a bonus of £7 10s. per share, this distribution contrasting with a 40 per cent. dividend in 1916-17.

The report of the *Fabrik Isolierter Drahte (Vogel) A.G., of Berlin,* states that the net profits in 1917-18 amounted to £135,000, as against £63,000 in the previous year, the dividend being at the rate of 18 per cent., as in 1916-17. The company's subsidiary at Vienna has now been transferred to an Austrian company, with a paid-up capital of £125,000.

The Rhein. Elektrizitats Gesellschaft (late Rhenish Schuckert Co.), of Mannheim, has just declared a dividend at the rate of 5 per cent. out of net profits of £50,000 in 1917-18, being the same rate as in 1916-17, when the net profits were £46,000. At the recent general meeting it was stated that the company's undertaking and its subsidiaries had been greatly expanded during the war, and very acceptable circumstances would arise if the possibility soon occurred, as was hoped, of resuming installation and station work.

The Elektrizitats A.G. vorm. Schuckert & Co., of Nuremberg, reports gross profits of £486,000 in 1917-18, as contrasted with £466,000 in 1916-17. After setting aside £179,000 for depreciation, as against £166,000, and making provision for the tax on coupons, the accounts show net profits of £372,000, as compared with £375,000 in the preceding year, these figures including the balance brought forward in each year. The directors recommend a dividend of 8 per cent., being the same rate as in 1916-17.

The accounts of the *Siemens-Schuckert Werke, of Berlin,* have been issued for the year ended July 31st, 1918. Including the balance forward, the gross profits are stated to be £1,347,000, as compared with £1,325,000 in the previous year. After defraying general expenses and interest on loans, the net profits are £791,000, as against £793,000 in 1916-17, permitting of the payment of a dividend of 10 per cent. to each of the two partners, as in the preceding year. The sum of £125,000 has been placed to the reserve fund, as in 1916-17, and £25,000 to the contingency fund, whilst the bonuses to officials and workmen have risen from £100,000 in 1916-17 to £150,000 last year.

The accounts of *Siemens & Halske A.G., of Berlin,* dealing with the year ended on July 31st, 1918, show gross profits of £887,000, as contrasted with £895,000 in the previous 12 months. Having provided for general expenses, interest on loans and depreciation, the net profits are reported at £697,000, as against £643,000 in 1916-17. It is proposed to pay a dividend of 12 per cent., being the same rate as in 1916-17; to allot £150,000 as economic assistance to the staff for the year, and to pay bonuses to officials and workmen to the extent of £90,000, as compared with £60,000 in 1916-17, and to carry £61,000 forward.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Erinoid, Ltd.—440,000 shares of 5s. each, fully paid (Nos. 1 to 440,000).

Marconi International Marine Communication Co., Ltd.—600,000 shares of £1 each, fully-paid (Nos. 1 to 600,000).

Anglo-Portuguese Telephone Co., Ltd.—150,000 shares of £1 each, fully paid, Nos. 1 to 150,000.

Buenos Aires Lacroze Tramways Co., Ltd.—£65,400 additional 5 per cent. consolidated mortgage debentures.

Alby United Carbide Factories, Ltd.—Interim dividend 6 per cent. on the ordinary shares.

Nitrogen Products and Carbide Co., Ltd.—Interim dividend 9 per cent.

Underfeed Stoker Co., Ltd.—Interim dividend at the rate of 5 per cent., less tax.

Compañia Anglo-Argentine de Electricidad, Sociedad Anónima.—For the year ended July 31st, 1918, the revenue amounted to $2,904,021 m/n., compared with $2,741,081 m/n. in 1917. Working expenses increased by $600,000, compared with a normal year, one item alone, oil, increasing from $25 per ton in 1915 to $165 per ton in the year under review. Applications to the towns supplied by the company for increased tariffs were only very slightly successful in a few instances. The credit balance was $402,950 m/n., of which $150,000 was placed to the depreciation and reserve fund, $100,000 to the contingency fund, $50,000 to writing down "issue of debentures," $20,000 to special amortisations, $16,754 to legal reserve fund, $11,697 to writing down improvements to $1, $8,271 to the board and syndic fund, and $46,228 was brought forward. In view of the uncertainty of the position, the Board did not recommend the payment of a dividend.—*Review of the River Plate.*

Companies Struck Off the Register.—The following companies have been struck off the register and are accordingly dissolved:—

Afflecks Engineering Works, Ltd.
Carleon Electrical Co., Ltd.
Chinnerys, Ltd.
Co-operative Publicity Co., Ltd.
Cordingley's Calculators, Ltd.
David Wilson's Patent Noiseless Winch Co., Ltd
Electric Lamp Repairs, Ltd.
Illuminated Posters, Ltd.
J. M. Shock Absorbers, Ltd.
Lounge Electrics, Ltd.
Manchester Cable Co., Ltd.
Printex Accumulator Co., Ltd.
Universal Electric Canoe Co., Ltd.

Dublin United Tramways, Ltd.—Final dividend at the rate of 6 per cent. per annum, less income tax, for the half-year to December 31st (making 5 per cent. for the year) on the ordinary stock, and a bonus of 1s. per £10 unit of ordinary stock, free of income tax. £35,000 is set aside to meet deferred replacements of cars and renewals of rails, and £15,000 to reserve fund. £3,262 is carried forward.

Delabole Electric Light & Supply Co., Ltd.—There is a profit on the year's working of £59, and a balance carried forward of £31.

STOCKS AND SHARES.

Tuesday Evening.

The serious disorders which have occurred in Buenos Aires had the effect of making the markets in Argentine issues decidedly weak. These are, however, amongst the few departments that exhibit any signs of dulness round the Stock Exchange. In point of fact, prices in most markets are hard, and have a tendency to rise. There is plenty of money about for investment, nor has the fact that this is the last week when National War Bonds can be obtained in their present shape had any particular influence in checking investment in other directions. The industrial market shows strength in most of its sections, and further rises have occurred amongst electricity supply shares.

No diminution in the buoyancy of Undergrounds is noticeable. Prices continue to mount. Districts have risen 2 to 28, and Metropolitans recovered a point to 32. In Underground income bonds and the 1s. shares a large volume of business is in progress. The price of the bonds has advanced to 95—is better, in fact, than might be inferred from the official quotation, while the 1s. shares are up to 10s. 3d. Those optimists who anticipate the immediate resumption of a 6 per cent. dividend on the income bonds may be well advised to moderate their prophecies, but in the more or less near future, no doubt this dividend will be paid. Transport facilities in London are taxed to their utmost capacity, and there seems little enough hope of relief to the unhappy straphanger. All this, of course, is to the good of the holder of Tube securities, whose comfort increases in corresponding ratio with the discomfort of the traveller. We hear interesting rumours of schemes in preparation for the provision of light railways in country districts. The Ministry of Reconstruction is alive to the opportunities offered by the materials now freed by the conclusion of the war, and financial support is not likely to prove wanting.

Anglo-Argentine Tramways preference shares, and both classes of debenture stocks, have given way somewhat sharply on the strikes and disorders in the streets of Buenos Aires. The markets for these issues had been previously so good that it was difficult to get the offer of stock. Strikes have changed all that, and although the difficulties are declared to have been composed, prices are still weak. To a minor extent, the dulness has spread to Brazilian and other South American securities, although up to the present Rio Tramway bonds remain quietly steady. There is little doing in the Mexican group, the tendency being for prices to give way in the absence of interest on the part of the purchaser, or of any news worth the name from the country itself. Mexico Tramways sixes are 1½ lower. Brazilian Tractions shed a point to 56, but the preferred at 94 are 1 to the good.

North Metropolitan Power preference shares, of which mention was made here last week, have been readily absorbed, and we believe it to be a fact that the total number of shares offered are now all placed. The price has improved to 18s. 9d., and seeing that the shares have mostly gone into the hands of the genuine investor, the quotation will probably mount to the neighbourhood of 20s. and stop there.

The electric supply market is a good one. Buyers have again come forward, professing that they care little for immediate dividend prospects, but that they are content to wait with a view to the undertakings regaining their former prosperity within a year or two. Therefore, even if the forthcoming dividend announcements should prove to be disappointing, they are not likely to have any adverse effect upon the prices of the shares, and the present buying movement is on behalf of individual investors fully aware that the next batch of dividends is not likely to be a good one.

Marconi shares have been a weak spot. The parent issue fell to 4½, and Americans went back abruptly to 27s. 6d., though Marines are fairly well maintained at 3⅝. In default of any definite reason to account for the drop, a vague rumour got into circulation as to possibilities of competition, but nothing certain is known. Apart from Marconis, the general market is a good one. Anglo-American Telegraph preferred rose to within 10s. of par, and the rest of the list maintained the advances secured last week. India-rubber shares have improved 5s. to 17¼, and amongst industrials connected with the electrical manufacturing companies, Edisons are a good spot at 19s. 3d. Babcock & Wilcox rose to 3⅞. Electric & General investment preference improved to 3⅛. Cordoba Light & Power ordinary went up 9d. to 3s. 9d. Melbourne Electric first preference at 5⅝ are ⅛ higher. The market for rubber shares is generally steady, and there is still a good deal of buying of the popular shares. The armament group keeps firm, but base metal descriptions are inclined to move downwards, as the prices of metals further gave way.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	1917.	Price Jan. 14, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	7⅜	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3½	+ ⅛	6 8 7
Chelsea	3	5	4	—	6 5 4
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
County of London	7	7	11⅛	—	6 5 7
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	6	+ ⅛	5 16 8
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	3	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3¼	—	6 18 6
St. James' and Pall Mall	8	9	7¼	+ ⅛	6 4 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	7⅜	+ ⅛	6 2 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99½	+ ½	6 0 6
do. Def.	1½	1½	23⅛	—	6 9 6
Chile Telephone	8	8	7⅝	—	5 5 0
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15⅝	—	*5 2 5
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	32⅝	—	6 15 0
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4½	— ⅛	4 9 0
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	8	—	*5 0 0
West India and Panama	6d.	1/3	1 11/16	—	*3 12 6
Western Telegraph	8	8	16⅝	—	*4 16 3
HOME RAILS.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan		1	32	+1	3 2 6
do. District	Nil	Nil	28	+2	Nil
Underground Electric Ordinary	Nil	Nil	3¾	+ ¼	Nil
do. do. "A"	Nil	Nil	10/3	+ 1/16	Nil
do. do. Income	6	4	95	+1	*4 4 3
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3⅞	+ 1/16	—
do. do. 2nd Pref.	5½	—	3⅝	— ¼	—
do. do. 5 Deb.	5	5	72½	—2	6 18 0
Brazil Tractions	—	—	56	—1	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	50	—	Nil
do. do. Deferred	Nil	Nil	45	—	Nil
do. do. Deb.	4¼	4¼	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	67	—	Nil
do. 6 per cent. Bonds	Nil	Nil	52	—1½	Nil
Mexican Light Common	Nil	Nil	38	—	Nil
do. Pref.	Nil	Nil	48	—	Nil
do. 1st Bonds	Nil	Nil	70	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3⅞	+ ⅛	3 17 6
British Aluminium Ord.	10	10	1 15/16	—	5 3 1
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref.	7½	7½	2½	—	6 0 0
Callenders	20	25	10¾	—	5 19 1
do. 6½ Pref.	5	5	5⅜	—	5 2 4
Castner-Kellner	22	20	3⅜	—	5 18 6
Edison-Swan, "A"	—	—	19/3	+6d.	7 16 0
do. do. 4 per cent. Deb.	4	4	74½	—	5 6 0
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10⅝	—	6 5 4
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2¼	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	6 12 6
India-Rubber	10	10	17¼	+ ¼	*5 16 0
Telegraph Con.	20	20	48	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 15th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/5	..
a	Ammoniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	"	£77	..
a	Bisulphide of Carbon	"	..	..
a	Borax	"	£43	..
a	Copper Sulphate	"	£60	..
a	Potash, Chlorate	per lb.	2/1	..
a	" Perchlorate	"	1/9	..
a	Shellac	per cwt.	£14	£3 10s. dec.
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers	"	£13	£1 dec.
a	" Lump	"	£15	£1 dec.
a	Soda, Chlorate	per lb.	10½d.	2½d. dec.
a	" Crystals	per ton	170/-	..
a	Sodium Bichromate, casks	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	1/1⅝	..
c	" Tubes (solid drawn)	"	1/3¾ to 1/4	..
c	" Wire, basis	"	1/2	..
c	Copper Tubes (solid drawn)	"	1/6½	1½d. dec.
g	" Bars (best selected)	per ton	£135	£15 dec.
g	" Sheet	"	£165	£15 dec.
g	" Rod	"	£135	£15 dec.
d	" (Electrolytic) Bars	"	£105	£17 dec.
d	" " Sheets	"	£161	
d	" " Wire Rods	"	£115	£17 dec.
d	" " H.C. Wire	per lb.	1/1⅞	1⅞d. dec.
f	Ebonite Rod	"	3/-	..
f	" Sheet	"	2/6	..
n	German Silver Wire	"	2/6	..
h	Gutta-percha, fine	"	11/-	.
h	India-rubber, Para fine	"	2/6	1½d. dec.
i	Iron Pig (Cleveland warrants)	per ton	Nom.	
l	" Wire, galv. No. 8, P.O. qual.	"	£40	£3 inc.
g	Lead, English Pig	"	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small	per lb.	9d. to 4/6	..
e	" " " medium	"	5/- to 10/-	..
e	" " " large	"	12/6 to 25-/& up.	..
d	Silicium Bronze Wire	per lb.	1/7	1d. dec.
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	"	£250	..
n	" Wire, Nos. 1 to 16	per lb.	4/3	..

Quotations supplied by—

a	G. Boor & Co.	g	James & Shakespeare.
c	Thos. Bolton & Sons, Ltd.	h	Edward Till & Co.
d	Frederick Smith & Co.	i	Bolling & Lowe.
e	F. Wiggins & Sons.	l	Richard Johnson & Nephew, Ltd
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n	P. Ormiston & Sons.
		r	W. F. Dennis & Co.

The Demand for Electrical Material in China.—The use of electric appliances is naturally limited to those cities and districts where electric power is obtainable, and the constant growth of this trade under these circumstances is promising. A great many electric power plants have been unable to get machinery during the past year to take care of natural increases in consumption, and new contracts for current have been subsequently refused. With an increased import of appliances under such circumstances we can only infer to what size the business would have grown under normal conditions. The following figures show the increase in the value of the imports of electrical materials and fittings during the three years up to 1918:—

	1915. Haikwan taels.	1916. Haikwan taels.	1917. Haikwan taels.
Japan	845,053	1,699,111	2,563,557
United States	314,403	614,321	908,960
Hong-Kong	259,585	339,992	381,287
Great Britain	403,851	710,744	379,693
Canada	3,181	73,863	58,941
All other countries ..	288,339	130,681	85,953
Total imports ..	2,114,415	3,568,712	4,378,391
Re-exports	71,525	137,141	351,148
Net imports ...	2,042,890	3,431,571	4,027,243

—*Journal of Electricity*, U.S.A.

Staggered Hours.—At a recent meeting of the Boston section of the A.I.E.E., L. L. Elden, electrical superintendent of the Boston Co., said that to add 15,000 kw. to the existing plant capacity during 45 winter days it would be necessary to change the working hours of about thirty industrial plants only about thirty minutes. The above saving represents about one-sixth of the total estimated peak load of the Boston system for the winter. The comparatively small change in closing hours required to realise so substantial an increase in available station rating was something of a surprise to those investigating the possibilities.—*Electrical World.*

INDUSTRIAL RECONSTRUCTION AND THE METRIC SYSTEM.

[The necessary expansion of our export trade, coupled with the imminent establishment of new industries and of new standards in old industries, calls for a reconsideration of the claims of the international metric system as the universal language of quantity.]

By HARRY ALLCOCK, M.I.E.E.

Economic considerations now render the expansion of our export trade just as necessary in the national interest as was the production of munitions during the war.

Great Britain is no longer the sole workshop of the world, and as most of the other producing nations are faced with the same economic problem it follows that international competition will be exceptionally keen. We have not only to secure our re-entry into those overseas markets which have been temporarily lost during our concentration on war work, but also to create new markets for British goods throughout the world. No effort must be spared, and all hampering influences must be eliminated.

Hitherto the general charge has been frequently made that we have not sufficiently considered the convenience of our overseas customers, and that, in particular, we have hampered our own prospects by failing to submit our offers in the language of the country concerned.

In this connection we are apt to forget that, although there are scores of spoken languages, there are now substantially only two languages of quantity, viz., the British Imperial system and the international metric system of weights and measures.

If either of these systems were adopted by the whole world as the *sole* language of quantity the conduct of international trade would obviously be greatly simplified, and it is clear that Great Britain more than any other country would benefit from such uniformity due to her special dependence upon her world-wide export trade.

Looked at from this point of view, it would appear that sooner or later Great Britain must abandon the British Imperial system, because even its stoutest supporters would refuse to undertake the impossible task of inducing the world to adopt it.

On the other hand, apart from its inherent excellence as a system, the points in favour of our adoption of the International metric system may be briefly summarised as follows:—

1. *Education.*—The committee recently appointed by the Prime Minister to inquire into the position of Natural Science in the educational system of Great Britain (Cd. 9,011) reported: "That the present chaos of English weights and measures causes waste of time and confusion of thought, and that there are strong educational reasons for the adoption of the metric system."

2. *Science and Industry.*—The scientists of the whole world including those now working in the so-called "non-metric" countries have already adopted the metric system. The experiences of war have proved the advantages of close co-operation between the scientist and the industrialist, and to that end it is desirable they should both work in the same system.

3. *Technical Progress.*—The ordinary rate of evolution in many industries has been accelerated by the experience of war to such an extent that "the best practice" of pre-war days is already obsolete. Extensive "scrapping" of patterns, &c., is inevitable, and a unique opportunity of starting afresh on the metric basis in thus provided.

4. *Commercial Progress.*—Just as in labour matters both employers and employed now fully realise the impossibility of returning to pre-war conditions and practices, so also on the commercial side are British manufacturers now disposed to develop new industries and to set up new standards in old industries, instead of merely reverting to the output of their unaltered pre-war products. By basing all new developments on the metric system, manufacturers would help themselves as well as the nation.

5. *Overseas Consumers.*—Our overseas customers may be considered under three heads, viz.:—

(*a*) Our Colonies.
(*b*) Our Allies.
(*c*) General.

(*a*) *Colonies.*—This trade is reasonably preserved for us (no matter what system of weights and measures we employ), both by ties of national sentiment and by the Government's declared policy of Colonial Preference. It may also be observed that the Colonies have frequently expressed their desire to adopt the metric system whenever the United Kingdom does so. In the Dominions Royal Commission Report of 1917 the following statement with reference to the metric system was published: "There is clearly in the Dominions a considerable body of opinion in favour of the change. So far, however, all efforts to induce the *community of the Mother Country* to agree to the change have proved unavailing." We should accordingly not jeopardise our Colonial trade by adopting the metric system.

(*b*) *Allies.*—All our European Allies have already adopted the metric system, and by now following their lead in this matter we should not only encourage them to entrust to British firms the temporary work of restoring and re-equipping their war-damaged factories, but we should thereby foster a spirit of permanent alliance by promoting the development of inter-allied trade to its fullest possible extent.

(*c*) *General.*—If we regard the peoples of the entire world as potential consumers of British goods we must necessarily adopt the international metric system, because its use is now obligatory in some 34 countries (representing approximately half the population of the world), and legally permissive in practically all other countries.

In addition it is recently reported that Russia (where hitherto its use has been merely permissive as in England) has decided to render the employment of the metric system compulsory throughout that country after a short transition period.

Even if they strenuously object to the metric system, British manufacturers and merchants thus cannot avoid its use, and the only escape from their present obligation to employ two systems—involving increasingly frequent conversions from one to the other—is for them to abandon the British system.

In the face of these arguments, it may well be asked, "Why does Great Britain continue to postpone her inevitable adoption of the metric system?"

Objections.

Apart from our innate conservatism the principal objections hitherto advanced are here enumerated, together with a few comments under each head:—

1. *That the use of the metric system is already legally permissive in this country, and that its alternative use side by side with the British system should result in the ultimate survival of the better system without compulsory legislation being introduced.*

The flaw in this argument is that it is impracticable to have, for instance, two sets of scales in different systems in concurrent use on a shopkeeper's counter. The system in possession, however bad it may be, will never disappear except under compulsion.

2. *That those who desire the introduction of the metric system should lead the way by conducting their own business solely in that system.*

Without some clear indication that the Government will later enforce the general use of the metric system this suggestion is unreasonable, because our industries cannot be regarded as watertight compartments. Any industry so acting in advance of other industries and transport authorities with which it is in daily contact, would merely penalise itself by its voluntary isolation. In this respect the position is analogous to that of the Daylight Saving Reform, from which no benefit could be derived until it was made compulsory.

3. *That the obligation to supply spare parts and renewals of machinery made to British measurements prevents British manufacturers from now adopting the metric system.*

This objection evidently arises from an unwarrantable assumption that our adoption of the metric system would necessarily involve altered dimensions of machine parts. Such is not the cause, because obviously any dimensions now expressed in inches and parts thereof can readily be expressed in millimetres and parts thereof.

The suggestion that metric equivalents can only be shown by employing six figures or so after the decimal point is shown to be without practical foundation when we remember that a tolerance of even one-hundredth part of a millimetre (0.01 mm.) demands much more accurate work than is usually obtainable in our machine shops. Furthermore, it may be observed that equivalents expressed even so approximately as to the nearest whole millimetre—thus dispensing entirely with the decimal point—could not differ from the original Imperial dimensions by more than one-fiftieth part of an inch, and even this degree of accuracy would suffice for the majority of dimensions excluding, of course, those of machine bearings and the like.

Finally, it should be remembered that the obligations to supply spare parts of existing machines has never yet prevented the progressive manufacturer from altering his designs from time to time so as to embody improved features. Many such changes are likely to be made at the present time, due to the war-accelerated evolution in technical progress, and to the new outlook of British manufacturers in the consideration of their peace programmes.

4. *That the opposition of the textile trade is an insuperable objection.*

The British textile trade and its nomenclature claims to be so firmly established throughout the world that it is immune from the international competitive influences to which other British trades are subjected. Assuming this to be the case, it is, in itself, no reason why other less privileged British industries should be perpetually handicapped.

The Swiss watch industry, which similarly held out against Switzerland's adoption of the metric system was accommodated by being specially exempt from the compulsory provisions of the Swiss Metric System Act. Ultimately the Swiss watchmakers realised that they had denied themselves advantages enjoyed by their fellow countrymen, and they accordingly came into line voluntarily by themselves adopting the metric system.

Furthermore, according to the recent report by the Committee on Commercial and Industrial Policy (Cd. 9.035): "Of the yarns exported in 1913 about one-third was taken by Germany" (already a metric country), and "rather more than half of the total exports of piece goods went to British possessions." None of this trade would be jeopardised by our adoption of the metric system, and in any case the sale of textiles in terms of the metric system is a relatively simple procedure already widely practised.

5. *That if we now adopted the metric system we should be at a disadvantage in competition with Germany.*

The metric system is not a German system, but, in spite of the anti-French sentiment then existing, Germany adopted the metric system from France immediately after the Franco-Prussian War. Since that time 24 other countries have likewise adopted what is now truly described as the *International* metric system, and we accordingly remain a "non-metric" country to our own serious disadvantage.

If it be argued that until they became expert in the use of the metric system British manufacturers and merchants would be at a disadvantage as compared with similar classes in Germany, it may be observed that such a temporary handicap must be faced sooner or later, and, this being the case, it would be a positive advantage for us to accept it now.

At the present time the sentiment of the world is anti-German, due to Germany's callous disregard of international and human laws during the war. We, however, cannot rely on such a sentimental protection favouring us indefinitely, and should therefore act promptly, and get through our transition troubles before Germany is rehabilitated in the world's esteem.

6. *That while our trade with "metric" countries might be stimulated we should jeopardise our trade with "non-metric" countries.*

This suggestion evidently arises from a superficial survey of official statistics which show that our pre-war exports to "metric" and "non-metric" countries respectively were approximately equal. This bare statement needs modification owing to the factors detailed above under the heading "Overseas consumers."

By eliminating the values of our exports to our Colonies and to Russia from the "non-metric" side of the balance sheet, and by noting the prospect of closer trade relations with our European Allies, the volume of "non-metric" trade sinks into comparative insignificance. There is no evidence to show that any of our "non-metric" trade would be jeopardised by our adoption of the metric system.

7. *That the United States still retains the British system.*

It is necessary we should appreciate that the manufacturers of the United States have hitherto been primarily concerned in supplying the needs of their own country and of the English-speaking "non-metric" countries comprised within the British Empire.

The passing of the Webb-Pomerene Act (legalising trade combinations for export purposes), and other indications, show that America now aspires to be an exporting nation in the widest sense, and it is accordingly not surprising to find that Americans are now regarding the metric system with increasing favour. *Vide* appended extract from *Board of Trade Journal*, December 19th, 1918.

There can be little doubt but that whether the United Kingdom or the United States first adopts the metric system, the other would rapidly follow, and, having regard to our relatively greater dependence upon our export trade, it is obviously incumbent upon Great Britain to make the first move although it would not be surprising to find the less conservative Americans taking the lead.

GOVERNMENT ACTION NEEDED.

Assuming that in the national interests, the exportation of manufactured goods must be increased, it is obviously the duty of the Government to facilitate international communications.

From the above notes it is clear that our use of the international metric system would be a useful step in that direction.

The Act of 1897 legalised the metric system in this country, but experience has shown that further Government action is required to bring it into general use.

It is accordingly suggested that the Government should forthwith announce that, having regard to its desire to simplify education, to assist in the re-establishment of British industries on a scientific basis, and to promote the development of British export trade, it has decided:—

1. To encourage the more widespread use of the international metric system both in the United Kingdom and in the British Empire generally by officially recommanding all British manufacturers hereafter engaging in new industries or introducing new standards into existing industries, to base their operations on the metric system on the distinct understanding that the Government will adopt that system as the sole legal system of weights and measures as and from .... (a date, say, five years hence) or upon such later date as Parliament may then decide.

2. To specify hereafter the requirements of all Government Departments in terms of the metric system wherever possible, and to recommend other public and semi-public buyers (*e.g.*, Home and Colonial Governments, municipalities, railways, harbours, &c.) to follow their lead in the national interest.

3. To require the railways and other transport companies to accept consignments of goods described in terms of the metric system without demanding a statement of British equivalents.

4. To prepare the way for the complete change-over from the British Imperial system to the International metric system:—

(*a*) By forthwith extending the practice already adopted of establishing metric standards by Order in Council, *e.g.*, on October 14th, 1913, the metric carat of 200 milligrams was ordained the legal standard of weight for precious stones and pearls).

(*b*) By forthwith abolishing all apothecaries weights in favour of metric weights throughout the entire trade in fine chemicals and drugs.

(*c*) By forthwith abolishing many of the multiples of existing British units, and by requiring all quantities to be expressed of units of single units instead of in a complex of units, *e.g.*, to express weight in lb. instead of in tons, cwt., qr., lb.

5. To prohibit the modification of existing British units or the introduction of any new units other than metric units.

6. To publish all official British trade statistics in terms of the metric system, retaining for a few years their British equivalents where necessary.

7. To require all scholars in public elementary schools to be efficiently taught the international metric system.

8. To require all applicants for appointments in the Civil Service and other Government Departments to have a working knowledge of the International metric system.

9. To advise the Overseas Governments of the British Empire and of the United States of America that the British Government has decided to adopt the international metric system as its sole legal system of weights and measures, and to invite them to take similar action, so as to secure its establishment as the universal language of quantity at the earliest possible date.

10. To act promptly along the above lines, so that British manufacturers and merchants may frame their peace programmes with full knowledge of the Government's intentions, and by their extended voluntary use of the metric system anticipate its compulsory employment by the entire community.

Extract from the *Board of Trade Journal* dated December 19th, 1918, page 781.

United States of America.

International High Commission and the Metric System.

"More extensive use of the metric system in the trade and commerce of the United States is recommended in a resolution adopted by the United States section of the International High Commission, of which Secretary McAdoo is chairman, according to a statement issued by the Treasury Department. The statement follows:—

"The Commission has regarded this subject as of particular importance in the United States. It is, of course, unnecessary for the United States section to recommend to the Latin-American sections of the Commission anything in connection with the metric system, which is exclusively in use throughout Latin-America.

"One of the main obstacles to documentary uniformity as between the United States and Latin-America is to be found in the fact that the United States does not make the use of the metric system obligatory, and consequently its consular documents have to allow the use of that system merely as optional. Any uniform system of classifying merchandise, however, will require on the part of the United States thorough-going and complete adherence to the metric system.

"*Use in Trade.*—Of more importance than statistical and administrative questions is the use of the metric system in trade. Now that the United States is being drawn into closer and more vital commercial relations by the rest of the world, and particularly with Latin America, her manufacturers and exporters will be obliged, the report states, to meet the demands of their prospective customers in a somewhat more accommodating frame of mind than hitherto. Only the English-speaking nations still have to adopt the metric system of weights and measures, and among them the British Empire, or at least Great Britain, seems to be giving serious consideration to the necessity of making a change."

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electric Accumulator Shunting Locomotive.

We illustrate herewith a new electric battery locomotive, recently built at the Horwich works of the Lancashire and Yorkshire Railway Co., which is now being used for shunting purposes at the company's electric power station at Clifton Junction. The motors are capable of hauling three loaded 20-ton coal wagons, or a load of 90 tons, on an incline of 1 in 189, in addition to the weight of the locomotive, which is 17 tons 18 cwt. The locomotive was built in substitution for five electric capstans, and it is capable of dealing with twice the load at twice the speed, as compared with capstans, as well as doing it at a lower capital and operating cost. The locomotive can be operated by one man, and, when the work is not continuous, this man can perform other duties, as the machine can be left without any attention, although it is ready at a moment's notice to perform shunting work. The equipment consists of two British Thomson-Houston motors, of 18 H.P. each, at hourly rating; the gearing has a ratio of 4.6 to 1. The battery consists of 120 Chloride I.M.V. 6-type "Ironclad-Exide" cells, the capacity of which is 71 KW.-hour at the 4½-hour rate. The total weight of the battery is 5,040 lb. The type of cell used is that commonly employed by the Chloride Co. for road vehicles, but in this instance the ebonite containers are made with thicker walls than in cells of the standard pattern. It is claimed that if the working instructions are adhered to, a life of anything up to 1,000 cycles of charge and discharge may be

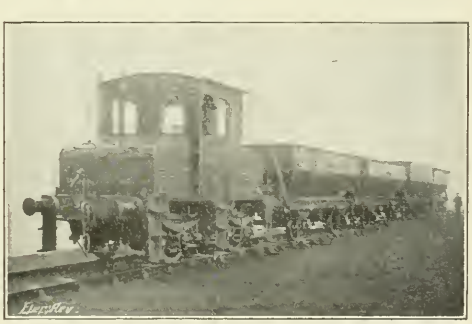

Fig. 1.—Accumulator Locomotive for Shunting.

expected from this battery, and, with careful treatment, a mileage of 25,000 miles has been secured from similar batteries without any electrical repairs being necessary. The battery is divided into two parts, so that the two portions can be used in parallel, to give a voltage of 120, or in series to give 240 volts. The capacity of the battery will admit of 3.2 hours' continuous shunting, or a 4-hour continuous run "light" on the level, at an average speed of 20 miles per hour. During the dinner hour it is usual to give a boosting charge, which will give back to the battery 40 per cent. of its total charge, raising the shunting capacity to 4½ hours. The motors are controlled from the cab by a series-parallel controller on the motors at 120 or 240 volts. There are ten notches on the controller for both voltages; the 120-volt supply is used for shunting purposes, giving a speed of about 4½ miles per hour, and the 240-volt supply for running from place to place at 20 miles per hour on the level. The tractive effort at the tread of the wheel up to 2.3 miles per hour is 5,400 lb., and at 4 miles per hour 2,500 lb., at the hourly rating. The wheels are 3 ft. in diameter, spaced 9 ft. apart, and the total length over buffers is 21 ft. 11 in. The locomotive is fitted with the vacuum brake as well as a hand brake. The vacuum is produced by means of a small electrically driven exhauster worked from either half of the battery. There is a commodious cab, and the engine has a very neat and workmanlike appearance.

Street Lighting at Oxford.

Oxford is the first city in England in which the new form of illumination by Holophane refractor lanterns in conjunction with gas-filled lamps has been adopted for public lighting. These refractor lanterns have been introduced to solve the problem of securing uniform lighting and of reducing the diversity factor to a minimum. At Oxford the main streets are illuminated by medium-size Holophane refractor lanterns provided with 300-watt gas-filled lamps, on old arc-lamp posts 22 ft. high. The spacing ratio varies from 7.9 to 13, and the illuminating diversity factors from 7 to 17 respectively, the maximum illumination being 0.495, and the minimum 0.027 and 0.028 foot-candles at the pavement level. From these figures it will be seen that with this system a remarkable uniformity is obtained. There is an absence of glare, as with the refractor the virtual illuminant is increased to the size of the refractor. The posts are provided with brackets for 60-watt gas-filled lamps and refractor lanterns, for use after 12 p.m. Fig. 2 illustrates the lantern refractor complete, and fig. 3 shows the refractor in section, indicating the application of the Holophane principle. The horizontal illumination recorded at the road surface is shown in fig. 5.

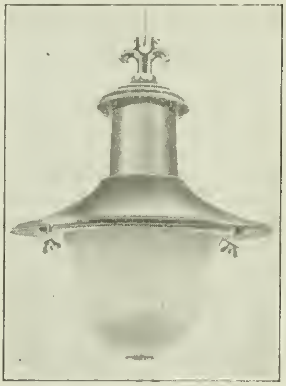

Fig. 2.—Holophane Refractor Lantern.

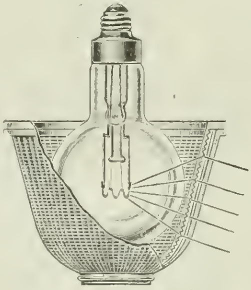

Fig. 3.—Refractor in Section.

The Holophane lanterns are made substantially of cast-iron, enamel-coated, green outside and white inside, and stoved. They are weather-proof, and provided with ample ventilation, and they have no screws, hinges, or working parts exposed to the weather. The refractors are made of transparent glass with prismatic refracting surfaces designed on the lens principle, allowing the light to pass through and directing the illumination in the direction desired. They are in two parts, one fitting inside the other, the two portions being sealed together to make a dust and weather-proof union. The prisms or lenses being on the inside close together, and the outside and inside surfaces of the complete refractor being perfectly smooth, the lanterns can be cleaned easily. The refractors are very stout, and can be roughly handled without fear of breakage. When fitted on the lanterns they can be easily opened for replacement of lamps or for cleaning purposes. Holophane refractors have been in use for some time in connection with railway, dock, harbour, and other Government lighting schemes. The large saving effected by the use of these lanterns in place of arc lamps, the avoidance of glare, and the uniformity of illumination make them particularly suitable for street and other outside lighting. They are of British design and manufacture throughout, the makers being Messrs. Holophane, Ltd., of Westminster, S.W.

New "Tricity" Oven.

Our illustration, fig. 4, shows the new form of oven made by the British Electric Transformer Co., Ltd., Hayes, Middlesex, which, now that labour and materials have been released, the company is placing on the market. The oven, which differs in several points from the original "Tricity" design, was designed and tested some time ago, but due to war conditions it has been in abeyance. The new oven, in which fixed side elements within the oven and solid lagging between the double sides have been adopted, has an internal capacity of 2½ cu. ft., the loading being: Maximum, 1,350 watts; medium, 750 watts; and low, 375 watts.

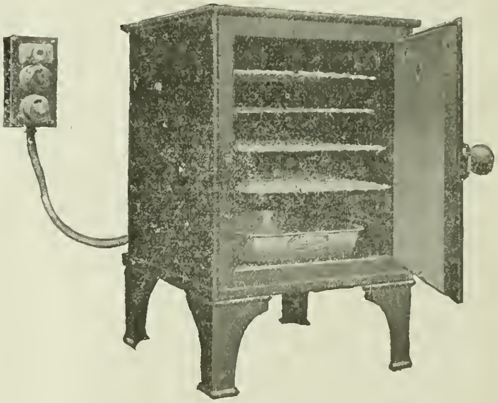

Fig. 4.—New "Tricity" Oven

Six 250-watt elements are fitted, two on each side at the bottom, and one on each side on the top; the elements are of the gilled type, the resistance wire being wound on mica strip and enclosed in casing. The elements stand out so as to throw heat direct on the food being cooked, and allow for circulation behind. They are all easily replaced. The oven is made of sheet steel, having a cast-iron front and door frame; the lagging is slag wool, and the unit is complete with a cast-iron control panel consisting of 3-heat switch and "Zed" fuse. While the manufacture of the ovens is proceeding, we understand that the company is in a difficulty with regard to switches, and until a supply of the latter is available the ovens will have to be kept in abeyance. It is a great pity that we should have to depend on supplies from overseas for such an essential item.

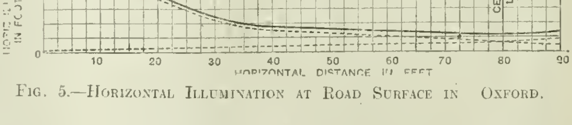

Fig. 5.—Horizontal Illumination at Road Surface in Oxford.

THE USE OF HIGH-PRESSURE AND HIGH-TEMPERATURE STEAM IN LARGE POWER STATIONS.

At Glasgow, on December 10th, Mr. J. H. Shaw's paper (an abstract of which appeared in our issue of July 19th, 1918) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers.

Mr. W. J. Poole said that turbine makers had anticipated the developments now under discussion. As far as boilers were concerned, makers could be relied on to take care of themselves, but when it came to pipe work and accessories it was sincerely to be hoped that history would not repeat itself. The increase in temperature proposed by Mr. Shaw was a very big one. Even now could anyone say that there was such a thing as an inch-valve suitable for, say, high-pressure drains which would behave satisfactorily for any length of time under a pressure of 450 lb., and a temperature which might vary between 100 and 700 deg. F.? He suggested the provision of adjustable tension rods, not across the expansion piece, but all the way between the stop valve and the main header. These tension rods would absorb the thrust, and would at the same time allow the expansion head to fulfil its proper function while maintaining the valve on the superheater and also the header at their relatively correct distance apart.

Staff-Sergeant L. M. Jockel thought they might expect some developments for the improvement of the lower limits of temperature and pressure. They required greater knowledge of the metals employed, particularly in flanges and bolts. He had had considerable trouble even with 160 lb. pressure and 200 deg. superheat in this connection, and thought this matter should be more stringently dealt with in specifications. The stress put upon bolts was unfair to anything but bolts of a special design. It would be unwise to jump to very high pressures and temperatures; for near future requirements 250 to 275 lb. per sq. in. and a total temperature of 650 deg. F. was quite sound practice. The line of development in turbines should be towards the two-cylinder type, with separate h.p. and l.p. turbines. It was absolutely necessary to split the turbine into two sections. The l.p. could be used alone in the event of emergencies, and the h.p. portion could be specially constructed to suit high pressure and temperature conditions, while the l.p. cylinder, being of double flow, would offer marked advantages in regard to blade relieving area and diminution of end thrust. The condenser water heads could be designed so that the tubes could be cleaned in sections without shutting down the turbine or the condenser itself.

Mr. R. B. Mitchell said it would be interesting to know if the series of failures in America of large turbo-alternator sets had anything to do with high pressure or superheat.[*] The work which had been done at Rugby, and which was soon to be done at the North Tees station of the North-East Coast Supply Co., would no doubt go far to provide accurate data upon which further advances could be made. He agreed that the use of higher pressures would mean the use of steam pipes of smaller diameter. Mr. Shaw's figures for a 20,000-kw. set at 200 lb. and 800 deg. F. gave the steam supply pipe as 14 in. in diameter. This seemed to be on the small side. The 15,000-kw. sets at Dalmarnock station, which would be put into commission this year, would have 16-in. pipes, and the pressure was to be 275 lb. at the boiler with 700 deg. F. temperature. Whilst admitting that the boiler of the future might be one of the flash type with no reserve, it was regrettable that it should be so, as a boiler which held a good body of water was a great asset in a station where sudden peak loads had to be dealt with. He agreed that the old method of arranging for ring mains on steam-pipe systems was bad, and would be difficult to maintain with present-day pressures and temperatures, apart altogether from its inefficiency. With piping designed on the unit principle, the author stated that "a small equalising main need only be provided at the end of the boiler house. The speaker took that to be meant for equalising purposes only. Would it not be well to have this pipe at least equal to the pipe supplying one turbine unit so that the overload capacity of the boiler could be utilised to the fullest extent, and each section of boilers need not necessarily run its own turbine only? The size of the pipe connecting boiler-house sections at Dalmarnock was 16 in., although it was not designed quite on the unit principle, but one section of eight boilers fed into a common receiver from which steam was supplied to two turbine units, and it was these receivers in each section of boiler house which were connected together by a 16-in. pipe. Steam pipes having welded flanges had given, in Glasgow T.C. experience, excellent results at the moderate pressures and temperatures now in use, but there seemed to be a contrary opinion favouring riveted flanges.

Mr. A. Page said he had worked out the overall efficiency coal to units on the bus-bars for several of the cases given in the schedules. The highest on 100 per cent. load factor was 22.2 per cent., and last year in the Glasgow area the efficiency of coal to units sold was only 8.6 per cent. There was ample room for improvement here in this direction. Mr. Shaw appeared to put the internal efficiency of the turbine rather high, and the steam consumptions were certainly better than the figures given by manufacturers when quoting. The assumption of constant boiler-house efficiency in making calculations was hardly justified, and it would require a great deal of demonstration to convince engineers in the West of Scotland that a 28-in. vacuum could be maintained using cooling towers on a large scale. He was surprised to find that pipe manufacturers supported the retention of welded pipes and flanges.

Mr. A. E. M'Coll said power houses were at present employing steam pressures much lower than those of Mr. Shaw's figures, and with a lower boiler-room efficiency, they were obtaining overall heat efficiencies slightly higher than those given by the author. While it was not clear that a good case could be made out for a jump to the maximum pressures advocated, there was no doubt that an increase in present practice was justified. Engineers generally were content with a good, instead of the best, vacuum, and condensers, in many cases, were giving better vacua than the turbine could properly deal with. A portion of the increased expenditure which the author advocated might profitably be employed in obtaining lower absolute pressures where the facilities were available, and a better overall heat efficiency would result. This did not apply to stations having cooling towers, and there might be justification here for the employment of the highest pressures.

Mr. J. H. Shaw, in reply, said he saw no reason why steam pipes should not be designed to take care of all the longitudinal stress. It was a wrong policy to do away with economisers and put in air heaters. As to ratio of water to steam, he had got 44, 45, and 46, though he did not think a designer would guarantee those figures. The breaking of bolts was due more to repetition of higher stresses than to high stress. Expansion joints were going to be one of the troubles with high-pressure steam. There was a lot to be said for and against welded flanges.

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[*] See Elec. Rev., April 12th, and October 4th and 25th, 1918.

TESTING FIAT ELECTRICAL ACCESSORIES.

As an example of the painstaking care necessary in electrical work, the methods adopted in the Fiat motor car factory are interesting. This firm decided that all its cars should have both electric lighting and starting, and immediately set to work to build up an important electrical department.

In every branch of the electrical works there is an inspector who controls the quality and workmanship of every article, according to a system common to the whole factory. In addition, there is a special laboratory for purely electrical tests. Thus, in order that there shall be no doubt as to the quality of the insulation, every collector, armature, and winding is passed through a measuring apparatus. The windings of the armatures of both dynamos and motors are examined in a special way by means of a magnetic field fed by an alternating current which induces a current in the single spirals. These induced currents show by their intensity whether any defect exists in the armature winding or insulation.

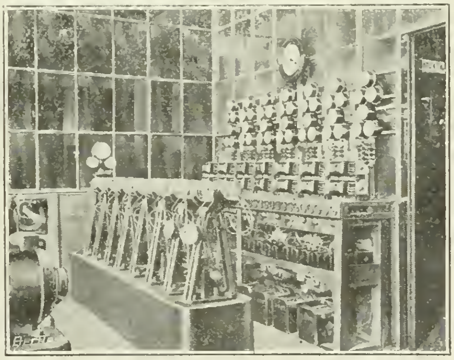

Fig. 1.—Fiat Electric Lighting Sets on Test.

The individual components having successfully passed their tests, the completed motor is mounted on a bench and tested by means of an electromagnetic brake on the Pasqualini patent. During this test the motor is made to run under maximum load. Following this there is a separate test of the engagement and disengagement of the starting pinion with the gears cut on the flywheel. Instead of a petrol motor, there is an electric motor fitted with a flywheel similar to that used on the cars. The starting motor is clamped down to a bench, and the engagement of its pinion with the electric test motor is noted. The use of an electric instead of a petrol motor for this test enables the resistance to be varied at will and provides complete accuracy of control. After having gone through the load and starting tests each starting motor is sent back for expert examination.

The current regulators, the cut-outs, electric horns, tremblers, all important accessories composed principally of a winding of fine wire with multiple spirals, are examined separately with a view to proper insulation. The two main regulators are enclosed in a metal housing, to which the eleven wires for the lamps, horns, &c., are connected. After being adjusted, each regulator is inserted between a dynamo and a storage battery and practically tested in order to see that it operates correctly under varying engine speeds and various intensities.

The most interesting test is that which includes the dynamo, lamps, and all the electric instruments and the wiring. Sets of 14 dynamos are mounted on a special stand (fig. 1, p. 83), and are driven by their own belts from shafting. Each dynamo supplies current through storage batteries to the full set of lamps used on the car, with the regulators, fuses, ammeter and voltmeter forming a part of the car equipment. In other words, the complete equipment as it will be established on the car is put under test. The dynamos are run at varying speeds, in order to correspond to the actual working on the car, for a period of two hours. During this time the dashboard instruments, which are mounted on a bench opposite the dynamos are subjected to as much vibration as they would undergo with the automobile engine running at full speed. The vibrations are obtained by attaching the instrument board to a shaft with an unbalanced flywheel.

There is a final test which is only possible when the car manufacturer makes his own electrical appliances. The regulator and cut-out are mounted on the front of the dashboard, the ammeter and switch are mounted; all the wires are cut to the right length and the terminals made, so that the dashboards go to the assembly shop with the electrical work fully completed. The assemblers merely have to bolt the dashboard in position and connect the wires to the lamps, the dynamo, and the battery. But before these completed dashboards are sent out of the electrical department they are tested by connecting up the wires to a standard set of lamps, dynamo, and battery, and operating them for a short time. This avoids all possibility of a defective installation finding its way to the assembly shops.

Finally the road testers verify the general working of the electric installations when the chassis are taken out for their general road trials.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

21,549. "Electrical heating appliances." J. G. Lozano. December 23rd.

21,559. "Electromagnetic drive for wheels, pulleys, &c." R. N. Lennox. December 23rd.

21,561. "Telephone exchange systems." C. A. W. Hultman. December 23rd.

21,568. "Electric lamps, &c." J. Burri. December 23rd. (Switzerland, October 8th.)

21,589. "Metallic conduits for electric wiring." F. S. Rippingille. December 24th.

21,592. "Sparking plug for explosion engines." R. Hureau & E. Ruillet. December 24th. (France, December 26th, 1917.)

21,610. "Incandescent electric lamps for automobiles, &c." Butlers, Ltd., and A. Reeves. December 24th.

21,614. "Cut-out device for use in electrical installations." General Engineering Co. & A. Quinn. December 24th.

21,628. "Electric welding." J. B. Murray & T. E. Murray. December 24th.

21,631. "Electric welding." T. E. Murray. December 24th. (U.S.A., October 4th, 1917.)

21,633. "Method of electric welding." T. E. Murray. December 24th. (U.S.A., February 6th.)

21,634. "Processes of electric welding." J. B. Murray. December 24th. (U.S.A., March 22nd.)

21,638. "Group-switching arrangements for automatic or semi-automatic telephone exchanges." C. A. W. Hultman. December 24th. (Sweden, December 24th, 1917.)

21,640. "Sparking plug." H. E. Broderick. December 24th.

21,643. "Luminous electric switches, bell pushes, &c." S. G. H. Long. December 24th.

21,644. "Electric switches." L. Benvenuti & G. Cigolini. December 24th.

21,653. "Automatic temperature control for electric irons." S. L. Goldebrough. December 24th.

21,667. "Wireless telephone transmitters." L. B. Turner & R. H. Wagner. December 24th.

21,680. "Magneto-electric machines." A. M. Allen & R. B. North. December 24th.

21,681. "Interrupter devices for magneto-electric machines." A. M. Allen and R. B. North. December 24th.

21,698. "Generation of electricity." C. M. Walter. December 30th.

21,731. "Railway-signalling apparatus." K. Cunningham. December 30th.

21,769. "Direct-current converters." R. van Cauwenberche. December 30th. (France, September 24th, 1917.)

21,776. "Automatic electric water-heaters." G. P. Dennis & J. Law. December 30th.

21,779. "Call indicator for telephone systems." Automatic Electric Co. and Automatic Telephone Manufacturing Co. December 30th.

21,781. "Twin sparking plug." J. Wilkie. December 30th.

21,783. "Means for actuating ignition magnetos for starting internal-combustion engines." J. Smith, December 30th.

21,804. "Sparking plugs for internal-combustion engines." W. Stead. December 30th.

21,807. "Electrical devices or motors." M. V. O'Leary. December 30th.

21,811. "Method for transforming kinetic energy in gases into electrical energy, and manner for utilising latter for carrying-out gas reaction." C. Petersen. December 30th. (Norway, January 8th.)

21,812. "Electric lamps." F. Lewis. December 30th.

21,813. "Electric clocks." Coventry Electric Clock Co. & T. Rushton. December 30th.

21,815. "Lifting magnets." F. N. Pickett. December 30th.

21,831. "Electric furnaces." E. Fenton. December 30th.

21,862. "Article for preventing crossed wires, rods, &c., vibrating or rubbing on one another." S. W. Pemberton. December 31st.

21,863. "Electric furnaces." E. Waring & W. Waring. December 31st.

21,869. "Dynamos." H. Leitner. December 31st.

21,894. "Electric arc furnaces." U. Magini. December 31st. (Italy, December 31st, 1917.)

21,897. "Construction of magneto-electric machines." G. M. Turner December 31st.

21,913. "Electric switches." E. Abegg. December 31st.

21,914. "Electric switches." C. E. Foster. December 31st.

21,922. "Detection and generation of sound, &c., waves." R. A. Fessenden. December 31st. (U.S.A., December 31st, 1917.)

21,930. "Automatic telephone exchange system." W. C. Davey & Sterling Telephone & Electric Co. December 31st.

1919.

43. "Electric accumulators." W. A. T. Twist. January 2nd.

46. "Electric switches and switch fuses." F. G. Warburton. January 2nd.

65. "Submarine telegraph cables." F. G. Creed. January 2nd.

84. "Electrification of seeds and apparatus therefor." J. Hewett & J. J. H. Sturmey. January 2nd.

139. "Ignition systems." Dayton Engineering Laboratories Co. January 2nd. (U.S.A., January 2nd, 1918.)

140. "Ignition systems." Dayton Engineering Laboratories Co. January 2nd. (U.S.A., January 2nd, 1918.)

165. "Electric fuses." Simplex Conduits, Ltd., & L. M. Waterhouse. January 3rd.

200. "Obtaining single-phase alternating electric currents from three-phase and *vice versa*." A. M. Taylor. January 3rd.

216. "Dynamo-electric machines." E. J. Harman & E. le Bas. January 3rd.

219. "Distributor devices for ignition apparatus." Remy Electric Co. January 3rd. (U.S.A., April 4th, 1917.)

221. "Electrode holders." P. W. Fawcett & J. Wightman. January 3rd.

222. "Electric furnaces." P. W. Fawcett & J. R. Hoyle. January 3rd.

226. "Magnetos." Soc. des Moteurs Salmson (Systeme Canton-Unne). January 3rd. (France, January 23rd, 1918.)

248. "Electrical resistance." W. Geary & L. Satchwell. January 4th.

253. "Sparking plugs for internal-combustion engines." A. Wilkinson. January 4th.

276. "Electric switch for burglar alarm." G. Nissen. January 4th.

293. "Electrical heating devices." J. P. Annacker & T. H. Ryan. January 4th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

8,926. Method of and apparatus for the electrical treatment of gases. L. Bradley. June 21st, 1916. (107,389.)

13,106. Apparatus for heating water by electricity. J. H. Robinson and W. O. Workman. September 13th, 1917. (121,302.)

13,136. Brush gear for electric dynamos and motors. J. C. Todman, T. L. R. Cooper & A. A. Lyon. September 13th, 1917. (121,304.)

14,654. Electrical cut-out. W. H. Illingworth. October 10th, 1917. (Cognate application 6,007/18.) (121,305.)

16,244. Electrical signalling systems. Sterling Telephone & Electric Co., F. G. Bell & W. C. Davey. November 7th, 1917. (121,308.)

16,261. Electric accumulators. H. Leitner & W. H. Exley. November 7th, 1917. (Cognate application 4,529/18.) (121,309.)

16,475. Electrically-heated clothing or fabrics. Igranic Electric Co., A. H. Curtis & S. R. Wright. November 9th, 1917. (121,310.)

16,581. Maximum-demand controller and load-indicator for electric power installations. C. C. Gow. November 12th, 1917. (121,312.)

18,046. Commutators for dynamo-electric machines. H. Chitty. December 5th, 1917. (121,320.)

18,172. Engine starters. V. Bendix. December 7th, 1917. (121,324.)

18,343. Miners' electric hand lamps. A. H. Railing & A. E. Angold. December 11th, 1917. (121,337.)

18,438. Multiple electric switches. V. E. Joyce & Park Royal Engineering Works. December 12th, 1917. (121,345.)

18,442. Electric transformers. British Thomson-Houston Co. & F. W. Cooke. December 12th, 1917. (121,346.)

18,497. Engine starters. F. B. Dehn (Eclipse Machine Co.). December 13th, 1917. (121,349.)

18,683. Electric cable grips. W. T. Henley's Telegraph Works Co., W. H. Nichols & E. Moore. December 15th, 1917. (121,358.)

18,963. Magnetos and like dynamo-electric machines. J. F. Poynter. December 21st, 1917. (121,364.)

1918.

945. Method of and apparatus for manufacturing lead linings for accumulator boxes, cistern boxes, and the like. W. G. Claughton and J. W. Claughton. January 17th, 1918. (121,383.)

1,032. Electric relays. Automatic Telephone Manufacturing Co. & P. T. Bates. January 18th, 1918. (121,385.)

2,572. Cooling of alternating-current motors. W. F. Higgs. February 13th, 1918. (121,399.)

3,883. Mechanism for regulating the electrodes of electric furnaces. V. F. Turner & J. Walker. March 6th, 1918. (121,409.)

6,257. Electric welding and riveting apparatus. Thomas Spot Welder Co. October 8th, 1917. (120,028.)

7,724. Machines for slotting commutators and other articles. F. E. Aurand. May 11th, 1917. (115,849.)

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THE

ELECTRICAL REVIEW.

VOL. LXXXIV. JANUARY 24, 1919. No. 2,148.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

Owing to the continued increase in the circulation of the ELECTRICAL REVIEW in recent months, an increase which has become accelerated since the signing of the Armistice, we cannot guarantee that casual copies will be available. The only way to make sure of securing a copy regularly as issued, is to place a definite order with a newsagent, or else to subscribe direct to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, London, E.C. 4.

THE RE-SETTLEMENT OF OFFICERS.

ONE of the biggest problems in connection with the whole subject of demobilisation is: "What shall we do with our officers?" To sing their praises in superlatives is needless to-day—'twere but to paint the lily; the long record of their brilliant and self-sacrificing achievements has already covered them with glory. The question now is not so much what do we *think* of them: nor is it what are we going to *give* them—that is settled up to a point nationally, and they do not ask our sympathy. As in the case of the private, so in the case of the officer—perhaps more so; "he does not want your sympathy—find him a job." Suitable employment and training for employment—these we are under solemn obligations to provide them with. It is stated that there are 400,000 men "of the officer type," and that they represent practically the best brain-power of the nation between the ages of 18 and 45, or thereabouts. It is useless pretending that the signing of the Armistice found us ready with properly developed plans for this or any other part of the work of general demobilisation. We had talked much about what we were going to do, and had put many things down on paper, but, as we have frequently stated, in referring to the aspirations and visions of reconstructors, some little thing may occur at the vital moment to jumble up the whole mosaic. Yet there can be, to our minds, little doubt about it that demobilisation along industrial lines is the sanest, because it is the safest course, and we believe that it will not be difficult to persuade the men to see it so, and to acknowledge that it is in their own interest. We welcome this week the publication of a new pamphlet, No. 12, of the "Reconstruction Problem" series issued by the Ministry of Reconstruction, because it puts forward fully and fairly the whole subject of the re-settlement of Army and R.A.F. officers. We consider it to be the duty of every employer and of every manager to secure a copy, and study the difficulties of the problem at once. We hope also that a copy will be put into the hands of each of the whole 400,000, while those who are interested in the future well-being of any particular officer will be unwise to overlook it. In this vast army of officers, as this pamphlet states, are comprised the whole University and Secondary School class, as well as the pick of the brains outside that class—"men who were selected from their fellows by reason of their intelligence, capabilities, and qualities of leadership." No doubt a very large number of them are "pivotal" men badly needed in business and the professions, but many of them were never in any business or profession at all when they joined the Colours. Perhaps a large percentage of them were at college or school, and the years spent in the Forces are those which would otherwise have been devoted to efforts to launch out upon a career in life. Speaking generally, the man who was singled out for his intelligence, capabilities, and leadership in the Army should be a very desirable man in civil employment, as calculated to assist the nation in the direction of increased efficiency. Who denies the need for such qualifications in commerce and in industry to-day? We used to have interesting discussions in the old days regarding the suitability of university men for business; well, we ought to have no difficulty in finding them if we want them now. But the problem is not one merely of university or secondary school men. There are others who were in very different circumstances, and were raised from the ranks on natural or acquired merit, which in their humbler civilian circumstances they had been denied the opportunity of developing. They will not return to civil life the lads or men that they were, and in many cases, though they have been deprived of years of business training, experience, or education, they may return to other positions in the same businesses fitted to fill far more responsible duties. For example, even an office boy of wayward ways may speedily develop the aptitude which may fit him for successful service "on the road" after he has got right down to the ways of the business with the older intelligence and the initiative that the Army ways may have encouraged in these years of impressionable mind. We suppose there is hardly a business in the country where this question is not exercising the minds of those in authority. They saw the lad leave them perhaps raw and timid; watched his progress under the influence of the training camp; noted the change in the tone of his correspondence; observed with pride and satisfaction the soldierly bearing, the quickness and the "liveliness" of the "boy"; welcomed him home from the Front with the older atmosphere of a maturer thoughtfulness and seriousness. And now the prospect of the return of the officer of "intelligence, capability, and leadership" to the "place kept open" is before them. It goes without saying that the conditions of industrial, commercial, and professional life have not altered in such a way that a large proportion of the 400,000 men can be absorbed under such circumstances that they will be able to continue the social position that distinguishes the officer from the general run of the men in the ranks—wealthy men and men of position as the latter have often been. Some hardness of lot is inevitable in cases, though it will be softened for a time by the gratuity provision. They will be assisted more satisfactorily from the national point of view, and in their own permanent interest, by the system of training and education that has been established as part of the policy of resettlement. But the early perplexity of some men arises from the doubt concerning the kind of career that they ought to adopt. They have arrived at years when they, in the ordinary course of events, would have practically completed their training. With the utmost goodwill in the world towards such we cannot but endorse the wise words contained in this pamphlet where it says:—"The average young officer . . . will be spared many disappointments if he makes up his mind to the fact that he has to make a new start, no longer as a cog in a vast machine, but as a competing individual." No longer will his pay automatically stand to his account at Cox's; "from the day the physically fit officer puts on civilian clothes he has to fight his own battle for his bread and butter. His earnings will be proportionate to his value as a civil worker." "It is not likely that there will be many 'cooshy' jobs to be stepped into—the competition will be too keen. *Training, education, character—these are the factors that are going to count.*"

It is well that the situation should be put thus frankly. The man who has fearlessly faced the Enemy will not be downhearted as he comes up against this difficulty. He will not have to go alone, for the Ministry of Labour established about a year ago an "Appointments Department" to advise candidates as to the career for which they are best qualified, to provide information regarding methods of training, and to bring employers and those seeking employment together under favourable conditions. This reads very encouragingly, and perhaps when the Department is able to deal with matters along the lines of these aspirations we shall make good progress. It may not, from what we hear, be working very efficiently yet, but it will need to hasten its improvement if it is to contribute that assistance in guiding men to their proper destiny that we all desire it to contribute. Everyone must recognise, however, that no Government Department, whatever its degree of efficiency or its wealth of good intention, can ever achieve great things in so difficult a matter unless there are present two things:—(1) A determination on the part of employers to afford suitable opportunity for men to qualify themselves and a willingness to give the spirit of enterprise free scope in connection with their businesses; (2) a due appreciation by the men of the necessity for making one more gallant effort—namely, to equip themselves for a new career by taking advantage of the facilities provided for their education and training.

"May I Start a New Electrical Business Yet?"

From a number of inquiries that have reached us during the last few weeks, we judge that some of our readers are uncertain whether they are yet free to open new businesses. We are not at all surprised, for it is not easy to keep oneself fully informed regarding the multitude of official notices concerning the withdrawal of restrictions. The Press, which during the period of hostilities suppressed so much interesting information by desire of the Censorship authorities, is not able to devote much space to present-day matters for which the Government desires publicity. The result is that unless the public read many daily papers, or make a regular study of either the *London Gazette* or the *Board of Trade Journal*, they don't know exactly where they are. The withdrawal of restrictions, speaking generally, is most welcome, and most of our readers would be thankful if the pace of their retreat could be accelerated: but steadiness must be assured as far as possible. There are very good grounds why electrical men want to get rid of all restrictions on business development. We are all on the tip-toe of expectation. There is much leeway to make up, and there are new opportunities presenting themselves of which we want to take advantage. The withdrawal of restrictions on the carrying out of new electrical installation work has, naturally enough, induced contractors to get a "move on" with their plans for resuming ordinary business operations. The demand for power for munition works having fallen off, domestic and non-munition industrial work can be considered by the supply authorities; but the many contractors who are with the Forces, and whose businesses have been left in other hands to be kept alive, or have been closed temporarily in their absence, would not like to know that their business interests were to be further jeopardised by new competition because they are not fortunate enough to secure early demobilisation. As our "Business" pages have shown, a number of such men have returned, and probably more will speedily follow as "pivotal" or "one-man business" men; but electrical men of certain types are still required with the Forces for particular duties. Notwithstanding these circumstances—and, of course, these men will have our sympathy, and, we hope, our practical consideration—there should soon be good work for electrical contracting businesses, of both the larger and the smaller descriptions. This opportunity has been recognised by several of our correspondents who want now to "make good," and they therefore ask what they are at liberty to do. The answer to their chief question is that the Retail Business (Licensing) Order of 1918 is still in operation. This Order prohibits the opening of any retail business without a licence issued by, or under the authority of, the Director-General of National Service being obtained. Where there is near at hand a closed or affected business of another electrical man who is with the Forces, there is, we should suppose, little chance of the licence being granted, but where there is virgin soil, possibly the Director-General would give the applicant every consideration, because presumably he is concerned, as everybody else ought to be, in assisting developments which will help the return to normal trading operations, and will provide employment for some of the vast bodies of men whose period of "national service" may be expected to come to an end before very long.

National Electricity Supply.

At last the report of the Committee formed by the Institution of Electrical Engineers to consider the proposals for the reorganisation of electricity supply has come to our hands, and we reproduce it *in extenso* elsewhere in this issue. We are glad to find that its recommendations are in harmony with the views that we have expressed as to the necessity of the immediate appointment of the Board of Commissioners, and that, unlike the various reports on the Reports of which we have published abstracts during the past few months, it is a thoroughly practical, business-like, and impartial expression of well-considered opinion. The proposal to appoint five Commissioners is approved, but, in accordance with the strong feeling which has been evinced in the country, it is advised that *all* of them be permanent or appointed for long periods, and independent of all other interests, and that the appointments be made sufficiently attractive to secure the very best men in the country. It is urged that general legislation to set the business of electricity supply on a new basis is impracticable, and that the most urgent necessity is to appoint the Commissioners as an advisory board, to guide undertakers in carrying out new developments, and to advise the Government on legislative matters connected with the electrical industry. It is interesting to note that the Committee would grant no administrative powers to the Commissioners, who apparently would take over the duties of the Board of Trade and the Home Office, but would exercise no initiative except through Parliamentary action.

The Training of Engineer Officers.

The publication of our leading article of last week, on the subject of electrical engineering in the Army, has elicited further information which, while it amply confirms our main contention—"that in future electrotechnology in the broadest sense ought to form an essential part of the training of a Royal Engineer officer"—also indicates that the conditions obtaining on our side of the trenches had a good deal to do with the differences between the methods adopted by our Engineers and by the enemy. For instance, we understand that on the British Front there were few, if any, large generating stations within reasonable distance of the fortified areas, the only large supply undertakings in the western districts being those situated at the Channel Ports; the Huns, on the other hand, were in possession of such industrial towns as Lille, Douai, Laon, &c., and of the coal fields of Northern France and Belgium, which greatly facilitated the development of electricity supply in the occupied districts. Further, the Huns made a point of destroying the French towns on our side of the line, whilst we abstained from shelling the French towns in German hands, out of consideration for the interests of our Allies. Hence it was far easier for the enemy to carry out extensive schemes of electricity supply than for ourselves. But where more favourable conditions prevailed—as at the ports above mentioned—not only did our Engineers make use of the existing plant, but they also carried out extensions on a considerable scale, and developed the use of electric light and power in base hospitals, laundries, bakeries, workshops, &c. While our statements with regard to the use of large numbers of small petrol-electric sets were correct in respect of the active Front, where much of the work had to be done under emergency conditions, better arrangements were made in the more stable areas out of range of enemy operations; as far as possible the small sets were replaced by oil-engines and dynamos of suitable rating, on a semi-permanent basis, and in many cases the local A.C. supply was brought into use, some 200 transformers, aggregating about 7,500 K.V.A., having been supplied for this purpose during the last 18 months of the war. In order to comply with local requirements, a considerable amount of high-pressure underground cable was laid in preference to overhead mains, but the latter were employed freely in the back areas.

Apparently some of the most serious difficulties met with by the Royal Engineer officers in charge of such work—who were professional engineers in civil life before the war—were due to the factor to which we directed attention in our issue of January 10th—the predominance of direct-current practice in this country. Owing to this circumstance, the supply of high-pressure insulators was extremely scanty, and it was equally difficult to obtain electricians acquainted with A.C. work. Transformers of suitable voltages were also not readily obtainable, and our standard types of switchgear, &c., while admirably adapted for permanent home installations, were absurdly out of place under war conditions. As time went on, these difficulties were overcome; and when the Armistice was signed quite a number of schemes were under way which, if they had been completed, would have put a different complexion on the appearance of our electrical practice at the Front.

We made it clear in our first article[*] that it was not our intention to reflect on the professional ability of our Royal Engineers—our explicit purpose was to point out the defects which had been revealed in the system under which they were trained; as we then pointed out, those defects could be made good by commissioning men who in civil life were engaged in such work, provided that they were given a free hand; and where this was done, excellent results were obtained. But it was naturally difficult for the officers in high quarters, trained under the old system, to appreciate the point of view of the professional electrical engineers, and to realise the importance of adopting modern methods. We are glad to think that this difficulty also has been largely overcome, and but for the sudden cessation of hostilities we should have seen a great improvement in electrical practice at the Front.

The Future of the Electrical Industry.

It hardly needs arguing to-day that the electrical industry is a "key" industry. Our readers know it; we believe that the official mind that has had to investigate such matters knows; we believe also that even the general public knows a little bit about it, though whether it understands the real importance of the electrical industry to the industrial and common life of the United Kingdom, and to the security of the entire Empire, we are in some doubt—it never has been taught the lesson. The Branch Committee of the New Engineering Industries Committee of the Ministry of Reconstruction is composed of men in direct connection with the electrical industry, and their findings should carry weight with all—the industry itself, the official mind, and the public. But the public must be brought to know somehow what those findings are, and the reasons for them. Their heads are too full of other things just now—so are the columns of the daily papers, and the technical Press they seldom read. We reproduce the report of the Electrical Branch Committee, in full, on another page of this issue. The chief conclusion arrived at is that, in order to secure the full development of the electrical industry, whether in existing or new lines, there must be some measure of Government protection in the home markets against dumped and sweated goods. We commend the complete statement to the careful attention of all our readers. There is no department of British industry for which the prospects are more brilliant than the electrical branch, provided that the safeguards against ruthless attack from outside are adequate. Anti-enemy sentiment will not die at once, but that alone will not suffice. We may, through the Peace Conference, be brought into nodding acquaintance with Germans again when they are committed to paying the full price for all their crimes. Nobody can yet foresee where Bolshevism and Socialism will leave them or the peoples of any other nation; but their efforts to secure their export trade position may be expected to be as enterprising and unscrupulous as in the past. We have got to be prepared against that.

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[*] Electrical Review, May 24th, 1918.

WIRELESS IN THE WAR.

Singular indeed it is to reflect that but for our command of wireless telegraphy, the British Empire, long ere this, would have been rent asunder, and we in these islands would have been writhing, crushed under the heel of the brutal Hun. Yet it is absolutely true. That wireless communication has played an important part in every field of war is, of course, a matter of common knowledge; not only have its functions been important, but also its operations have been in the highest degree romantic—to it were entrusted on a thousand occasions messages of world-wide interest, of the most tremendous import; by wireless the outbreak of war was proclaimed, the signing of the Armistice was announced; the despair of the heroes of Kut—the surrender of the Turks; the arrogance of the German High Command informed the world that the Allied cause was lost—the United States Government declared itself on the side of civilisation and liberty; but, above all, and most important of all, the British Navy maintained communication with its innumerable component elements in every part of the world. And that is why we say that the *rôle* of wireless in the war was of pre-eminent importance to the Allied cause—for without it the submarine menace could not possibly have been averted, and this country would inevitably have been starved into submission, despite the utmost efforts on the part of our glorious Navy.

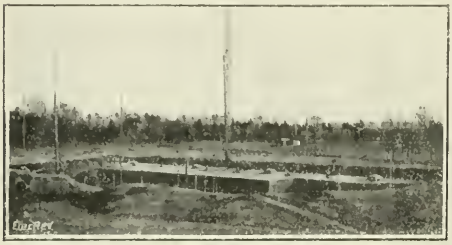
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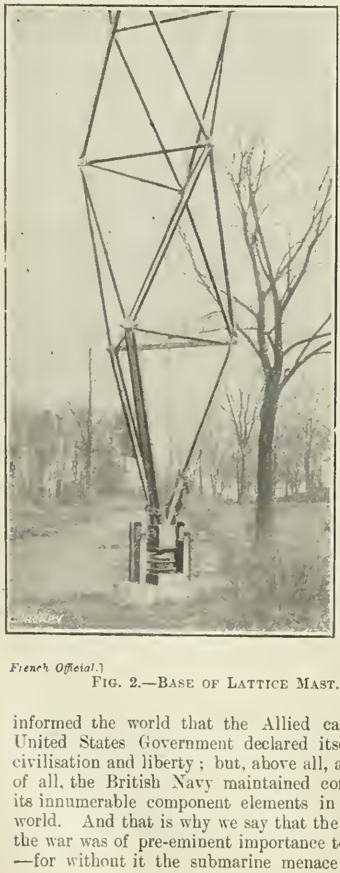
Fig. 1.—Wireless Station at Metz.

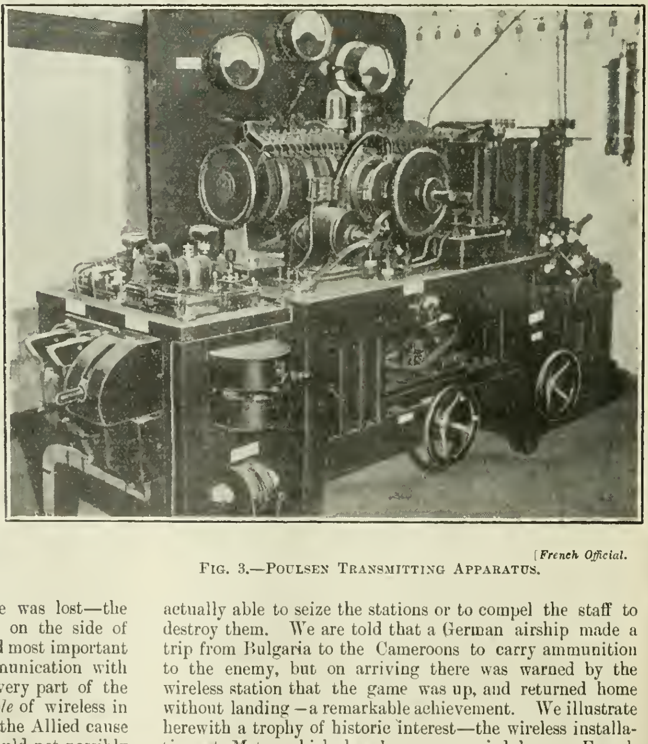

French Official.]
Fig. 2.—Base of Lattice Mast.

To recapitulate the numberless services that have been rendered to the nation by wireless telegraphy—and telephony—during the war would be impossible; it was active and effective over land and water, in the air, and (we are now told) even below the surface of the sea.

Just as the art of aviation has been developed by four years' warfare out of all knowledge, so have astonishing advances been made in the technology of wireless telegraphy and telephony, so that continuous communication can be maintained even with aeroplanes, in spite of the deafening roar which prevents ordinary conversation when aloft, and airmen can actually call up telephone subscribers in their own offices and talk to them.

We are all anxious to learn the details of the new methods which have been developed, but no doubt we shall have to wait until the seals have been attached to the Treaty of Peace. In the meantime, let us not forget the debt which we owe to the science, and let us congratulate ourselves that Mr. Marconi, when he arrived in this country as an unknown young man with a mysterious "box of tricks," was not disheartened by the lack of enthusiasm for his proposals with which he was met in official circles, but persisted in the evolution of wireless telegraphy within our borders despite all obstacles until success crowned his efforts, with the result, fortunately for us, that when war broke out this country led the world in the development of wireless communication.

The Germans were not far in the rear; they made the most extensive use of wireless telegraphy throughout the war, and had it not been for "circumstances beyond their control," it would have been of priceless value to them in destroying our commerce; their communication with their colonies was maintained in each case until we were actually able to seize the stations or to compel the staff to destroy them. We are told that a German airship made a trip from Bulgaria to the Cameroons to carry ammunition to the enemy, but on arriving there was warned by the wireless station that the game was up, and returned home without landing—a remarkable achievement. We illustrate herewith a trophy of historic interest—the wireless installation at Metz, which has been reoccupied by our French


[French Official.
Fig. 3.—Poulsen Transmitting Apparatus.

Allies, after an alienation of nearly half a century. The station itself is built below ground level, as shown in one of our views (fig. 1); there are two aerials, one supported on a timber mast, the other on the peculiar "Rendahl" mast of steel lattice work, of which the base is illustrated in fig. 2. The wooden mast is 300 ft. high, and tapers from 32 sq. in. at the base to 12 sq. in. at the top; it stands on a concrete block. The steel mast is built up of triangles of steel tubing, making a very light structure, 80 metres high. Other views show the Telefunken and Poulsen transmitting sets, and the receiving apparatus.

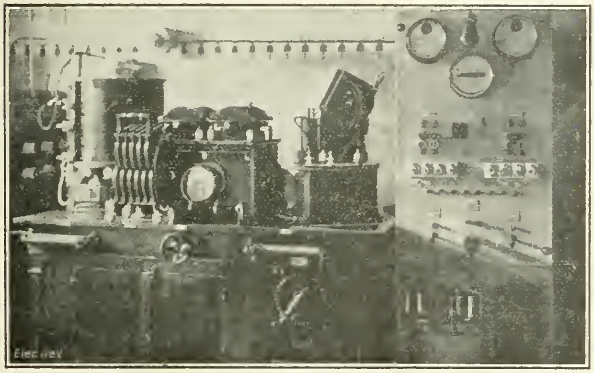


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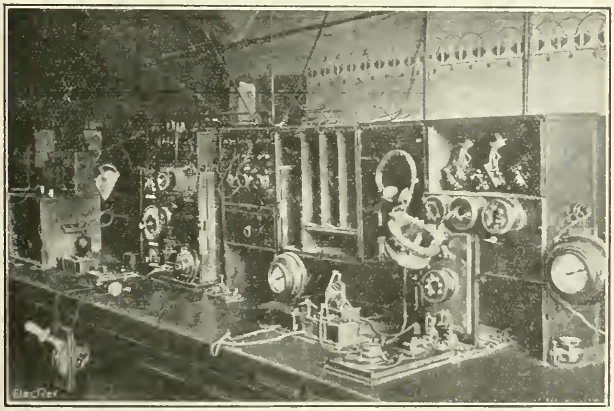
Fig. 4.—Telefunken Transmitting Station.



[French Official.

Fig. 5.—Receiving Apparatus.

Underwater Wireless.—A dispatch to the New York *Times* states that Navy Department officials have disclosed how underground and through-water wireless has been put to practical use during the war. This was heretofore a carefully guarded secret. This development resulted from the private research of James H. Rogers, of Hyattsville, Maryland. In practical use the new system has so far been employed only in receiving messages. Radio messages sent from powerful stations in Europe are being read at underground receiving stations in the United States in some cases better than when caught by elaborate and expensive air stations. By the adaptation of the Rogers theory submarines under water can intercept radio signals sent from shore, and with a crude apparatus the scientist succeeded in transmitting signals 2 miles from a submerged wire simulating a submarine. Officials state that it is possible that underground and water transmission can be developed to a considerable extent.—*Pall Mall Gazette.*

THE ELECTRIFICATION OF SEED.

By H. HAMMOND DUNN, F.L.S.

Three years ago my attention was drawn to a series of field experiments which were being conducted on Mrs. Duke's estate at the village of Godmanstone, near Dorchester, with cereals, the seed of which, previously to being sown, had been electrically treated.

I got in touch with the inventor of the process, Mr. Henry E. Fry, who resides in the village of Godmanstone, and found that he had been experimenting with electrified seed, and had come to the conclusion that he had achieved success.

On the eve of the following harvest, I accompanied a few well-known agriculturists on an inspection of crops grown from electrified seed, and the marked difference between the produce of the treated and the untreated fields of oats and wheat convinced us "that there was something in" Mr. Fry's invention, which he had patented under the title of "The Wolfryn Electrochemical Process."

Some five plants for the treatment of electrified-seed corn were installed by the beginning of 1918, the largest being at Poole (Dorset). The seed is treated by being placed in a tank containing liquid chemicals. The tank is connected up to the electric supply, and immediately the seed is placed in the tank the electricity is turned on, and passes through the grain, the process continuing from three-and-a-half to six hours, according to whether the seed corn is barley, wheat, or oats. At the expiration of the period required to treat the seed, the current is switched off, and the grain is conveyed from the tanks to a kiln—up to the present a malt-kiln has been found the best—and is dried at an even temperature. The seed is then sacked up and sent out to the farmer.

Nearly 2,000 acres of electrified-seed corn were harvested in 1918. One farmer grew as much as 300 acres, whilst others ranged downwards to as low as one acre.

So much has been said in the past concerning the application of electricity to farm crops, that it was only to be expected that a considerable amount of interest would be taken in the results of the 1918 harvest of grain grown from electrified seed, and much criticism brought to bear on the process.

At the end of July and the first week in August I had the pleasure of conducting three parties on a tour of inspection of some of the crops grown in Dorset from electrified seed, and they included, amongst others, representatives of the Governments of the United States of America, India, South Australia, Brazil, and Japan, several well-known agriculturists and representatives of the London daily and agricultural Press.

A few days later an investigator—not appointed by the patentees nor by any person interested in the process—came into Dorset, and took measurements of the standing corn, which was cut in his presence, and he afterwards conducted the threshings himself. The results of his investigations were as under:—

Mr. W. W. Lovelace, Piddlehinton, Dorchester, gain on wheat from the produce of electrified corn over untreated, 12 bushels per acre.

Mr. C. Foot, Bincombe, Dorchester, gain on wheat, 6½ bushels per acre.

Mr. H. J. Cake, Burton, Dorchester, gain on barley, 16 bushels per acre.

Mr. W. W. Lovelace, Piddlehinton, Dorchester, gain on oats, 5¾ bushels per acre.

Mr. H. Legg. Blashenwell. Corfe Castle, gain on oats. 18 bushels per acre.

Messrs. S. & H. Smith. Rollington Corfe Castle. gain on oats 19½ bushels per acre.

The investigator, who was connected with one of the well-known agricultural colleges, arrived at these figures after making most careful tests from plots picked out by himself from fields ranging from 2½ to 20 acres. Other results, given by farmers themselves, after threshing, are as under:—

	Bushels per acre.
Mr. S. Hawkins, Whitestone Farm, Exeter, gain on wheat...	8¼
Mr. A. T. Cock, Ford Farm, St. Cleer, Cornwall, gain on wheat	12
Mr. W. F. Smith, Godmanstone, Dorchester, gain on wheat...	7¼
Mr. A. H. Moore, Leatherhead, Surrey, gain on wheat ...	5¾
Mr. R. S. Hicks, Welbraham Temple, Cambridge, gain on oats	5
Mr. B. Godwin, Moreton, Dorset, gain on oats	12
Mr. W. F. Smith, Godmanstone, Dorchester, gain on barley	2

Messrs. Holman & Son, of Totnes, South Devon, also report that two of their customers had gains on barley of 50 per cent. and 21 per cent. from the produce of electrified seed over the untreated. It is not an exaggeration to state that 90 per cent. of electrified seed has produced gains over the untreated produce in the harvest of 1918.

The seed should be sown in the ground within 35 days of treatment.

The visible effect to the eye of electrifying the seed is to blanch it; thus red wheat after treatment becomes pale red, whilst white wheat becomes a purer white.

Another effect of the process on the seed is that the weight per bushel is diminished.

Great care is needed in properly drying the seed after its removal from the tank; if the grain is not properly dried failure is almost certain to result.

In addition to a gain on the produce of the grain there is usually, but not always, a substantial gain in the quantity of straw per acre from electrified seed.

There is usually but little difference to the eye in the appearance of the crops grown from electrified and untreated grain until after the plant has come in ear, and the most marked difference which I have noted is the tillering properties of the plants grown from electrified seed.

At present, the process only applies to wheat, barley, and oats, but Mr. Fry is experimenting with potatoes, maize, rice, tomatoes, and vegetable seeds, and has already achieved much success.

No account of the electrification of seed would be complete which did not bear tribute to the publicity given to it by Dr. Charles Mercier, the famous brain specialist, whose letters in *The Times* and other well-known journals aroused so much interest in the "process" last spring. It was a great pleasure to Mr. Fry and his friends to know that Dr. Mercier was able to visit several farms and inspect the crops grown from electrified seed on the eve of last harvest.

Mr. H. L. Bromby, the engineer to the process, has also accomplished much "spade" work, and it is due to his untiring efforts that some 25 plants for the electrification of seed corn have been, or are being, installed in this country.

Electricity in Agriculture in Italy.—A writer in *Annali d'Ingegneria e d'Architettura* discusses the necessity for the wider application of electricity to agriculture, especially for ploughing, threshing, pressing hay and straw, and for pumping water for irrigation purposes. He describes the construction of an experimental network, comprising 40 km. of high-tension conductor with 20 distributing centres, installed on the Roman Campagna with the collaboration of the Rome municipal electricity works. From the first, threshing and pressing operations were carried out with mobile transformer houses and electric motors mounted on carts, at a cost from 10 to 15 per cent. lower than where steam-power was used. A number of orchard owners have installed motor-driven pumps for irrigation purposes, and with these the cost of irrigating a hectare of ground is from 35 to 50 lire per month, according to the lift of the pump. Owing to the uneven character of the ground in the neighbourhood the author suggests that, to save expense, large tracts of ground should be irrigated from one centre. Experiments made with electric ploughing showed the system to be convenient and practical, provided the work was carried out with method.

BRITISH ELECTRICAL TRADE IN CHINA.

II.—The Difficulties.

By PROF. MIDDLETON SMITH, M.Sc., M.I.Mech.E.,
Hong-Kong.

It would be absurd to under-rate the peculiar difficulties of the China trade. It is, for example, useless for a firm in Great Britain to send a representative out to China and expect him to send home orders within a month or two of his arrival. A successful local doctor in Hong-Kong came out to the Colony, and was nearly a year resident here before he commenced to practise. He was collecting friendships and making acquaintances. "Friend pidgin," as we call it, goes a very long way in the Far East.

The climate is so very different to that "at home" that it takes some time to get used to it. Once you get over the period of being "a griffin," or a stranger, all goes well. But the conditions of life in China are also different from those in Europe. The ways of the Chinese are said to be "strange and peculiar," and so they seem to the Westerner at first. After a time he understands. The handling of the Chinese, from the man of commerce to the official, or even to the household servant, needs experience. You must pay for it.

The exchange difficulty should not be minimised. Fortunes in business can be, and have been, made, and lost, in exchange transactions. An example was given in a previous article of the fluctuations. But there is a system of "buying gold" ahead. A few weeks ago the writer "fixed exchange" a year ahead for his long leave in England in 1919 at a 3s. 8d. dollar, or say at 5.4 dollars to the pound. When Bulgaria and Turkey went out of the war no local bank would fix it for a month ahead. To-day the dollar is at 3s. 3d. It would be possible for the writer to "sell ahead" and make about from £10 to £12 on every 100 "fixed" without using a penny or a dollar in the transaction, except the profit. But if the dollar had gone to 4s., the laugh would have been the other way. A local business man "fixed exchange" for a year ahead at a 2s. 4d. dollar. When the year had passed and he took up his deal, the dollar was at 3s. 3d. If he had not "fixed," but had waited, he would not have lost 11d. on each 39d. bought. Let us call the loss about 28 per cent. There is, of course, a very distinct amount of chance operating in these matters, and the Chinese gamble on the exchange as all Orientals love to gamble on anything. The shrewd business men cannot always be sure about exchange, but they have experience that the newcomer has to buy—sometimes dearly.

A great difficulty of the British is their excessive dislike to throw a sprat in order to catch a mackerel. That must be done in China. The Chinese like the sprats—by them "they are tickled to death," as the Americans say. Any firm that wants to reap the harvest of trade in China must spend money in sowing and watering the soil. Style means a good deal in China. There are many different ways of advertising, but they all cost money. The Chinese, and for that matter the European "old China hand," dislikes meanness or cheeseparing. The thing must be done well if it is to be done at all. "Nothing succeeds like success" is particularly true of business in China. The most valuable asset of any commercial concern is a general halo of prosperity around its "taipan," of chief manager.

Therefore, the concern ambitious for the China trade must be prepared to spend money in the early years—to throw the sprat. The mackerel swarm in the seas of China trade; the sprat will catch it all right unless the sprat is too skinny, or the line is held by nerveless hands. Not only must the hands be capable, but they must be experienced concerning China.

Another difficulty is the language problem. There is now a fashion for young men to "come out from home" to firms, and to attend the Chinese language schools of the local chambers of commerce. That is excellent in its way. But observation rather goes to show that by the time a man has mastered the technicalities of engineering work he is not keen on studying what is about the most difficult language on earth. Of course, he ought to do it, and he should be encouraged to do it. Yet it is probably cheaper in the long run to supply a British technical man with a Western educated young Chinese assistant. That is the plan that the writer would put into force if he were exploiting machinery in China. For these young Chinese know their own countrymen as no European of less than about 20 years' residence in China knows them.

Finally, the difficulty with British machinery is that it is all too good. The Chinese do not like a heavy capital expenditure. They find it difficult enough to raise the money—they have great faith in the shares of British companies, but they will not readily co-operate with each other. They do not want brass bearings if cast-iron lined with white metal is good enough. They do not care a button about appearances. So long as the wheels go round and the price is the lowest—that is their purchase. It is futile to talk of educating them above that sort of thing in a year or so. It will take time—but do not let us lose the markets meanwhile. And do not forget that the Chinese like to have plenty of time allowed to them before they pay up.

The Japanese.

A great difficulty facing the British in China to-day is the competition of the Japanese. It is always best to be quite frank about these matters, and the best friends of any Oriental nation are those who speak out. But it is unfair to hide the good, and throw the searchlight only on to the bad points.

The writer has travelled in Japan, and he came out to the Far East decidedly pro-Japanese. Are not these amazing people our pupils—did not Sir Alfred Ewing, Ayrton, Perry, Robert H. Smith, and other men so well known in our engineering profession introduce the science of engineering into Japan? Do we not rather flatter ourselves as we refer to Japan as the "Britain of the Far East"? Are they not our Allies? Yes—all of those things are true. Japan is, for the tourist, a delightful country. The Japanese are a nation of devoted patriotism and remarkable adaptability to Western progress. They are splendid organisers. But in political and economic matters the Japanese have done some things that need a good deal of explanation.

Let it be bluntly said at once that the Japanese are unpopular in China. The Chinese feel themselves powerless, but they have long memories. The European traders in the treaty ports have many stories about the Japanese, and very few of them are in their favour. Decidedly, the Japanese are unpopular in China.

There are two recent political actions of Japan which must make the Briton pause. When our country was at grips with the biggest menace to its life—when the days were dark and we had not America with us, there swept through Japan a violently anti-British Press campaign. The military party of Japan was in power—no patriotic Briton out here at the time will ever forget that attempt to damage our national prestige, in the Far East, at the most critical moment of our history. It was, as the phrase goes, "not playing the game." If the Japanese Government did not inspire it, some of us think it could have prevented it.

The ambitious island power of the East has acquired more wealth than any other nation because of the war. Fortunes have been made out of munitions and ships. She is our ally; she turned the Germans out of Tsingtao, and she swept the seas to protect her own and our commerce. But in 1915 she made demands on China which astounded the oldest residents out here. An acute American observer, Paul Myton, who has lived in the Far East, wrote of those demands at the time as follows:—

"The programme of Japan in China, as announced from day to day during the last few months, is simply stupendous. The mind is overwhelmed in its consideration. The world has never known anything like it before, and our own petty declarations of the Monroe Doctrine on the Atlantic and the Open-door Policy on the Pacific become mere kindergarten babbling by comparison. For not only does Japan demand of China her most valuable concessions, industrially and commercially, including railways and mining franchises, but she would prohibit China from hereafter ceding such concessions to other countries; thus practically making herself not only the absolute political master of China, but, indeed, the lord trustee of all her domain, and in demanding that the Japanese be employed to the highest rank of the army, of the navy, and of the police, as well as to the highest positions in the Customs and Departments of Finance, they attempt to gain an advantage in the perpetuation of that hitherto unheard-of power which is so tremendous in its possibilities as to bewilder the mind in an attempt to find even a moderate comparison to it in the long history of the world's great conquests."

If the British are Allies of Japan, they are, and always they have been, good friends of China.

The thing which makes the British man of commerce feel so sore in China is the fact that the Japanese trader uses methods which he himself will not use. It is useless enumerating examples. The cotton manufacturers in Lancashire have publicly complained. Imitations of British goods are said to be sold as British in a most unblushing manner, although they have been made in Japan.

The electrical trade of Japan has increased by leaps and bounds during the war. So long as the orders are obtained in open competition, and the goods sold are what they are described as, every one in China wishes Japan "Good luck." There is any amount of room in the enormous potential market of China for the output of Japanese, American, and British factories. All that we ask for is a fair field and no favour. We are, indeed, proud of any good work done by the Japanese. But they must not expect British men of commerce to sit quiet while they exclude them, by so-called diplomatic methods, from the China trade. Their record in Korea and Manchuria before the war may have been of small moment to British statesmen, but it did not please British traders.

Let us "keep our end up" in China, and make a bold bid for the external commerce of the country. We can succeed in fair competition with Japan. We shall only be too pleased to see Japan prosper; we want to be friends with her; we admired her pluck in the war against the Russians, and we have a right to remind her that we "kept the ring" for her while that struggle went on. But there are certain definite Anglo-Saxon ideals in politics and trade, and we will not depart from them to please anyone. All we ask for is open competition and the fair deal. We have paid too dearly in this generation because we wilfully kept blinkers over our eyes. It can do Japan no good in the long run to use trade methods which are utterly at variance with Anglo-Saxon ideals. We have full confidence that her statesmen and commercial men will realise that—the sanguine think that already they do so. The British want to trade with Japan as with China; co-operation must be the policy of the future in political affairs; and clean, good-humoured competition in the markets of China. As a fact, the latter really means co-operation, for the greater the stimulus the more will be the trade that goes on. Britain opened the oyster of Chinese trade, but there are plenty of pearls for everyone. We most certainly do not want to exclude any legitimate competitors from the markets of the world. The British trader and manufacturer can hold their own against all comers if all comers play the game squarely.

These words are written in no spirit of malice, nor even of hostility, to Japan. They may seem harsh to those who are blinded by the dazzling brilliance of the Rising Sun. They will be agreed to by 90 per cent. of the Britons in the Far East.

The political difficulties of China cause trade difficulties. The Chinese themselves are by no means free from blame, for they have failed to produce a Government which can govern. It may be true that a country gets the government it deserves; but China could be a wonderful market if the system of the Maritime Customs Service were extended to all the Chinese Government Departments.

The British traders in the Far East think that in the past our own British Government has "let us down" badly in China. Even Lord Salisbury made us "lose face" in the late nineties, and to "lose face" in China means complete humiliation. Perhaps the greatest difficulty before the British trader in China can be solved only in Downing Street. It is therefore essential to be alert in London as well as in China if any of the golden eggs laid in China are to be gathered. But, commercially, there are very few geese in China. On the other hand, there is a great deal of gold and other minerals.

Japanese Electrical Goods.

The fact of the matter is that the Japanese electrical goods are not doing the engineering profession very much benefit in China. To put it bluntly, so far as the observation of the writer goes, they are shoddy. They have been selling at high prices, and Japanese wires, lamps, &c., bought in Hong-Kong have been very unsatisfactory. The climate of the China coast finds out any bad spots in cables, instruments, &c. Remember, that for some three months in the year the humidity of the atmosphere is about 90 per cent. Japanese wire had to be used by the writer—he could not get other. But it gave him plenty of trouble.

The Japanese are in danger of overlooking the fundamental principle that in all engineering work time tells the tale. The Chinese buyer is ignorant —he just buys the wire or the lamps because they are cheapest. Some of us are using up our energies in the endeavour to explain that tests are essential. Slowly, but surely, the Chinese of the coast ports is "getting wise" on this point. But the Japanese are going inland and getting orders for complete installations in remote towns and villages. When the plant is in all goes well for a few months. Later on the failures will discourage the Chinese.

The Briton goes to the other extreme. He is too apt to forget that this is a very rough-and-ready country. He does all right in the Treaty ports, where the trained British engineers appreciate his refinements. But don't waste money on paint if the goods go up country. And please see that the goods sent out are ready for use. One British firm sent out plant that had never been "assembled." If it had gone inland it would never have been used. It took modern machinery in Hong-Kong, and also expert European supervision to make the plant "gee."

The following example proves that the Chinese are keen on electric light:

In 1914 the Hong-Kong Electric Co. sold 614,750 units. In 1916 it sold 5,177,109, and it was compelled to refuse any new connections because its plant was badly overloaded each night. On the one hand, consumers have been indignant because they must not put in a new light anywhere. On the other hand, the local shift engineers have read about life in the trenches with envy. They had a very bad time of it without a scrap of spare plant. The growth of demand by the Chinese was too phenomenal for calculations; it might have been met but for the war. Perhaps in 1920 the figures of 1916 will be doubled.

It is the same everywhere. The Chinese love a blaze of light. A Chinese restaurant uses three or four times as much as one in London; a brilliant light and violent noise is the Chinese aid to digestion!

American competition will help us. Our Anglo-Saxon trade rivals work well with us in China. They do good pioneer work. They show us how to "push" things, but they will forgive an admirer for reminding them that they have not had anything like the experience in trade or in engineering that the Briton has had. But they will be with us in the maintenance of the ideals of our profession. Their technical goods may be less finished than ours, but it does not disgrace the reputation of engineering work. Americans give me the impression that they expect much bigger profits on their capital outlay than do the British. Wherever they go they spread the gospel of the English language and the "get-on-with-it" point of view. They have made up their minds to get into this market, but there is any amount of room for them and for us. It is absurd to suppose that they can drive us out. We may slip off the car because we are asleep, but they will never push us off. It is right to add that, usually, they are more popular with the Chinese because they are rather less of what they call "the higher brow" type than the average Briton. They do not hesitate to mix freely with the Chinese. We suffer just a little in China from the traditions of the Anglo-Indians.

The next article will deal with the rewards open to British engineers and manufacturers in China.

NEW ELECTRICAL OPENINGS FOR BRITISH MANUFACTURERS.

There has been published this week the report of the Engineering Trades (New Industries) Committee appointed by the Ministry of Reconstruction. Pressure upon our space prevents us from dealing this week with the whole of the ground covered. We therefore limit ourselves to the section relating to electrical machinery and apparatus. The Branch Committee responsible for this matter consisted of the following:—

Messrs. J. Taylor, O.B.E. (chairman); H. Taylor (hon. sec.), Mather & Platt, Ltd.; L. B. Atkinson (Cable Makers' Association); A. F. Berry (British Electric Transformer Co., Ltd.); R. Dumas (B.T.H. Co., Ltd.); G. E. Pingree; D. N. Dunlop (B.E.A.M.A.); B. Longbottom (Electromotors, Ltd.); R. H. Schofield (Ferranti, Ltd.); S. D. White (General Electric Co., Ltd.); F. Hird (Siemens Bros & Co., Ltd.).

The report reads as follows:—

The branch Committee was directed to consider a preliminary list of articles furnished by the main committee, which was afterwards modified to the following:—

Adaptors; arc lamp globes; auto horns and buzzars; automobile lighting accessories; bell relays; batteries; brass caps for electric lamps; cables; car lighting sets; car starting sets; carbons; ceiling roses; clocks and clockwork for recorders; counterweights and pulleys; cut-outs (all kinds); distribution boards; dynamos; electric bells, indicators and their accessories; electric cooking and heating apparatus; electrical measuring instruments of the indicating and geographically recording types and parts of the same; electric truck and vehicle motors; electroliers; fittings (small, of all kinds); flash lamps; flexible metallic tubing; fuse boards; fuses; fans —table, ceiling, and propeller; glassware—heat-resisting and non-heat-resisting; hand lamps; holloware for lighting purposes, including reflectors and shades, lanterns and fittings; indicators; induction coils; insulating materials of all kinds; insulators; porcelain and glass; lamp bulbs; lamp holders (all kinds); lightning arresters for large high-voltage overhead transmission lines; magnets, permanent; magnetos; metallic filament lamps; motors; nickel secondary cells; primary cells (various descriptions); porcelain balance weights; portable electric drills, small; portable electric grinders, buffers and polishers, small; power limiting reactance coils; pushes; resistance wire and strip; sparking plugs; static transformers for electrical energy; street fittings; switches (all kinds); switchgear, extra-high-tension. Open-air sub-station equipment suitable for fixing on poles.—Telephone switchboards; apparatus; accessories and kindred appliances, including mining telephones, mining bells, and mine signalling apparatus; vacuum cleaners; wall plugs and sockets (all kinds); watertight fittings; wire (enamel-insulated).

The committee is satisfied, as a result of its investigations, that the majority of the items in this list cannot correctly be described as "either not made in the United Kingdom before the war, but were imported or were made in the United Kingdom in small or insufficeint quantities." As regards most of the items, ample manufacturing facilities undoubtedly exist, and, in many cases, existed before the war, for meeting the whole requirements of the United Kingdom and the Colonies, and, in certain cases, for taking care of the export trade to other countries. These facilities were not, however, fully employed owing to the importation of articles from abroad.

Certain items rightly appeared in the above-mentioned list, and as a result of the activities of the committee, intimations have been received of intention to undertake the manufacture of the following articles: Car lighting sets; car starting sets; electric truck and vehicle motors; fans—table, ceiling, and propellor; motors, small ½-H.P. and less; small portable electric drills; small portable electric grinders, buffers, and polishers. The labour employed in the production of these articles would be chiefly women supervised by skilled men. The concerns who propose undertaking the manufacture of the above articles are already established in the electrical industry, and intend simply to add them to their present lines of manufacture.

Certain items appear in the preliminary list which it appears advisable to treat separately from the general run of items in the list, because they are either not manufactured by the average electrical manufacturing concern, or, if so, are, as a rule, the product of an entirely separate factory; in this category fall: (1) Carbons; (2) insulating materials; (3) magnetos; (4) porcelain for electrical requirements; (5) glassware for arc lamps; (6) sparking plugs. (Items 1, 2, 4, and 5 are not products of engineering industry, but are essential to the manufacture of electrical machines and apparatus.)

(I) *Carbons.*—A special report has been presented by the branch committee, entitled "The Manufacture of Carbons in Great Britain, with special reference to Arc Lamp Carbons," which is printed as an appendix to this report.* In view of the vital importance to the country of this industry, as proved by the position which existed at the outbreak of war, the branch committee strongly recommend that measures be taken by the Government to ensure the continuance of the industry. Certain Government departments and public authorities should reverse their former policy, and in the national interest purchase only British-made carbons.

(2) *Insulating Materials.*—The manufacture of insulating materials can scarcely be considered as falling within the scope of the engineering trades, but ample supplies of satisfactory insulating materials are absolutely essential to the carrying on of the electrical manufacturing industry.

"Insulating materials" includes a very wide variety of products, for example:—

1. (*a*) Ebonite; (*b*) magneto distributor materials; (*c*) composite materials other than the above.

2. (*a*) Cable papers and papers generally; (*b*) leatheroid and fibre.

3. (*a*) Mica and mica products; (*b*) porcelain; (*c*) glass.

4. (*a*) Varnished cloth, silk, and paper; (*b*) adhesive tapes; (*c*) varnishes and compounds; many of which were, to a great extent, if not wholly, imported from abroad prior to the outbreak of war. Considerable progress has been achieved during the war in overcoming the deficiency, but the collective opinion of the industry indicates that: (*a*) An enormous amount of research work is necessary. (*b*) Manufacture in this country cannot be successfully established without State assistance and support. The branch committee finds that many firms are preparing for increased production of insulating materials, and is of the opinion that the development of this industry is absolutely essential to the ultimate success and permanency of the British electrical manufacturing industry. The branch committee recommends that electrical manufacturers should purchase in future only British-made insulating materials where obtainable, and thereby foster this branch of industry.

(3) *Magnetos.*—This subject has already been dealt with in the "Interim Report on certain Essential Industries" (Cd 9032-1918). Magnetos are now adequately made in this country, and the exclusion of German magnetos is recommended for a period after the war, except under licence, together with the imposition of a duty on all imported magnetos.

(4) *Porcelain for Electrical Requirements.*—This can be divided as follows:—

(*a*) Porcelain for accessories such as ceiling roses, fuses, lampholders, switches, &c.

(*b*) Porcelain insulators for high tension transformers, switchgear, transmission lines, &c.

(*c*) Porcelain for heating and cooking apparatus, sparking plugs, &c.

The branch committee met representative manufacturers of the British porcelain industry, and a resolution was passed unanimously, strongly recommending immediate co-operation between porcelain manufacturers and electrical manufacturers, with the object of promoting standardisation of parts, research, &c. This co-operation has since been established.

(5) *Glassware for Arc Lamps.*—Glassware is an essential part of the arc lamp, and can be divided into two classes: (1) Heat-resisting glass; (2) non-heat-resisting glass; both of which came exclusively from Germany and Austria and were manufactured in moulds and not hand-blown. The method of manufacture of heat-resisting glass was practically unknown in the United Kingdom before the war. During the past three years some progress has been made in this direction, but it is represented to the branch committee that unless Government support is forthcoming glass manufacturers will not be in a position to supply arc lamp glasses in sufficient quantities after the war.

(6) *Sparking Plugs.*—Sparking plugs for internal combustion engines were manufactured in considerable quantities in this country before the war, but the quantity of finished sparking plugs imported was probably greater than the number manufactured here. In the case of the British Colonies, the bulk of the plugs were of foreign manufacture. The manufacture of sparking plugs is a very specialised trade, which, in the opinion of the branch committee, should be encouraged in this country.

Extra-high-Tension Switchgear.—The development of electric power for industrial purposes and for operating railways will, in all probability, cause a demand for extra-high-tension switchgear for working pressures of 25,000 volts and upwards. The fact that such switchgear has not yet been manufactured on a commercial scale in the United Kingdom has led public authorities in the past to place their orders for such gear abroad, usually in Germany or the U.S.A., on grounds that the work must be given to a concern which has "successfully done similar work before." This position seriously affects British export trade, because foreign competitors have been able to bring forward to the detriment of the British manufacturers, not only their greater experience, but the fact that British public authorities were in the habit of placing their orders for such gear abroad. British manufacturers of switchgear should be encouraged, because they have the capacity for such work, which represents merely a step beyond that which they have been doing successfully for years past.

Dependence upon Other Industries.—The electrical industry is dependent upon other industries for certain requirements, amongst which are the following: Refined oil for transformers and switchgear; silicon steel for generators, motors, transformers, &c; glassware, such as lamp shades and lamp bulbs; flexible metallic tubing for industrial electrical fittings. The war has disclosed a shortage of the above materials, and the branch committee urges the trade associations affected to consider the establishment in this country of the necessary productive capacity.

Effect of Restrictive Legislation.—The electrical industry represents probably the highest development of applied science and mechanical engineering. It originated, broadly speaking, in Great Britain, and should have been nationally fostered and supported, but, on the contrary, its development was hampered by stupid repressive legislation. It was, on the other hand, fostered and supported in other countries, where it consequently progressed rapidly and prospered. To prevent this country from developing the home industry and obtaining its due share of overseas trade, foreign competitors deliberately tried to strangle the industry. Credit should be given to the British manufacturers who under such conditions struggled to maintain their position. It was well known at the time war broke out that the capital employed in the industry was very poorly remunerated, in consequence of which it was difficult to obtain financial support.

Effect of Unrestricted Imports.—The free importation into this country of manufactured goods has always formed a very serious hindrance to the development of the electrical manufacturing industry. Efficient production depends upon specialisation and the scale on which manufacture can be conducted. The insecurity of the home market brought about by the fact that foreign manufactures can at any time be introduced into it for the purpose of deliberately checking or destroying home manufacture by sale at an unreasonably low price, discourages the investment of capital in production on the scale necessary to obtain the highest efficiency, with the result that costs are not lowered as they should be by manufacture on a large scale. The power to withstand foreign competition by keeping selling prices low is thereby lessened, so that the whole system of free importation of manufactured electrical goods, without reference to the conditions under which they may be made has seriously hampered the development of home manufactures, in the absence of which it is difficult to do foreign trade, and to develop to its full extent the trade within the Empire. The free importation of electrical plant and apparatus has made it necessary to share our home market with foreigners, who, operating in their own home markets protected by tariffs and fostered nationally, produce on a far larger scale than the British manufacturer; in face of such conditions the industry cannot be expected to thrive; every effort it may make can be immediately checked by foreign competitors and the home producer has no weapon with which to defend himself.

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* The Committee, in their appendix report, point out that had it not been for the action of one firm in continuing to make arc lamp carbons at very considerable loss to themselves, the country would have had considerable difficulty in meeting the demands for searchlight carbons.

The branch committee finds from the evidence placed before it that it is essential to establish confidence in the future of the electrical manufacturing industry by assuring it the support of the home market, without which the manufacturers practically all agree that it is hopeless to expect any great development of the industry after the war unless some measure of protection is available. The branch committee accordingly passed the following resolution unanimously: "That war experience and the finding of various industrial committees having proved to demonstration that the electrical industry is a 'key' industry, the recommendations of the Electrical Branch Committee will therefore be based on the assumption that the electrical producers of this country are entitled to receive from the Government protection in the home markets against dumped and sweated goods."

Supply of Electrical Machinery for National Power Stations.—In the event of the Government adopting the recommendations of the Electric Power Supply Committee's Report (Cd. 9062), the branch committee recommends the establshment of a permanent Advisory Council. This Council should be mainly composed of leading British electrical engineers engaged in actual manufacturing, and with a view to keeping the Council always up-to-date there should be compulsory retirement of a certain proportion of the members at reasonably short intervals. The branch committee further recommends that the Advisory Council should be consulted in the first instance with regard to the gentlemen it is proposed to appoint as Electricity Commissioners—who should be technically competent—and should continue as a Standing Advisory Council to the Electricity Commissioners, with a view to ensuring that national development and progress are in conformity with the latest workshop methods of quantity production.

NATIONAL ELECTRICITY SUPPLY.

We have received the following very important statement from the Institution of Electrical Engineers, in the form of a letter, dated January 1st, 1919, and addressed to the Rt. Hon. Sir Albert H. Stanley, P.C., M.P., President of the Board of Trade:—

Electric Power Supply.

1. On June 27th, 1918, the Council of the Institution of Electrical Engineers took into consideration the reports of the Committees appointed by the Board of Trade on Electric Power Supply (Cd. 9,062) and Electrical Trades After the War (Cd. 9,072).

2. These Official Reports embody recommendations leading to drastic revisions of the conditions under which the electrical supply industry had been carried on in Great Britain.

Recognising that the future course of development in electricity supply for industrial and domestic purposes, in electric traction, in electrical manufacturing, and in many other branches of electrical business depended on the character of the legislation based upon these reports, the Council was convinced that the Institution of Electrical Engineers, as the body including and representing those engaged in all sections of the electrical industry, should endeavour to obtain and to collate the opinions of these sections on the fundamental issues involved.

In view of the vital importance of a cheap and abundant supply of electricity to the engineering and other industries, the Council decided to form a special committee, and to include therein representatives of the most important consumers of electric power.

3. Each of the following bodies was invited to nominate two representatives, who, with the President and four Vice-Presidents of the Institution of Electrical Engineers acting *ex-officio*, would constitute the Committee:—

The British Electrical & Allied Manufacturers' Association.
The Association of Consulting Engineers.
The Federation of British Industries.
The Cable Makers' Association.
The Incorporated Association of Electric Power Companies.
The Provincial Electric Supply Committee of the United Kingdom.
The Tramways and Light Railways Association
The British Electrical Federation, Ltd
Edmondsons' Electricity Corporation, Ltd
The Iron and Steel Institute.
The Conference of Directors of the London Electric Supply Companies.
The Electrical Contractors' Association.
The Incorporated Municipal Electrical Association.
The Association of Municipal Corporations.

4. At a preliminary meeting of the Committee, held on July 29th, 1918, it was agreed that each Association represented should give separate and independent consideration to the reports of the two Board of Trade Committees, and should draw up their recommendations as to the main lines which future legislation should follow. The Incorporated Municipal Electrical Association and the Association of Municipal Corporations had, however, decided to submit separate reports to the Board of Trade, and were not represented on the Committee.

5. The reports of the remaining Associations were duly prepared and laid before the Committee, after having been adopted in most cases by the respective Councils of the Associations. They accordingly embody the considered opinions of the accredited representatives of several large groups of electric supply undertakings, the great majority of electrical manufacturers, consulting engineers, and the most important users of electric power for industrial purposes in Great Britain.

6. Some of the reports were less detailed than others, and it is therefore not possible to present a combined opinion upon all the matters dealt with by the two Committees of the Board of Trade. On no point of primary importance, however, is any material difference of opinion displayed. Substantially on the main issues relating to present electrical legislation the various Associations showed an impressive unanimity.

7. The following views and recommendations in regard to electric power supply more particularly are, therefore, presented as expressing the united convictions of the Committee, and through it of the many sections of industry which it represents:—

(*a*) The restrictive conditions embodied in the Electric Lighting Acts, the Tramways Act, the Light Railways Act, and the various Acts relating to electric power supply have had a most detrimental effect on electrical progress in Great Britain. This legislation has led to the multiplication of small arbitrary, and uneconomical areas of electricity supply and systems of electric traction; it has discouraged the investment of capital in electrical undertakings by imposing limited tenure with unattractive terms of expropriation, and various other onerous conditions; it has placed obstacles in the way of grouping undertakings into comprehensive systems of supply and transport; it has, generally, prevented British electrical engineers and manufacturers from realising in their own country the highest achievements of which their technical skill and productive capacity were capable, and it has, in consequence, put them under a serious handicap in the competition for export business against countries in which the conditions have been more favourable for successful commercial demonstration.

(*b*) The evil effect of past legislation, emphasised so strongly by both the official reports, necessitates drastic reform of the enactments referred to, both in the spirit and the letter, if the industry is to fulfil its function of providing cheap and abundant electricity for industrial, agricultural, and domestic purposes, and for the development of electric traction on railways, light railways, and roads.

(*c*) In addition to releasing electrical enterprises from the existing disabilities the chief necessities of the situation are: (1) the treatment of the problem of electrical generation and distribution on broad lines, and (2) the provision of simple forms of procedure in obtaining powers for electrical utilities of all kinds.

(*d*) In order to secure these and other essentials of ordered progress, the proposed appointment of a Board of Electricity Commissioners is welcomed, subject to the provisions expressed below.

(*e*) The Committee is strongly convinced that, owing to the complexity of the technical, administrative, and financial problems involved in a comprehensive scheme of electric supply reform, it will be found altogether impracticable to deal directly with the task of reconstruction by means of general legislation covering all the points at issue. It accordingly urges that immediate action should be confined to the creation of the Board of Electricity Commissioners, which should have powers and functions as outlined in the following paragraphs. There should be a gradual development in the establishing of the administrative machinery as the necessity is felt, otherwise the industry may be hampered in the future by excessive organisation to the same extent as it has been in the past by the conditions which have been referred to.

(*f*) This Board should be a tribunal of skilled men, free from political influence, charged generally with the duties of (1) examining all proposals for the extension and consolidation of existing electrical enterprises, (2) recommending to the Board of Trade and to Parliament, for authorisation, schemes which are on the soundest financial and engineering lines, and (3) advising the Government on legislative matters for the encouragement of the electrical industry.

(*g*) The functions of the Board should be exclusively judicial and advisory. Strenuous objection is urged against the granting to the Board of administrative powers over electrical undertakings, and also of authority to appoint District Boards in the event of such bodies being constituted. In this respect the powers of the Commissioners should be limited to examining schemes brought before them for dealing with the various districts.

(*h*) The preparation of such schemes, whether company, municipal, or joint, should be left as a matter of free and natural development to the initiative of undertakers who would formulate such schemes (it may be rival schemes), and put them forward for the consideration of the Commissioners, who would report to Parliament upon any Bills intended to carry them into effect. Opponents would be entitled to be heard against such Bills in the usual way.

(*i*) The Board may be empowered to deal with the electrical rules and regulations administered by the Board of Trade and the Home Office, and it may also act as arbitrator and as a court of record for the electrical industry

(*j*) The Railway and Canal Commission is suggested as a general model for the constitution and powers of the Board.

(*k*) The number of Commissioners on the Board should be five, and in all cases the appointments should be permanent, or for long periods, and should be on such conditions as will attract men of the highest ability, knowledge, and independence. One member should be skilled in legal affairs and in sifting evidence, one in finance, one in the problems of electrical manufacture, and the others with experience in engineering and the management of electrical undertakings.

(*l*) While in the main the work of the Board will consist of formulating the principles of procedure in the course of electrical progress, and of recommending the legislative amendments and the specific schemes which are in agreement with these principles, it may be necessary in some cases for the Board to propose the enforcement, by Parliamentary authority of arrangements for interconnection or amalgamation of supply undertakings.

8. Recommendations have been made by various associations represented on the Committee regarding specific matters dealt with in the reports of the two Board of Trade Committees, but it is felt that these problems will receive a satisfactory solution as a result of the formation of an independent authoritative Board of Electricity Commissioners, which is the crucial matter at this stage.

I am directed respectfully to urge on behalf of the committee that legislation adverse to the views of the large proportion of the industry and of the consumers which the committee represents may not be introduced without its being accorded an opportunity of discussing the matter with you.

I have the honour to be, Sir,
Your obedient servant,
(Signed) P. F. Rowell, Secretary, I.E.E.,
On behalf of the Committee.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Electrical Contracting.

Under this heading a few weeks back, I expressed through your "correspondence" my desire to see established a proper basis for electrical installation work, whereby all contractors or other persons fitting in an installation of electric lighting, &c., would have to adhere to a specification drawn up by some authorised body.

I was pleased to see in your footnote to that letter that the matter was being taken up immediately by the Institution of Electrical Engineers. I am more pleased to see, however, that the matter has been taken in hand by the supply authorities of this district, who, I am informed, are now vested with power from the Government to act in the interests of intending customers, and protect them against rubbishy wiring, &c.

I understand the position has been aggravated by the fact that just recently several large installations which were being put in by the class of individual I mentioned in my previous letter have been condemned, and have had to be stripped out as unsound.

The annoyance to the customers can best be imagined; some might say it served them right for letting out the work in such a careless manner. However, being the representative of a large contracting firm myself, perhaps I had better leave my own opinion unsaid.

The supply authorities inform me that only *bona fide* qualified contractors, who are both in a position as regards experience, and from a financial standpoint, to undertake and carry out an installation which will comply with severe tests, and be in every way satisfactory to them, and absolutely free from the danger of fire, will be allowed by them to commence such work.

I endorse their precautions most strongly, and knowing with them that the whole position of electrical work, speaking generally, is about to be lifted up to a level which it never thought to reach in this country, it is up to someone in authority to see that it does reach that level, and, moreover, remains there for good. A person badly needing electricity on the premises and not in a position financially to pay for a properly installed service should be assisted, to my mind, by the supply authorities, *i.e.*, by the Government. If such assistance is not extended to enterprising persons, and they are debarred from having a cheap job put in by someone out for that class of work, they will possibly turn to some other means of obtaining light and energy.

We want to encourage people to go in for electricity, and prepare them for the time when little else will be obtainable. Under the reconstruction scheme for housing, I believe most of the houses will, as they should, be electrically equipped, as in the States, where the electric sewing machine, mangle, boot cleaning machine &c., are as common as ditchwater

The lighting specification for this property should here and now be fixed and standardised by Government, and let out to *bona fide* contractors working under supply authorities' regulations.

H. Y. Fowler.

Messrs. Waring & Gillow, Ltd.,
Electrical Contractors, Liverpool.

[We do not know what powers have been conferred on the Liverpool electric supply authorities by the Government, or under what statutory authority they could be so granted; under the Electric Lighting Acts supply undertakers have no legal control over contractors, though they are authorised to refuse to connect unsuitable installations to their mains. Financial assistance to intending consumers is out of the question.—Eds. Elec. Rev.]

The Shorter Working Week.

In view of the 48-hour week becoming operative for power-station and sub-station shift men in the London District on February 1st, 1919, the method of working adapted by the Manchester electricity undertaking as from January 1st, may interest your readers. A copy of which is enclosed.

Harold H. Morton,
Sec., No. 1 Branch.

London, S.E., *January 19th*, 1919.

SHORTER WORKING WEEK. SHIFT WORKING. METHOD AS ADOPTED BY THE CITY OF MANCHESTER FOR POWER-STATION AND SUB-STATION EMPLOYES, ON AN AVERAGE WEEK OF 47 HOURS. AS FROM JANUARY 1ST :—

Day.	1st week.	2nd week.	3rd week.
Tuesday ...	11—7 a.m.	3—11 p.m.	7—3 p.m.
Wednesday ...	11—7 „	3—11 „	7—12 noon.
Thursday ...	11—7 „	3—11 „	Off.
Friday ...	11—7 „	3—11 „	7—3 p.m.
Saturday ...	11—7 „	Off.	7—3 „
Sunday ...	11—7 „	3—11 p.m.	7—3 „
Monday ...	Off.	3—11 „	7—3 „

The above gives two 48-hour weeks and one 45-hour week, or a 47 average over a cycle of three weeks.

A Protective Association for Non-Technical Officials.

I would like to draw attention through your columns to a matter which, to the writer, appears to be one of considerable importance to a large number engaged in the electricity supply industry, *i.e.*, the need for an association on the lines of the E.P.E.A. for those engaged on the "non-technical" side of the industry—chief clerks, accountants, cost clerks, advertising men, &c. An association on the lines indicated to cater for the welfare of this class of employé would appear, in view of foreshadowed developments, a necessity. As it is, we have no organisation to protect our interests. Cannot one be brought into being?

"Non-Technical."

January 17th, 1919.

[An attempt was made a few years ago to form such an association, but without success. Probably the present is a more propitious occasion. We shall be pleased to have the views of other readers on this subject.—Eds. Elec. Rev.]

Engineer Surveyors' Salaries.

Mr. Abraham's letter in last week's Review deserves the thanks of all engineer surveyors employed by insurance companies. As Mr. Abraham remarks, there is no doubt it is a standing disgrace to the insurance companies concerned. The salaries paid are totally inadequate to the knowledge required, and the writer, as an electrical surveyor of 16 years' standing, is now getting the princely salary of £230 and £50 bonus. I am a member of the Engineer Surveyors' Association, which includes both mechanical and electrical surveyors, and my opinion is that if it had not been for the above Association, the insurance companies concerned would not have increased our salaries as much as they have done during the past two years. What is required is that someone like Mr. Wordingham should take up the cause of us poor surveyors. The companies pay 25 to 30 per cent. dividend, so it is not a case of "cannot afford."

Electric.

January 18th, 1919.

Mr. Abraham's letter in your current issue, regarding the salary offered to electrical engineers to act as inspectors for a leading insurance company, will be endorsed by men who know what a man in such a position really ought to understand.

For a man to be competent to judge other people's work it is reasonable to expect him to be something of a past-master in such work, in addition to sound practical experience he should possess a keen sense of perception to get at the points that matter.

In the survey of plant from an insurance point of view, a man with the right qualities would observe points which would not catch the eye of the inspector of the "rules and regulations" type until something happened later which would attract his and everybody else's attention, but which happening would be avoided by the man who really possesses the experience, and can see potential trouble in time to prevent it developing.

High technical knowledge is of little value without years of troublesome experience when it is up to a man to discriminate between a good and a bad job, especially when the latter is of an obscure nature; yet a good technical knowledge is essential, therefore the man for such work as an insurance company's inspector should be one with well-balanced qualities; these being technical knowledge and real practical experience—perception and sound judgment—imagination and logic—determination and tact.

All these qualities are required to enable a man to see weak points in a job or in the case of a breakdown to say what has been the cause, and how it can be repaired without wasting money, or in other words, without making a comparatively small job into a large and costly one at the insurance company's expense; an "inspector" who is buying his experience (also at the insurance company's expense) will not be difficult to bamboozle by a more experienced man, whose object is to get more out of the company than is just, so, after all, the insurance company is not likely to profit by paying such low salaries.

Had the advertisement not stated the salary, but left it for the applicants to state what they required, I think there would have been applications from really qualified men, but not at £150 plus £25 war bonus, even with the vague promise of increase according to merit.

"Practech."

January, 1919.

I am glad to see the question of engineers' salaries was taken up by Mr. A. J. Abraham in last week's issue.

I am a student of electrical engineering, and for the last five years most of my spare time has been utilised for technical advancement. Upon perusing the advertisement columns of weekly engineering journals, and seeing the low salaries offered for various technical posts, I often wonder if I am not working in a "blind alley" direction, and whether my time could be spent in more profitable employment.

I think if engineers in responsible positions would fix a minimum salary for men who can prove that they have recognised technical and workshop qualifications, then something would be done to raise the status of their profession.

E. R. Bishop.

Devonport, *January 20th*, 1919.

Electrical Engineering in the Army.

Your leading article in the current issue on "Electrical Engineering in the Army" is extremely interesting to those who have been engaged on electrical work in France. You are quite correct in stating that for the most part power and lighting was supplied by numerous petrol-electric generating sets, but I think the conditions on our side of the line were rather different. It must be borne in mind that the Germans had numerous large towns in their hands which had large power stations. Some of these were in range of our guns, but were not shelled by us, whilst the few stations on our side of the line were destroyed in the early days of the war. I think you will find that at our bases advantage was taken of the French high-tension systems to illuminate our camps and depots, and in a few cases fair-sized power stations were erected where French supply was not available. These stations, however, were equipped with D.C. plant only. One fact remains certain, and that is that advantage was not taken of the services of the large number of electrical engineers in the Army, the great majority of whom were employed on searchlight work only. In the later days of the war, I believe, there was a "petrol economy department" which used to make arrangements to take current from the French power stations, and scrap the petrol-electric sets. Probably the armistice put a stop to the development of this branch of the R.E.'s.

H. Payn.

Exeter, *January 18th*, 1919.

I am very glad to see that you are taking up the question of our shortcomings in the field with regard to the use of electricity, as compared with the Germans.

I am afraid, however, that many people will construe your remarks as a reflection upon the ability and knowledge of the many electrical engineers who served throughout the war with His Majesty's Corps of Royal Engineers. I am sure you do not intend that they should be misunderstood in this way.

The great trouble we were always up against was "tradition" wrapped up in red tape. Tradition in its right place is a splendid thing. It makes men face dangers and stand up to hardships, but as a drag on initiative and an obstacle to advancement, it is certainly *not* in the right place.

In September, 1914, a brother officer and I spent a fair amount of money in carrying out experiments, the results of which would have been very valuable in connection with telegraphy and telephony for military purposes. Having protected the idea—to do which we had to get permission, which was granted—we submitted the idea to the War Office. Somewhere in the early part of 1915 the invention was finally turned down by "The Director of *Artillery*!!" Before the end of the war the idea was discovered in use by the Germans, and we then copied it!!

This is not an isolated instance of the definite discouragement of the technical officer, and after a few such, one gives it up as a bad job, and conforms to regulations very strictly, thus ceasing to be a thorn in the side of one's superiors.

Now! Criticism alone never built anything, but I feel sure that the only solution is to definitely departmentalise the Corps of Royal Engineers, so that we may have specialists instead of Jacks of all trades.

Major, R.E.

London, *January 18th*, 1919.

[We endeavoured to make it clear, both in the article above referred to, and in that of May 24th, 1918, that we did not wish to cast reflections on the Royal Engineers themselves, for whose indomitable courage and professional skill we have repeatedly expressed the greatest admiration; what we aimed at in our criticisms was the *system* which sent those heroes of the old Army into the field without an adequate training in up-to-date electrical engineering. In the former article we said: "It may be thought that the problem can be solved by commissioning as officers men who in civil life are engaged in such work, and this is perfectly true, but only on one condition—that they are invested with full powers to carry out their plans without interference. This, we believe, has not been the case." Our correspondent, "Major, R.E."—with every word of whose letter we wholly agree—emphasises the truth of this statement, while he quite rightly defends the professional electrical engineers who were serving with the R.E.'s against any accusation of inefficiency; we, of course, made no such accusation—as will be seen from the above quotation, we claimed for them freedom from the tyranny of "tradition," to which our correspondent so feelingly refers. Had their services been properly utilised, immense benefits would have been derived from them by the Allied nations in respect of saving of life, economy of expenditure, and an earlier end of the war.—Eds. Elec. Rev.]

Electricity Supply Progress.

The courteous manner in which you dealt with my previous letter emboldens me to crave your indulgence in order to carry the subject a little further.

To my mind, and to be quite candid, your otherwise useful criticism of the Greater London Authorities' report was rather spoiled by just a perceptible tinge of prejudice in favour of company control, and a somewhat contemptuous reference to the efforts of the small local authorities, scarcely justified by the facts.

I did not, of course, claim that either of the two authorities mentioned in my letter were "pioneers," but merely instanced these in support of my contention that small local authorities were just as ready as the companies, to adopt modern methods. I note you question the date of the Halifax installation, but perhaps this is not very material to the point.

There is nothing very surprising in the fact that the Newcastle and District Supply Co. "fostered and developed" Messrs. Parsons's turbines. The company naturally formed a convenient outlet for Messrs. Parsons's activities. Moreover, it was not uncommon for manufacturers to provide machinery for the supply companies, accepting in payment thereof an equivalent value in the supply companies' shares, and this arrangement often enabled supply companies to make progress.

You emphasise your view that "only large undertakings can afford to experiment," but I think it is open to question whether either large or small municipalities are justified in expending any formidable sums of public money for experimental purposes, and even company shareholders have been known to kick against the employment of their money for the purpose of launching untried schemes.

About twenty years ago or thereabouts, very much the same arguments were used in regard to local authorities, and any little township not having a provisional order or which, having obtained one, refrained from putting it into operation, was sure to be branded as "unenterprising" or "lackin public spirit."

It should also be remembered that in the majority of cases these authorities employed the most expert professional advice available, and surely they should not be too much blamed for being guided accordingly.

The fact that we have been greatly outpaced on the Continent, and particularly in the United States and Canada, is, I think, indisputable, but this was not altogether attributable to company control. It was in a great measure due to the freedom with which these companies were allowed to develop, almost according to their own sweet will, whilst at home we have always been handicapped (municipalities and companies) by sluggish legislative machinery and harassing restrictions placed upon us by Government departments, mostly for the protection of private interests. Under the different conditions it is doubtful whether the U.S.A. companies would have been any more successful than our own authorities.

Further, and writing with some fair experience (not being exactly a "stay-at-home"), I do not believe that overhead transmission, so common in the States, could have been developed in this country to anything like the same extent, nor yet that its adoption would have saved the situation.

One of the greatest stumbling blocks to progress in this country is, I think, traceable to the inherent conservatism of the British factory owner. No tariffs, however ingenious, would induce him to scrap his beam engines, counter shafting, &c. Even the large firms when they did decide to adopt electricity remained in "splendid isolation," and preferred to put down their own comparatively small plants rather than have anything to do with the central supply authority. There are thousands of such plants all over the country, and unless these people can be converted, induced or coerced into taking their requirements from a central source, no national scheme can be altogether successful. Notwithstanding all their difficulties, however, it cannot be denied that many small municipalities have developed their undertakings enormously.

Take, for instance, the Rotherham municipality. Rotherham commenced its supply in May, 1901 (this time I am certain of my dates), in a very modest way indeed, and although commercially successful from its inception, the annual output up to 1914 never exceeded five or six million units, therefore it cannot be regarded as one of the large undertakings. Yet Rotherham has now provided itself with the first super-station in the kingdom, and bids fair to surpass the activities of even the "Great North-East Coast" combination (on whom be peace). The credit for this achievement is surely attributable to municipal enterprise, well directed, and supplemented by capable administration.

The general assumption that small local authorities are anxious to hang on to inefficient and obsolete generating stations will, in my opinion, prove to be entirely erroneous. Accustomed for years to defend themselves against encroachment on the part of their avaricious and more powerful neighbours, these authorities are naturally suspicious as to any infringement of their rights. The circumstances surrounding the appointment of the Board of Trade Committee and the method of investigation subsequently adopted by the committee itself, did not tend to allay these suspicions. On the contrary, antagonism was aroused, not altogether confined to local authorities, which should, and might easily, have been avoided. Given a sound scheme, however, and equitable treatment, the small local authorities will be found as ready to co-operate as either the companies or the larger municipalities.

Let our new Electricity Commissioners be real "live men," unhampered by politics or private interests; give them a free hand to retain what is good, and discard the inefficient, whether such belong to a company or municipality; let them not be too much guided by the reports of the Coal Conservation Sub-Committee or the Committee on Electricity Supply: better still, let them forget that these precious documents were ever issued, and I for one am optimistic enough to believe that an era of phenomenal prosperity for the electrical industry as a whole will be assured.

J. C. Williams,
Engineer and Manager.

Electricity Supply & Tramway Dept.,
Erith, *January 15th*, 1919.

[Mr. Williams has certainly carried the subject further; we are reminded of the gentlemen who was found in possession of a pig some miles from its home, and said it was "only a joke"—the magistrate held that it was "carrying a joke too far." We are tempted to answer his letter in detail, but must restrict ourselves to the following brief comments:

Our admitted prejudice in favour of company control is shared by not a few engineers in municipal employment, besides many such who have transferred their services to companies with advantage to themselves in more ways than one.

We did not suggest that there was anything "surprising" in the fact that the Newcastle and District Co. fostered and developed the Parsons turbine; quite the reverse—it was a particularly apt illustration of what could be done by a company, but could never have been done by a municipality, and the fact that companies can pay for machinery in shares strengthens the argument. In his next paragraph, Mr. Williams emphasises the inherent obstacle to municipal enterprise—the fact that publicly controlled undertakings are not spending their own money; and of course their professional advisers have had to avoid experimentation (though we could readily name instances in which this rule was transgressed, with very unfortunate results to the undertakings).

Mr. Williams agrees that the rapid progress made abroad was due "to the freedom with which these companies were allowed to develop"; we, of course, agree that both municipalities and companies have suffered from legislative and administrative restrictions, but the point which we had in mind was this: that on the Continent and elsewhere abroad companies were allowed to supply over large areas, including towns within those areas, whereas in this country our power companies were excluded from the big towns in their areas by the action of the local authorities, and thus their development was hampered, and is hampered to this day

The demand for facilities for overhead transmission has been endorsed by the municipal authorities.

The British factory owner is sensitive enough when his pocket is touched; had a cheap supply of power been available at his door, he could not have afforded to ignore it.

The extraordinary development of electricity supply undertakings during the war was due to extraordinary circumstances; the municipal authorities rose to the occasion splendidly—but what progress would they have made if the war had not happened?

Having been granted statutory powers, the small local authorities are justified in maintaining their rights against infringement; but they admit, through their representatives —both engineers and councillors—that the system is all wrong, that electricity supply should not have been confined within municipal boundaries, and inferentially that those statutory powers should never have been granted.

With the last paragraph of Mr. Williams's letter, almost every word of it, we cordially agree.—Eds. Elec. Rev.]

The "Taylor System."

I would like to be allowed to make a few remarks regarding Major Pells's article on "What is meant by Efficiency Methods?"

Major Pells has voiced what has actually been in the minds of thousands of engineers. Where in past years it has been the practice in a good many industries to attempt to fit a man into a job, in some cases wasting their own and their employé's time getting the man used to a class of work he has never before had any experience in, in future it must be the task of every employer, not to find the job for the man, but to get the man for the job.

Many a young pupil or apprentice after serving his time has been forced, against his wish, to seek other fields in search for improvement, often having to remodel all his ideas to suit new conditions, and waste a year or so before he becomes as useful in his new job as he was in his last. I would suggest to any firm that adopted Major Pells's idea of an efficiency engineer, that it would be well advised to make use of its most apt pupils or apprentices for this purpose.

Regarding the electrical trades, now that the wages earned are being placed on a footing equal to that of other industries, the call for increased efficiency and economy will be more urgent than it has ever been before, and it will become necessary for all employers to study the smallest details that lead to efficient working, and thus help reduce the working costs. Employés are kept too much in the dark regarding their respective values to any undertaking. It is seldom that any employé knows how his efforts have added to or reduced the working costs. More light on this subject would keep the efficiency problem fresh in the minds of the workers. How many times has a stoker, switchman, or driver, been able to point out to his station engineer the way to improved methods? Although it is early yet to say that plant efficiency has reached its maximum, for the present it appears to be at a standstill, and while this is so the only path to increased efficiency is for the engineers and men to work together, and for all employés to take an active interest in the work.

Some years ago I worked under Major Pells before he commenced his Army career. Then his idea of combating foreign competition was by Tariff Reform. I am pleased to see that he has so far altered his opinions as to realise that there are other means of attaining this end.

H. Bujama.

London, N.W., *January 14th*, 1919.

Station Engineers and Representation.

Whilst viewing with admiration the "spade work" of the pioneers of the above section of the E.T.U., and extending due credit to their achievements, it is nevertheless generally felt that following the influx of central station men, such powers as the Joint Industrial Committee should have been reconstructed, as the existing constitution is certainly not representative so far as those men are concerned, and it is regrettable to note that efforts from these channels to rectify this important deficiency are strongly opposed by sub-station representatives, who claim to "know all about" central station men and their conditions.

I used to imagine that trade-union members *elected* their delegates, but I have yet to learn why a sub-station engineer is most fitted to negotiate matters concerning station engineers.

Back pressure.

January, 1919.

German World Trade Schemes. — The *Frankfürter Zeitung* learns that a limited liability company has been formed in Germany, with headquarters at Düsseldorf, for the purpose of reconstructing the world trade relations of industrial undertakings and of re-establishing agencies and warehouses abroad. The firm has been started by the Mannesmann Tube Works, which formerly played a leading part in the tube trade on the world market.—*Board of Trade Journal.*

BUSINESS NOTES.

Our Letters from the Front.—A Major, R.A.O.C., writes:—"Please accept my thanks for your kindness in sending me a copy of your valuable journal, as you have done, during the past [illegible] months out here. The paper has been extremely welcome, I can assure you, as you can imagine when one has served over three years' continuous service out on this Western Front how "rusty" one must be as regards electrical matters.

It may be imagined by many that we are having a slack time of it: I can assure you that our particular branch is just as busy as ever, but of course under better conditions, inasmuch as we are free from bombing and shelling.

It is to be hoped that the electrical manufacturers and others allied to the great industry will remember that we shall all be seeking jobs before long; our experience may not be up to date as regards specialist work, but the experience gained is invaluable, whatever branch one has been connected with.

I am now stationed in one of the Belgian towns which is surrounded by an area teeming with factories and coal mines: in most cases the Hun has taken away the machinery. The business to be done out here when things settle down will be simply enormous, and those manufacturers who have a good stock of apparatus will clear their stock out in a week: I am speaking of plant, large motors, switchgear, &c.

The Institution of Electrical Engineers might evolve some scheme of "liaison" with the electrical profession over here, so as to assist those who will have to do business at an early date.

There appears to be very little copper wire about here, as the Hun took that, so that copper wire contracts ought to be a good line for someone."

Italian Standards for Electrical Machinery.—An Italian standard for electrical machinery is to supersede German standards in the requirements of Government Departments in Italy. By a decree published in the *Gazzetta Ufficiale* of December 12th, all electrical machinery ordered by Italian Government Departments is to conform to the standard regulations (for testing) compiled by the Italian Electrotechnical Association in 1916. Before the war German (A.E.G.) standards were in universal use in Italy. This decree crowns the efforts of the Italian Electrotechnical Association to bring Italian standards into application in Italy. The text of the decree, and a copy of the standard regulations (in Italian) can be consulted at the Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, E.C. 2.—*Board of Trade Journal.*

Compensation Claim.—In support of a claim by the Phonopore Construction Co., before the War Losses Commission, in respect of the occupation of the firm's factory at Southall, Middlesex, the claimants stated that the War Office took possession of their factory for a period of 17 months, and that this occupation resulted in direct loss and dislocation of business.

Telegraphs and Trade.—The London Chamber of Commerce, through the Council, has forwarded to the Prime Minister, the President of the Board of Trade, and the Postmaster-General, a memorandum urging upon them, among other things, the great importance of the resumption of cheap and rapid means of communication. The complete freedom of cable communication, the unrestricted use of cable codes other than those now authorised, and of registered telegraphic addresses, are necessary in order to rehabilitate the United Kingdom in the markets of the world, to increase production, develop exportation, and so on. While the withdrawal of code restrictions might facilitate the resumption of enemy commerce, it would confer upon our own international trade an immeasurably greater advantage, "and the sooner the withdrawal the greater will be the ratio of that advantage."

Prices Advance.—THE ENTERPRISE MANUFACTURING CO., LTD., announce an advance of 15 per cent. in their list prices of motors, owing to continual advances in labour and material.

Trading with the Enemy.—A further list of names of bodies and persons abroad with whom trading is prohibited, or whose names have now been removed, is published in the *London Gazette* for January 17th.

Export Restrictions Removed.—*The London Gazette* for January 17th contains a further list of relaxations in export prohibitions.

Tar Oils Order Suspended.—The Ministry of Munitions has suspended the operations of the Tar Oils Control Order, 1918, as from January 15th.

Engineering Advertising.—In order to assist firms in the engineering industry to produce a higher standard of advertisement in the Press, Messrs. S. Davis & Co., of 30 and 31, St. Swithin's Lane, London, E.C., have issued a booklet in which they show, printed on a very high-class art paper, examples of a number of advertisements designed by them for well-known manufacturers. We have long held that the preparation of advertisements for the technical Press has been more or less neglected by some firms. A new-comer or underling, of no experience either of publicity or of engineering, pitchforked into such responsible duties, cannot be a success unless he be one of nature's great prodigies. If firms are not disposed to afford a specialist who will be both efficient in the performance of his work and happy in his relations with the Press, they had better by far enlist the assistance of one of the several firms who are qualified in both of these ways, and are prepared to secure good results. Messrs. Davis will send a copy of this booklet to any reader on application.

American Electrical Export Trade Co.—A Central News dispatch to an evening paper states that the International General Electric Co. has been established in America by charter, with a capital of $20,000,000. The incorporators are identified as the General Electric Co., and it is believed that the new company will engage in foreign trade.

Fire.—A fire occurred at the works of the Silumiuite Insulator Co., Ltd., Southall, on the evening of January 16th, causing damage estimated at about £1,000. The machinery was saved, and work is being carried on as usual.

The E.T.U. and 47 Hours.—According to the *Daily Dispatch* (Manchester), an analysis of the voting of the engineering and shipbuilding trade (in which 337,029 voted for and 159,887 against) shows that the Electrical Trade Union voted as follows:—For, 4,665; against, 2,295. The Instrument Makers voted: For, 1,528; against, 1,102.

47-Hour Week Strike.—In London, 15,000 engineering employés are on strike, among their grievances being the fact that since the working of the 47-hour week was introduced certain shop privileges have been eliminated; such as the 10 minutes' interval for morning refreshment. A conference of the employers and the employed took place on Monday. Surely this is a point that could, and should, have been foreseen and considered by both sides when the 47-hour week was agreed upon!

A Scientific Management Society?—The suggestion that a society be formed for the study of scientific management, and for propaganda on the subject, has already received a certain amount of support, as a result of recent contributions to these columns. "Increased production" has been a favourite topic in both the technical and daily Press for some time past, and it is felt that some association of those interested would be helpful for the interchange of ideas and the gathering of information on the subject. The field of activity for such a society would probably be a large one, but it is felt that the nucleus of the society, rather than its initiators, should decide what its policy should be. All those interested in this proposal are requested to write to the ELECTRICAL REVIEW (marking envelope "S.M.S."), so that notice of an inaugural meeting may be sent to them.

Socials.—The fuse department of MESSRS. FERRANTI, LTD., electrical engineers, Hollinwood, held a tea, concert and ball at Failsworth, last week, when presentations were made to the day and night foremen, Mr. John Tillotson receiving a timepiece, and Mr. Hartley Hicks a smoker's cabinet.

The annual dinner of the operative staff of the Royal Arsenal Central Power Station took place at Pinoli's on Saturday last, Mr. G. W. Paine presiding. The toasts and musical programme were much appreciated, and at 10.30 p.m. "Auld Lang Syne" concluded the festivity. Messrs. Rolls, Stroud and Grant acted as Committee.

Bankruptcy Proceedings.—ANDREW MATSON, late electrical engineer, 69, Ewbank Street, Stockton-on-Tees, late 10, Hardwick Terrace, Stockton-on-Tees.—This debtor applied on Tuesday, last week, at the Court House, Bridge Road, Stockton-on-Tees, for his discharge from bankruptcy. The Official Receiver (Mr. Meredith Hardy) stated that the debtor filed his petition in 1917. His liabilities were £219, and his assets realised £29. A first and final dividend of 1s. 5½d. had since been paid to the creditors. It appeared that the debtor started business as an electrical engineer at 10, Hardwick Terrace, Stockton-on-Tees, about 18 months prior to his failure. When he started he had a capital of £20, borrowed money, which he repaid. At his public examination he admitted that he had never been in a position to pay 20s. in the £ since he commenced business, and that all his liabilities had been incurred with that knowledge. He attributed his failure to having commenced business with borrowed money, illness of his wife, keen competition, and loss on contracts. Mr. C. L. Townsend, for the debtor, said that since his failure he had been working in the mercantile marine, and had accumulated a little money, which would put him in the position of starting with capital. He was prepared to pay an amount which would provide for a further dividend to his creditors, if it could be spread over a short period so as not to interfere with his capital, as he wished to start at once. His Honour Judge McCarthy granted the discharge, conditional upon the payment of £20 within a period of three months.

CHAS. MAYFIELD, electrical engineer, Clifton, Bristol.—Adjudication order made January 15th.

A. F. HAWDON, formerly an electrical engineer, Newcastle-on-Tyne, now a wireman in the Navy.—At Newcastle-upon-Tyne Bankruptcy Court, on January 16th, Judge Greenwell granted an application for discharge. The discharge was suspended for two-and-a-half years.

Iron Prices.—The Minister of Munitions gives notice that the advance of 15s. per ton in the price of bar iron for home sales, which was announced on December 30th, 1918, as coming into force on January 1st, 1919, also applies to prices of rolled edges iron, sheared-iron tube strip and iron plates and sheets for home sales.

Aluminium.—The price at which the Government are prepared to sell their stock of aluminium has been reduced to £150 per ton for 98/99 per cent. ingot, at which price steps have been taken to stabilise the market. Arrangements have been made in regard to these stocks that they shall be disposed of in such a way as to avoid dislocation in the aluminium industry.

Excess Profits Duty.—The report of the Committee on Financial Risks Attached to the Holding of Trading Stocks is now published by the Ministry of Reconstruction. They regard it as most desirable that the position of industry should be specially strengthened when on the threshold of a period in which markets have to be reorganised or created, and in which industrial conditions are in the highest degree uncertain. The most hopeful line of approach to a solution of this problem lies, they think, in a reduction of the present rates of excess profits duty. The present 80 per cent. duty, they consider, encourages extravagance and discourage enterprise, the reward being paltry, while little margin is left for renewals, development, and the capture of new markets, to say nothing of the establishment of reserves against bad times.

The committee recommend two alternative remedies:—

1. A reduction in the excess profits duty from 80 per cent. to 65 per cent. for the accounting period approximating to the year 1918 now in course of assessment, on the understanding that the duty so remitted is retained in the business and not distributed. This reduction might be accompanied by the withdrawal of the first concession in the White Paper, which was largely a result of the raising of the duty to 80 per cent.

2. If this course is impracticable, the committee suggest that part of the duty now to be paid should be treated as a suspensory reserve for a period of five years, the amount so treated to be represented by a special kind of War Loan to be held on joint account by the Government and the taxpayer. The amount of this reserve should be 20 per cent. of the average excess of profits in the last two years of the duty. After five years this reserve should either revert finally to the State or, in certain specified circumstances, become wholly or in part the property of the taxpayer.

The committee recognise that they have been unable to formulate any scheme of relief for those who pay no excess profits duty. They also consider that a business which has denuded itself of its "immanent stock" at the instance of the Government, to meet immediate needs, has a claim for consideration which is best preferred to, and granted by, the department of State to which the assistance was rendered.

Enemy Propaganda in South America.—The *Times* has received from a Buenos Aires correspondent a characteristic example of the unblushing continuation of German propaganda immediately after Germany had lost the war. The following is a translation of a circular issued by German agents in Argentina for a new weekly paper, price about 6d.:

> We take the liberty of bringing to your notice our new illustrated weekly journal, *Neue Welt*, which will appear on January 1st. This paper will not serve for the usual novels and other light reading, but will occupy itself *with all questions of present and future interest to Germans in South America.*
>
> The leading questions of the day will be dealt with, and in addition we shall produce the literary pearls of our leading poets and writers, as well as original articles of the highest class. We shall not be influenced by political events in the Old and New World, as we do not wish to divide our ranks by party politics, but instead to strive for one end:—
>
> Protection and furthering of German *Kultur* and German trade in South America.
>
> We shall hope to reach every German circle in South America.
>
> The *Neue Welt* is no party politics organ. No, it *enters the New World in the interests of all German South Americans whether their origin be Germany, Austria, Switzerland, or Russia.*
>
> We wish to be German in the broadest sense of the word!
>
> *We do not wish to destroy, but to construct!*
>
> All suggestions in this sense are welcome, and for advertisements and subscriptions please go direct to Publishers, *Neue Welt.*

Restoring Devastated France.—The Paris correspondent of the *Times* says that a congress of French and American civil engineers has been discussing during the last fortnight a series of vast works designed to enlarge certain French ports, repair roads and mines, canalise certain rivers, and generally perfect the national outfit. With regard to the repair of the devastated mines, it is estimated that it will take one year to pump out the water, and machinery of 30,000 H.P. is being set up for that purpose. Even then it will take two years before the mines can be set going, and five before a normal output will be reached. The Rhone is to be made navigable as far as Lyons, and big irrigation works are contemplated. The Rhone will, it is calculated, be able to furnish electric power to the extent of 750,000 H.P. The necessary capital will be sought in France and America, and it is suggested that the State should assume charge of these works, and entrust their execution to Franco-American societies.

The Federation of British Industries has issued No. 2, Vol. II, of its *Bulletin*, one of the articles in which discusses the Lyons Fair, which is to take place early in March, as an opportunity for British firms to come to the help of France in re-establishing her industries.

The Electrical Market in South Africa.—In the course of an article on South Africa's Great Market for Electrical Equipment," the *British and South African Export Gazette* says:—

"That the market in South Africa for machinery, cables, fittings, and other material for electric light and power purposes is one which is well worth looking after may be judged from the fact that for a recent five-year period the average annual value of such imports, exclusive altogether of telephone and telegraph cable and wire, amounted to as much as £1,086,340. It is all the better worth looking after now that Germany is unlikely to be able to compete for many years to come on anything like the old favourable terms of the past. Great as the strides are which have been made in electrical development throughout the Union, Rhodesia, and British and Portuguese East Africa, it is even yet only in its infancy, and when railway electrification is seriously taken in hand in the Union, as it seems certain to be at no very distant date, and the large new industrial equipments already projected are permitted to be undertaken, the plant and material for which an urgent need will have been created must represent very much more in annual value than the gross total of all the electrical imports which South Africa has in the past drawn from other parts of the world. Relatively small as the beginnings which have been made may be rated, however, there are to-day scattered throughout South Africa no fewer than 53 plants, each busily occupied in supplying electricity either for power, lighting, heating, or cooking."

The writer goes on to give a summary of the principal electrical systems serving the mine districts and the larger cities.

The U.S. and Foreign Electrical Trade.—In the course of an editorial, entitled "The Foreign Trade Door Open," the New York *Electrical World* says that it is high time that the American nation made a substantial beginning in learning what it required to know on the subject of foreign trade. The writer remarks that present American foreign trade knowledge rests largely with the companies which have done an international business for many years, notwithstanding unsympathetic laws and law-makers, and they have paid a price for their information. "Certainly the big companies have done much in the past to build a reputation for this country in foreign lands. They have put distributive organisations in the leading countries where sales are possible; they have established connections, men and agents trained in their products and the needs of consumers; their names and output are known favourably. They have faced European competition for years; they are able to market apparatus and supplies where that competition exists. Probably they can continue in much the same way as they have done. But with expanding circles of consumers in other countries it is to be hoped that they will develop the size of their business in proportion. They are entitled to benefit from their pioneer work."

But our contemporary is also interested in the case of the smaller manufacturers. It says:—"With the small companies in the electrical industry the desirability of building export business under the new domestic and world conditions is also clear. They have a large productive capacity; they can meet competition as the large companies meet it; they have their individual problems of keeping labour employed at good wages. Under the old conditions they lacked sufficient points of contact with buyers in foreign countries to make a profitable business easy, if indeed it was practicable at all. They could not afford to finance exploitation of foreign possibilities as readily as companies of greater resources. But now that Congress has opened the way for co-operative organisations in foreign trade through the enactment of the Webb law they can initiate a movement to represent a number of units in the electrical industry."

Iron and Steel Output and Stocks.—The following figures are issued by the Minister of Munitions:—

A. *Stocks of Iron and Steel.*—The total stocks in the hands of the Government available for disposal at the end of December, 1918, were as follows:—

	Government stock at end of December, 1918
Pig iron (Swedish)	80,000 tons.
Shell steel billets (suitable for re-rolling	210,000 tons.
Ships plates (purchased in U.S.A.)	19,800 tons.
Bright steel	5,000 tons.
Bar iron (Swedish)	10,000 tons.

These figures, which include all stocks of U.S.A. steel in this country, only represent stocks in the hands of the Government still to be disposed of, and do not include stocks in the hands of private firms, neither do they include stocks of forgings and semi-finished shell.

B. *Outstanding Commitments from Overseas.*—The bulk of the Government contracts in U.S.A. for iron and steel have been cancelled, and the existing stocks of shell steel at American ports and steel works are being disposed of in the American market. The only outstanding commitments still due to arrive in this country are: (1) 40,000 tons of basic pig-iron from U.S.A., the whole of which has already been allocated to its final destination, (2)-7,500 tons of wire rods from U.S.A. and 2,500 tons from Canada, and (3) 4,000 tons of pig-iron from Sweden.

C. *Output.*—The average weekly output of pig-iron and steel ingots and casting in the United Kingdom during the last six years is as follows:—

	Pig Iron.	Steel (Ingots & Castings).
1912	168,000 tons.	131,000 tons.
1913	200,000 tons.	147,000 tons.
1914	173,000 tons.	151,000 tons.
1915	169,000 tons.	161,000 tons.
1916	174,000 tons.	173,000 tons.
1917	179,000 tons.	187,000 tons.
1918	175,000 tons.	184,000 tons.

Output during the latter half of 1918 was seriously interfered with by the influenza epidemic in July, and the Armistice in November. The average output figures for the first half of the year were 181,000 tons of pig iron and 192,00 tons of steel.

Demobilisation and Employment.—Our readers do not require to be told that the task of reinstating our soldiers and sailors in civil life is a colossal one. Machinery exists for performing it, however, and it is to be hoped that intending employers and employés will avail themselves of it. The Employment Exchanges, assisted by the Local Advisory Committees, which represent equally the interests of both parties in every neighbourhood, are said to have the organisation ready for use. The staffs of the Exchanges have been considerably strengthened in order to meet the extra strain thrown upon them. It is not generally known that branches have been set up to deal with discharged men only, while special sections for disabled men have been established in a great number of cases. As far as possible, the work in these new additions to the Exchange system is carried on by men in the same position as those whom they are helping back to civil employment. Discharged men, with no small proportion of disabled among them, superintend the placing of discharged and disabled men. It has been found that the loss of an arm, of a leg, of two legs, and even of eyesight, is no insurmountable obstacle to the performance of efficient work, given the employers who will employ the men.

The Industrial Reconstruction Council.—The report for 1918 summarises the work accomplished in the setting up of joint bodies on the Whitley principle. The concluding words of the chairman (Mr. E. J. P. Benn) read thus:—

> In entering the New Year the Committee once again appeal for help in carrying on the campaign. We need money, we need personal service, we need the active influence of all who wish to see our great country still greater. One of the most powerful factors towards this end would be united effort in the field of industry. Our safety is menaced by extremists on either side, and it is for the majority who are genuine in their desire for industrial peace to rouse themselves to meet the danger. Let us be as eager for construction as the Bolsheviks are for destruction, and we need have no fear for the security of our civilisation.

Electrical Openings at Palma.—Manufacturers of electrical tramway plant and electric motors suitable for adaptation to sailing ships are invited to send catalogues and prices to the Camara Oficial de Camercio, Industria y Navegacion, Palma, Balearic Isles. The Acting British Consul at Palma states that several important orders have been recently placed by this company.—*Board of Trade Journal.*

Port Elizabeth.—We have received a copy of "The Trade and Commerce of Port Elizabeth," published by the Electricity and Industries Department of the City Council. Mr. B. Sankey, the City Electrical Engineer, is one of the editors of the publication, which sets forth a large amount of information and includes many excellent pictures, which would interest those who want to know anything concerning the general facilities offered by Port Elizabeth from the industrial, residential, electric power, and other points of view.

Catalogues and Lists.—Messrs. Thacker, Bell, and Co., Ltd., 44/46, Leadenhall Street, London, E.C. 3.—Illustrated descriptive circulars dealing respectively with standard A.C. motors, and D.C. dynamos and motors, also electric stop motion, manufactured by Messrs. James Tate, of Harris Street, Bradford, for whom they are sole agents.

Messrs. Electrical Components, Ltd., 36, Cannon Street, Birmingham.—Illustrated price leaflet of their convertible electric fire stove.

Trade Announcements.—Mr. Harry Moss has taken new and larger premises at 82, Leeds Road, Bradford, with showroom, &c. All communications should be addressed there.

Mr. T. R. Topping, electrical engineer, has now resumed business at his former address—Station Road, Wigan.

Owing to the expiration of the lease of their present offices in Manchester, Messrs. Drake & Gorham, Ltd., are removing on January 27th to 29, Piccadilly, Manchester. Telephone No. 3700; telegraphic address, "Accumulator, Manchester," both unchanged.

Mr. C. M. Simpson, manufacturing electrical engineer and wholesale supplier, having been released from the Army, is reopening immediately at 4, St. Augustine's Place, Tramways Centre, Bristol.

Book Notices.—*The Electrical Contractors' Year Book,* 1918-19. London: The Electrical Contractors' Association (Inc.). Price 2s. 6d.—This, the first issue of the year book, was prepared in April last year, but, owing to printers' delay, was not published until October, and we understand that it is, consequently, incomplete; another issue is in preparation, for publication in July of this year. The copy which we have received for review came to hand recently, and the general secretary, Mr. Leonard G. Tate, has just settled down in the new offices of the Association at 11-13, Southampton Row. The organisation of the electrical contractors of Great Britain embraces, in addition to the E.C.A., the National Electrical Contractors' Trading Association, Ltd. (N.E.C.T.A.) and the National Federated Electrical Association, with a Council and officers common to all three, Mr. H. J. Cash being the president. Lists are given of the *personnel* of the various committees, sectional Boards, and branches of the organisation; lists of members of the respective Associations follow, and an interesting historical sketch of the career of the Association, from its formation in 1901 as the outcome of correspondence in the Electrical Review, is given. The varied activities of the Association form the subject of a short article, which is followed by an account of the year's work of each of the Associations during 1917. Finally, the working rules adopted at various centres, and the pre-war rates of wages, Committee on Production awards, &c., up to August 10th, 1918, are given. The year book is a welcome addition to electrical literature, and will fill a place which has long been waiting for it on the contractor's bookshelf.

"The Decrease in Ultra-Violet and Total Radiation with Usage of Quartz Mercury Vapour Lamps." By W. W. Coblentz, M. B. Long, and H. Kahler. Washington: Government Printing Office. Price 5 cents.

The Edinburgh Review. No. 467. Vol. CCXXIX. January, 1919. London: Longmans, Green & Co. Price 6s. net.

"Post Office Electrical Engineers' Journal." Vol. II. Part IV. January, 1919. London: H. Alabaster, Gatehouse & Kempe. Price 1s. net.

"Wires and Cables." Pp. 270. Illustrated. Montreal: Eugene F. Phillips Electrical Works, Ltd.

"A Treatise on Gyrostatics and Rotational Motion." By Andrew Gray. Pp. xx + 530; 122 figs. London: Macmillan & Co., Ltd. Price 12s. net.

We have received from Messrs. H. Dunod & E. Pinat, Paris, their list of scientific and industrial books, amongst which are many electrical works. We note that the foreign subscription to *La Technique Moderne*, that excellent review of science applied to industry, which resumed publication a year ago, has been raised to 42 francs to new subscribers.

"*Engineering* Directory." No. 65. October, 1918. London: *Engineering*, Ltd. Gratis.

Calcium Carbide.—The Minister of Munitions announces that on and after February 1st, 1919, the maximum prices for dealings in calcium carbides are amended, and will be as follows for quantities of 110 lb. and over, exclusive of carriage charges, namely—£30 per ton for lump sizes; £30 10s. per ton for granulated sizes up to 15/25 mm.

Dissolutions and Liquidations.—Coventry Engineering Accessories Co., Ltd.—This company is winding up voluntarily, with Mr. C. B. Lee, 4, St. Anne's Road, Coventry, electrical engineer, as liquidator.

National Research Syndicate, Ltd.—Winding up voluntarily. Liquidator, Mr. E. N. Wise, of 6, Cavendish Square, London, W.

Engineering Accessories Co., Ltd.—Meeting of creditors on January 27th, at 18, Hertford Street, Coventry.

Alfred Graham & Co., electrical engineers, St. Andrew's Works, Crofton Park, and Kilmorie Works, Kilmorie Road, Forest Hill, S.E.—Messrs. A. G. & E. A. Graham have dissolved partnership. Debts will be attended to by Mr. E. A. Graham.

Hatcher Bros. & Large, motor and general electrical engineers, Johnson Street, East Ham.—Messrs. T. C. Large, A. M. Hatcher, and H. G. Hatcher have dissolved partnership as from September last. Debts will be attended to by Mr. T. C. Large, who will continue the business.

British Huhn Metallic Packing Co., Ltd., London, E.C.—First and final dividend 20s. in the £.

Hafod Oil and Grease Co., oil and grease manufacturers, Earl Street, Swansea.—Messrs. J. Richards and W. H. Reynolds have dissolved partnership. Mr. Reynolds will attend to debts and continue the business.

Radio-active Substances: Order Suspended.—The Minister of Munitions has suspended the Radio-active Substances (Control) Order, 1918.

Raw Asbestos Order Cancelled.—The Admiralty has cancelled the Raw Asbestos Order (including crude and asbestos mine fibres) made January 5th, 1918.

Calendar.—Messrs. E. P. Allam & Co., of 107-109, Gray's Inn Road, W.C. 1, have issued a desk calendar with monthly date cards amidst brilliant surroundings of red and gold.

Catalogues Wanted.—Messrs. Lowth & Smith, electrical and mechanical engineers, 49, Deansgate, Manchester, ask for catalogues of all classes of electrical apparatus.

Copper Prices.—Messrs. F. Smith & Co. report Jan. 22nd:—Electrolytic bars, sheets and rods, no alteration.

Messrs. James & Shakespeare report January 23rd:—Copper bars, sheets and rods, £132 per ton.

LIGHTING AND POWER NOTES.

Aberystwyth.—Price Increase.—The Electricity Co. has informed the T.C. that, from the next reading of the meters, the price of electricity for power will be increased to 3d. per unit net.

Armagh.—Proposed E.L.—A meeting of the local Workers' Union has called upon the T.C. to undertake an E.L. scheme.

Aylesbury.—New Plant.—The T.C. has decided to install new plant at the electricity works, at a cost of about £17,000.

Barnsley.—Price Increase.—The T.C. has decided that, in future, the tariff to bulk supply consumers taking A.C. supply is to be on the following basis:—6s. 6d. per month per K.V.A., plus 0·55d. per unit, based on coal at 15s. per ton, with an increment of ·0025d. per 1d. increase in the price of coal.

Bedford.—Year's Working.—The total income of the Corporation electricity department for the year ended March 31st, 1918, was £40,368, and the working expenditure £28,565. Loan redemption amounted to £8,750 and interest to £3,465; £950 was transferred to the reserve fund and £1,060 to the suspense repairs account, leaving a net deficiency of £2,423. During the year, £23,425 was spent on additional buildings, plant, &c.; 6,641,028 units were generated, of which 5,462,838 were sold, including public lighting, 73,000; sewage pumping, 301,986; lighting, 591,782; and power, 4,493,140; 142,323 were used on the works; and 1,035,867 were unaccounted for. The maximum demand was 2,590 KW.

Benfieldside (Durham).—Proposed E.L.—The U.D.C. has resolved to arrange for the lighting of its area with electricity, and has voted £700 towards this purpose.

Birmingham.—Extensions.—Last week the Electricity Committee, accompanied by Mr. C. P. Sparks, who was acting for the Ministry of Munitions, in conjunction with which the Committee is working, visited the new power station in course of erection at Nechells. Nearly £60,000 was spent on the undertaking before the war, but construction was then suspended until a few months ago. The estimated cost of the station, up to an initial capacity of 30,000 KW., is £1,338,710, and sub-station equipment and mains, including a linking-up main to Smethwick, is put at £287,430. The Committee has decided to install two 15,000-KW. turbo-alternators at once.

Bodmin.—Proposed E.L.—A meeting, held last week, and presided over by the Mayor, decided to consider the question of an E.L. scheme for the town.

Bradford.—Proposed E.L.—The Baildon U.D.C. has inquired with reference to a supply of electricity for lighting from the Corporation.

Calne.—Prov. Order.—At its next meeting the T.C. is to consider the question of applying for an E.L. prov. order.

Continental.—Hungary.—The Ministry of Trade has prepared a memorandum dealing with the question of supplying the whole country with electric power, which states that the coal supplies of Hungary amount to 1·7 milliard quintals (quintal = 220½ lb. average); the water power is estimated at 1·7 million H.P., which might be increased to three million, and 72 milliard cb. metres of natural gas and 1,200 million cb. metres of peat are available. In 1913 the consumption of coal amounted to 183·4 million quintals, as against a coal output of 102·7 million quintals: of these 83·9 million quintals were consumed by industry, 58·3 millions for the production of power, and 41·2 million quintals for traffic purposes. Electrification according to modern principles would bring about a great saving, even if the power requirements of industry and traffic were covered by means of energy produced from coal. In the last few years before the war the production of 1 H.P. required 3·7 kg. of coal, and the State Railway trains consumed 0·11 kg. of service coal per kilometre. Should electrification be introduced, one-half of the former amount and one-third of the latter amount would be saved. During the war the output of coal has considerably declined, while the consumption has increased. Even with an increased output, the necessity of import can only be obviated by electrification. To carry out this scheme in its very first stage duplicate plant must be erected—one driven by water producing 180,000 KW. and one by steam producing 150,000 KW. The cost would amount to 840 million kronen, of which 310 millions would have to be covered by the State, especially as the cost of electrifying the railways must be estimated at 170 millions. Steps should be taken to secure the execution of this programme as soon as possible in view of the great coal shortage.—*Pester Lloyd.*

Crayford.—Street Lighting.—The P.C. has arranged with the West Kent Electric Co. for the public lighting of the new estates at Northumberland Heath and Barnes Cray.

Eccles.—Inquiry.—Owing to the increased working-costs at the electricity works, the Electricity Committee has decided to hold an inquiry on the subject.

Edinburgh.—Portobello Station.—Subject to the Government's reconstruction scheme, the T.C. has received permission to proceed with the erection of the new power station at Portobello. The scheme provides for three 10,000-KW. generating sets, and the total cost is estimated at nearly £1,000,000. A Sub-Committee has recommended that the work be proceeded with immediately.

Egham.—Street Lighting.—The public lamps on the main road are being converted from gas to electricity, by the E.L. Co.

Gillingham.—New Plant.—The T.C. has secured a loan of £12,668 for the installation of a Diesel engine at the electricity works.

Harpenden.—Proposed E.L.—The U.D.C. has appointed a Sub-Committee to meet representatives of the North Metropolitan E.P.S. Co., with reference to an E.L. scheme for the district.

Hove.—New Services.—The T.C. has decided that when new services are being installed, the consumer shall pay for so much of the mains as are on private property; previously the Council has borne the cost of services up to 35 ft. from the main

Ireland.—Loans.—The L.G.B. for Ireland has informed local authorities that it can now consider applications for loans to carry out urgent public utility schemes.

King's Lynn.—Supply to Shipyard.—The T.C. has agreed to supply electricity to the new shipbuilding yard at West Lynn at the following rates:—Power, 25,000 units and over per annum, 1 13/16d. per unit: 200,000 and over, 1⅝d. per unit: lighting, up to 6,000 per annum, 6d. per unit; over 6,000, 5d.; plus 10 per cent. on all charges, and a coal clause.

Proposed Extensions.—The electrical engineer has reported that the present plant will be insufficient in the coming year, and has recommended that tenders be obtained for one 1,000-KW. turbo-generator, with condensing plant, one 400-KW. rotary converter one Lancashire boiler, and an induced-draught fan.

Electricity Charges.—An application by power consumers for the remission of the last 10 per cent. increase on electricity charges has been rejected by the E.L. Committee. During the war, charges for lighting have increased by 50 per cent., and for power by 95½ per cent.

Kirkcaldy.—Proposed Extensions.—The borough electrical engineer is preparing plans for the extension of the electricity works.

Lancashire.—Wages.—An application by the employes of 26 Lancashire and Cheshire municipalities for a further bonus of 10s. per week, in addition to the present bonus of 20s., has been considered by a Court of Arbitration, and an award of 4s. 6d. per week has been made.

Lewis.—Proposed E.L.—Lord Leverhulme, who is the proprietor of the Island of Lewis, has acquired the Stornoway Gas Co., and proposes to develop the E.L. prov. order held by the company for the supply of electricity to the town, and for power in connection with canning, guano, and oil factories, which are to be erected on the island.

London.—Poplar.—The B.C. has approved the selection of Mr. E. M. Lacey to prepare a report on the joint supply of electricity for (1) Poplar and West Ham, and (2) the whole of the N.E. London area. The borough electrical engineer has been directed to prepare a report on extensions of boiler-house plant required for next winter.

Stepney.—Loan Sanction.—The L.C.C. has sanctioned the borrowing by the B.C. of £12,000 for temporary sub-stations and mains.

E.P.S. Committee and Loans.—In connection with the proposed centralisation of electricity supply, the L.C.C. Finance Committee has agreed to a request of the B. of T. that all applications from local authorities for the extension of generating stations shall be submitted to the Board before sanction is granted, in order that such applications may be considered from the electricity supply point of view, as apart from the financial.

Woolwich.—Price Increase.—The L.C.C. Fire Brigade Committee has sanctioned the payment to the Woolwich B.C. of an increase of 1½d. per unit for electricity for lighting purposes, and ½d. for power.

Shoreditch.—The Lighting Committee has recommended that, subject to the consent of the B. of T., the agreement with the Stepney B.C., for the bulk supply of electricity, be extended until March 31st, 1919, unless the turbo-alternator plant at the Whiston Street works be running before that date.

Matlock.—Proposed E.L.—The T.C. is considering an electric lighting scheme for its area.

Navan (Co. Meath).—Workhouse Lighting.—Mr. Scott, engineer to the B. of G., has been instructed to prepare a specification for increasing the E.L. installation to meet future requirements.

Rhyl.—Street Lighting.—The U.D.C. has decided to replace the arc lamps previously used for street-lighting purposes by 1,000-C.P. half-watt lamps.

Salford.—Wages.—The T.C. has protested to the Committee on Production against awards of increased wages to Corporation employés being made without previously consulting municipal authorities, and has asked the Committee what contribution it is prepared to make towards relieving the financial strain thus imposed. Alderman Phillips said that in Salford they were paying in war bonuses £236,952 per annum, and people were complaining of the increased fares on the tramways, and the higher gas and electricity charges. The Tramways Committee had to pay £117,928 in bonuses and allowances to dependants, and the Electricity Committee was called upon to find nearly £20,000 per annum.

South Molton (Devon).—Water Power.—The T.C. has decided to ascertain from a local firm the terms on which water power can be obtained for the generation of electricity for the town.

Spenborough.—Proposed Extensions.—The engineer to the Council has been instructed to submit a scheme for the laying of electricity mains in Westgate and Cleckheaton, and the supply of electricity for the Scholes district.

Stafford.—Minimum Charges.—The T.C. has decided to reduce the minimum charge for electricity from 7s. 6d. to 5s. per quarter

Staffordshire.—Breakdown.—Owing to a breakdown on Tuesday, last week, at the electricity works, the supply of power to many factories in the Old Hill, Blackheath, Rowley, and Cradley Heath districts was suspended for several hours.

Swindon. — Proposed Extension. — The T.C. has requested the acting electrical engineer and the tramways manager to report on an application of the Oriental Fibre, Mat. and Matting Co., of Highworthy, for a supply of electricity for power purposes.

Thurles (Munster).—Proposed E.L.—The U.D.C. has decided to consider the question of installing an E.L. scheme within its area.

Wallasey. — Proposed Extensions. — At an L.G.B. inquiry into the work which was necessary to be carried out in the town immediately, the town clerk stated that, although the Corporation had just completed an up-to-date power station, a further £79,432 was required for immediate extensions at the electricity works. The Corporation had been informed that its undertaking would be one which would survive the Government's centralisation scheme.

TRAMWAY AND RAILWAY NOTES.

Belfast.—Working Hours.—The Belfast Branch of the Amalgamated Association of Tramway and Vehicle Workers has instructed its branch officials to take steps to obtain a 41-hour week for vehicle workers, overtime to be paid for at the rate of time and a half, double time for Sundays and holidays, and six days' holiday per year, with pay.

Blackburn.—Strike.—The tramway employes' strike has been settled by the setting-up of a Committee on the lines of the Whitley Report, to deal with matters affecting semi-skilled and unskilled workers.

Blackpool. — Proposed Purchase. — The Fleetwood U.D.C. has threatened to oppose the Corporation's Bill for the acquisition of the Blackpool and Fleetwood Tramroad Co.'s undertaking, as the Corporation will not consent to a joint ownership.

Bradford. — Proposed Extensions. — The Baildon U.D.C. has asked for information as to the commencement of the scheme for a tramway service from the terminus at Baildon Bridge to Baildon village, which has been held in abeyance.

At the T.C. meeting, last week, the chairman of the Tramways Committee said that there were now only 117 cars available, against 218 before the war. Contracts for motors placed in 1915 were not yet fulfilled, and there was little prospect of delivery in the immediate future. There was increased traffic to contend with, and the situation had not been made any easier by the institution of the 47-hour week. It was an utter impossibility for any improvement to take place at present.

L.B. & S.C.R. Electrification.—It is proposed to electrify the line at an early date as far as Sutton and Cheam.

Liverpool.—Working Hours.—The dispute as to the working hours of the employés at the Formby power station, which supplies electricity for the L. & Y. Railway Co.'s electric service between Liverpool, Southport, and Ormskirk, has now been settled. The shift men will receive overtime for all hours above 47 each week. The remaining matter at issue is as to the overtime rate. Under the present arrangement the employés will receive ordinary time rate for overtime; their request is for time and a quarter, and other grades of railway wórkers are affected by this demand.

London. — Underground Railway Breakdown.—Owing to the overturning of a rail between the Temple and Charing Cross Stations on the District Railway, the whole of the services, with the exception of a few trains going East, were suspended from 5 p.m. till 8 p.m. on Monday. On Tuesday morning, at 10 a.m., inconvenience was again caused by the interruption of the District and Tube Railways, through a mechanical defect at the power house at Lots Road, Chelsea. This delay was of short duration only.

Sunderland. — Electric Vehicle. — The T.C. has sanctioned the purchase by the Tramways Committee of an electrically-driven tower wagon, at a cost of £1,300.

South Africa.—Johannesburg.—The T.C. has rejected the proposal to establish a municipal foundry in connection with the tramway undertaking.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—H.B.M. Minister, Sir Reginald Tower, conversed on December 10th with the Minister for Foreign Affairs regarding concessions for wireless stations in Argentina; Sir Reginald is reported as having said that British firms had the intention of erecting powerful stations to enable wireless communication to be effected between Great Britain and the countries of South America. A report was circulated in December last to the effect that the German firm of Siemens-Schuckert proposed to erect and work a high-power station in Argentina.

France.—Rapid communication with America was of supreme importance to General Pershing at the Front, and it was owing to his urgent representations that the "Lafayette" station at Bordeaux, described as the largest and most powerful wireless station in the world, was erected by the U.S. Navy. The power of the station is said to be 1,200 KW., and it provides absolutely reliable communication at any period of the year.

Floating mines have caused many breakages of Channel cables recently, and two out of six cables, specially laid for the transmission of Peace Conference messages, are interrupted.

Pacific Cable Traffic.—During the year ending March 31st, 1918, the Pacific Cable Board handled over 7,500,000 paying words of international traffic, nearly 600,000 words of messages (sent free) in relation to wounded members of the Expeditionary Force, and over 1,720,000 paying words between New Zealand, Australia, and the Pacific Islands.

Sweden.—All attempts at mediation have failed in the strike of telegraph and telephone workers, which threatens to affect the entire south of Sweden. It is expected that the majority of the lines of the Stockholm General Telephone Co. will soon cease working.—*The Times.*

Trans-Atlantic Cables.—One of the minor, but extremely important, side issues of the Peace Conference concerns the elimination of every element of German control over the Atlantic cable systems. Before the war, Germany possessed two cables between Rockaway (Long Island), just outside New York, and Emden. In August, 1914, exactly four hours after the declaration of war, a British cruiser cut both cables at a point near Fayal, in the Azores. The cables became prizes of war, and one of them was appropriated by the British, who, two years later, reorganised it to connect between Halifax (Nova Scotia) and the British Isles. The other cable was allotted to France, who up to now has made no attempt to utilise it. The question now arises whether England and France will retain the two cables permanently. France possesses only two direct cables, and no public wireless service to America. A large proportion of her communications have been sent *viâ* British cables and by wireless through London.—*Morning Post.*

United States.—By a unanimous vote the House Committee on Merchant Marine and Fisheries rejected the proposal of the Navy Department that the Government should assume ownership of radio-telegraphy.—*The Times.*

With further reference to the new multiplex system of telephony and telegraphy, invented and developed by the technical staff of the Bell system, the *T. and T. Age* explains that physically it can be employed on any open wire telephone line, but practically it is not advantageous to use it on any short line—say, less than 100 miles in length. The highly technical equipment required is so costly that it is economically available only for long lines. One installation is in service on the Baltimore-Pittsburg line distributing messages to their destinations which are received from Washington over the ordinary circuits. A great amount of new apparatus must be installed, and considerable work must be done on the lines themselves to adapt them to the new system.

The new system sends five voice currents simultaneously over one telephone circuit, taking each wave as it is delivered into an ordinary telephone and delivering it at its destination, another ordinary telephone, exactly as it was formed at the sending point. These five voice currents travel together and are sorted for delivery at their destination. Not a tone or inflection of the speaking voice is changed in passage. This result is achieved by combining each voice wave with a carrier current which has characteristics in degrees of frequency that are entirely different from those of other carrier currents. The carrier current thus gives the voice wave an identity of its own, and at the end of the journey the waves are sorted and directed into their proper channels, to be delivered as formed originally. The advantages of the system, when applied to telegraphy as well as to telephony, were clearly shown in tests. Using the multiplex system with the ordinary hand-operated telegraph instrument, connected with a telephone circuit, from 1,500 to 1,600 words can be sent in a minute. When the multiplex system is connected with the printing telegraph, from 1,000 to 5,000 words can be sent in 60 seconds.

The Commercial and Commercial Pacific Cable Companies have filed appeals in the Supreme Court against the decision of the Federal Court, which, on January 10th, dismissed the suit which they brought to restrain the U.S. Postmaster-General from taking over their cables.

An official United States Bulletin states that the Censorship Board instructions heretofore issued that all confirmations of cablegrams shall be in plain language have been revoked, and the original freedom of action of cable users in this regard is restored. Accordingly, postal packets addressed to the United States which contain the original text of code cablegrams are no longer stopped by the British Censorship.

Uruguay.—Some interesting details regarding the part that wireless telegraphy played in the war in this quarter of the globe were given by Mr. A. Mitchell Innes, H.B.M. Minister at Montevideo. According to the *Montevideo Times*, he said that "the use of the port of Montevideo for provisioning, repairing, and coaling British cruisers had been of great service. Then there was the wireless station at Cerrito. No other American country had permitted the use of its wireless stations for cipher messages. The Cerrito station was the sole medium of wireless communication between the Admiralty, the naval base at the Falklands, and the South Atlantic Fleet. Hence the importance attached to it by the Admiralty—and the efforts of the German Legation to prevent its use." The Minister entered into interesting details showing the important part this privilege had played in the battle of the Falklands—always "within the strictest rules of benevolent neutrality."

Wireless Telephony.—A Washington Press message states that the Director of Military Aeronautics, seated before an ordinary desk telephone in his office, talked to a pilot of the Air Service, who was operating a wireless-equipped aeroplane in the air. The communication involved the use of the telephone lines of the Chesapeake and Potomac systems, and was made at Boling Field, where the apparatus transmits speech over either system automatically. Communications have hitherto passed between pilots in the air and landlines on the field. This conversation, however, was the first official demonstration of a two-way conversation direct between a person using a telephone on a circuit and an aviator in flight.

CONTRACTS OPEN AND CLOSED.

OPEN.

Aberdeen.—Corporation Electricity Department. Five-ton tipping wagon for coals. Electric vehicle preferred, but not essential. See "Official Notices" January 10th.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney. A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Melbourne.—March 4th. Deputy Postmaster-General. Cables (schedule No. 1,504). A copy of the specification may be seen at the Inquiry Office, Department of Overseas Trade (Development and Intelligence).

March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

Aylesbury.—B.C. 200 to 400-kw. internal-combustion engine and dynamo complete. See "Official Notices" January 17th.

Belfast.—February 24th. Electricity Department. One 50-ton overhead travelling crane, one 5-ton overhead hand crane, and two 3-ton travelling electric cranes: two 24-in., one 5-in. and one 3-in. electrically-driven centrifugal pumps; five cast-iron water storage tanks.

Belgium.—February 14th. Special interest attaches to the fact that for the first time since the memorial year of 1914 we are able to draw attention to the call for tenders for electrical installation work in Belgium. Thus we learn that the municipal authorities of Herstal, near Liege, are inviting projects until the February 14th, for a system of electricity distribution in the town.

Glasgow.—Supply of complete A.C., 1,500-kw., 50 periods, three-phase, 3,000-volt generating plant, consisting of steam boilers, steam engines, A.C. generators, steam and exhaust piping and valves, surface condensers and water piping, main switchboard and accessories, cabling and sub-station panels, &c. For further particulars see "Official Notices" to-day.

Liverpool.—February 3rd. Tramways Committee. Supply of 50 electric tramcars. Specification, &c., from C. W. Mallins, General Manager, 24, Hatton Garden, Liverpool.

London.—H.M. Office of Works. January 29th. Supply of electric wire and cable to December 31st. See "Official Notices" to-day.

Manchester.—February 11th. Tramways Committee. (*a*) Tramcar motors. (*b*) Tramcar trucks. Specification, &c., from J. M. M'Elroy, General Manager, 55, Piccadilly, Manchester.

New Ross (Co. Wexford).—February 20th. Gas and Electricity Supply Co., Ltd. Suction gas plant and dynamos, storage battery, main switchboard, overhead lines and street lamps. See "Official Notices" to-day.

Sheffield.—Corporation Water Department. Two 3-ton steam locomotive cranes and one 5-ton electric locomotive crane, D.C., 460/500 volts. See "Official Notices" January 10th.

Spain.—The municipal authorities of Jerez de los Caballeros (Province of Badajoz), have lately invited tenders for the concession for the electric lighting of the town during a period of eight years.

Stretford.—February 8th. Electricity and Tramways Committee. Electricity converter station at Old Trafford. Specification, &c., from E. Worrall, Surveyor Council Offices, Old Trafford.

Warrington.—January 28th. Electricity and Tramways Committee. One 300-kw. and one 500-kw. rotary converter. See "Official Notices" January 10th.

CLOSED.

Cape Town.—The Corporation Electricity Committee has recommended that the tender of Messrs. Reunert & Lenz, Ltd., for two 34,000-lb. Babcock & Wilcox marine type water-tube boilers, supplied and erected at a cost of £35,975, be accepted, the Council to provide the necessary foundations.

Glasgow.—Electricity Committee. In connection with the erection of the new power station at Dalmarnock:—

Water softening plant.—Paterson Engineering Co., £1,236.
Flooring tiles for switch-house.—J. T. Gondie & Co., Glasgow.
Steam travelling crane.—J. Grieve & Co., £650.

Tramways Committee. Accepted:—

500 tons of rails.—Bolckow, Vaughan & Co.

Government Contracts.—The undermentioned contracts were placed during December, 1918:—

War Office.

Vulcanised fibre.—Sutcliffe (Crumpsall), Ltd.
Motors, &c.—E. Brook, Ltd.; General Electric Co., Ltd.
Transformers.—British Electric Transformer Co., Ltd.

Post Office.

Telegraph apparatus.—Siemens Bros. & Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; Western Electric Co., Ltd.
Telegraphic and telephonic cable.—British Insulated & Helsby Cables, Ltd., Siemens Bros. & Co., Ltd.
Coating brass bodies with lithoid.—New Lithoid, Ltd.
Ear pieces.—North British Rubber Co., Ltd.
Glow lamps.—Siemens Bros. Dynamos Works, Ltd.

H.M. Office of Works.

Engineering works services.—Electric Wiring, G.E. Co.'s Building, Kingsway, W.C.; Lund Bros. & Co.

India Office.—Store Department.

Brass tubes.—Muntz Metal Co.; Yorkshire Copper Works, J. Wilkes, Son and Mapplebeck; Birmingham Battery & Metal Co.; Broughton Copper Co.
Cable.—Siemens Bros. & Co.
Cells.—J. C. Fuller & Son; General Electric Co., Ltd.
Headgears, &c.—Peel-Conner Telephone Works.
Lamps.—British Thomson-Houston Co., Ltd.
Relays.—Automatic Telephone Manufacturing Co., Ltd.
Telephone sets.—Peel-Conner Telephone Works.
Voltoids.—Brunner, Mond & Co.

Sunderland.—T.C. Accepted tenders:—

E.H.T. switchgear.—Ferguson, Pailin & Co.
Incandescent lamps.—General Electric Co., Ltd.

FORTHCOMING EVENTS.

Institution of Electrical Engineers Students' Section.—Friday, January 24th. At 7 p.m. At the Northampton Polytechnic Institute, Clerkenwell, E.C. Paper on "A General Outline of Telephony," by Mr. H. T. Body.

Western Centre.—Monday, January 27th. At the South Wales Institute of Engineers, Park Place, Cardiff. At 7 p.m. Paper on "The Training of the Electrical Engineer," by Lt. Col. W. J. O'Meara, C.M.G.

North-Western Centre.—Tuesday, January 28th. At 7 p.m. At the Engineers' Club, Manchester. Paper on "The Supply of Single-phase Power from Three-phase Systems," by Prof. Miles Walker.

Institution of Mechanical Engineers.—Friday, January 24th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Electric Welding," by Mr. J. T. Heaton, and other papers on "Oxy-acetylene Welding."

Greenock Association of Electrical Engineers.—Saturday, January 25th. Visit to Messrs. A. F. Craig & Co.'s Engineering Works, Paisley.

Manchester Association of Engineers.—Saturday, January 25th. At 6.30 p.m. At the Grand Hotel. Discussion on "The Past, Present and Future of Electricity Supply," to be introduced by Mr. S. L. Pearce.

Junior Institution of Engineers.—Monday, January 27th. At 7.30 p.m. At the Royal Society of Arts, John Street, Adelphi. Discussion on "National Electricity Supply."

Industrial Reconstruction Council.—Tuesday, January 28th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Workers' Interest in Costing: A Factor of Industrial Reconstruction," to be opened by Mr. J. Joseph.

Institution of Civil Engineers.—Tuesday, January 28th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "Centrifugal Pumps for Dealing with Liquids Containing Solid, Fibrous and Erosive Matters," by the Hon. R. C. Parsons.

Royal Society of Arts.—Wednesday, January 29th. At 4.30 p.m. At John Street, Adelphi. Paper on "Food Production by Intensive Cultivation," by Dr. F. Keeble, C.B.E., F.R.S., Controller of Horticulture, Board of Agriculture and Fisheries.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following is a list of further contributions of 10s. value and over received in response to the appeal made by Mr. Hunter, the Chairman :—

	£	s.	d.
Anon.	1	1	0
F. Brown & Co.		10	6
Jas. S. Foreman	1	1	0
G. W. Neale		10	6
Wm. W. Lackie	10	0	0
C. Richardson & Sons	1	1	0
S. Dixon & Sons	5	0	0
Bertram Thomas	1	1	0
Ward & Goldstone	3	0	0
Attwater & Sons	10	10	0
Cromil Eng. Co., Ltd.	1	1	0
A. E. Ingle	1	1	0
J. M. Gorham	1	1	0
A. A. Rye	2	0	0
W. Cozens Cooke		10	6
Fred. Lake & Co., Ltd	1	1	0
Kiesow	1	1	0
Mosers, Ltd.		10	0
Kartret Eng. Co.	1	0	0
C. T. Quicke, J.P.	1	1	0
Z. Elec. Lamp Co., Ltd.	10	0	0
Hy. Coates		10	6
Robson & Coleman	1	1	0
Marconi Wireless Telegraph Co., Ltd.	105	0	0
J. Griffiths & Sons	1	1	0
Saxonia Elec. Wire Co., Ltd.	1	1	0
A. L. White		10	6
J. F. M. Bennett		10	6
R. H. Houstoun	1	0	0
G. Stanley Mappin	1	1	0
L. le Personnet Co.	2	0	0
Haydn Harrison	2	2	0
H. Gobie	1	0	0
E. Gimingham	10	0	0
J. F. Caine		10	6
Theodore Settle	3	0	0
Lawton & Sons	1	1	0
Major E. A. Pells, R.E.	1	1	0
Sir David Salomons, Bt.	10	10	0
R. J. Kauen	1	1	0
J. Dodimead & Sons	2	2	0
R. Savory		10	6
H. Hirst	10	10	0
G.E.C.	26	5	0
Dugard Bros., Ltd.	2	2	0
E. Wilson	3	3	0
M. Solomon	2	2	0
H. Fenemore		10	6
Pritchett & Gold, Ltd.	1	1	0
C. J. Hobbs & Co.		10	6
B.E. Co. (of London and Birmingham)	1	1	0
G. W. Franklin	1	1	0
C. D. Patterson	1	1	0
Davis & Dawes	1	1	0
F. Brahy & Co., Ltd.	2	2	0
J. M. Moffatt	1	0	0
A. H. Drewer & Co.	2	2	0
Stearn Electric Lamp Co., Ltd.	1	1	0
T. J. Grainger	5	0	0
G. T. Moody	1	0	0
Paragon Rubber Manufacturing Co.	2	2	0
J. Y. Fletcher	5	5	0
F. Broadbent	1	1	0
J. S. Child	3	3	0
H. Harrison	1	1	0
W. E. Burnand	1	1	0
R. Becker & Co., Ltd.	1	1	0
Whipp & Bourne, Ltd.	1	1	0
J. J. Pritty	10	0	0
C. H. Cox	2	2	0
G. B. Etches	1	1	0
W. M. Horsfall	1	1	0
J. Jones	1	1	0
H. Stokes	1	0	0
Cowton & Sons, Ltd.	2	2	0
E. M. Evans & Sons, Ltd.	1	1	0
D.P. Battery Co., Ltd.	1	1	0
G. Austin	2	2	0
C. G. Nobbs		10	6
P. T. King	1	1	0
Diamond Fibre Co., Ltd.	5	0	0
Brecknell, Munro and Rogers, Ltd.	1	0	0
Capt. C. W. Speirs	2	2	0
C. Nurse & Co., Ltd.	2	0	0
T. Burnley & Sons		10	0
R. A. Chattock	1	1	0
Solenoid Reg. Co.	1	1	0
Clarke, Hunt & Co., Ltd.	1	1	0
C. W. Cox	5	0	0
J. Gibb & Co., Ltd.	2	2	0
A. P. McDonall	1	0	0
W. Thom		10	0
Messrs. Lamlok	1	1	0
Boots Pure Drug Co., Ltd.	1	1	0
F. Allen & Co	10	0	0
J. Taylor	2	2	0
G. H. Fawcus	2	2	0
Equipment & Eng. Co.	1	1	0
Falk, Stadelmann and Co., Ltd.	10	10	0
Porter & Co.	1	0	0
E. Bodin	1	0	0
J. W. Elliott	5	5	0
F. W. Potter & Co., Ltd.	5	5	0
Weiss, Biheller & Brooks, Ltd.	2	2	0
F. Birkett		10	6
Vacuum Oil Co., Ltd.	1	1	0
J. W. Garsden	4	4	0
W. Dixon	10	10	0
Nalder Bros. & Thompson	5	5	0
E. Fawssett		10	6
T. P. Pollitt & Co., Ltd.	5	5	0
O. M. Andrews	1	0	0
W. E. Highfield	1	1	0
H. M. Brigg		10	0
O. Wheeler		10	0
Kennedy & Donkin	5	0	0
W. R. Rivers Moore	1	0	0
F. Ritchie		10	0
I. L. Roberts	1	1	0
A. Stanwell	1	0	0
M. J. Railing	5	5	0
E. Coote	2	2	0
J. Dickson		10	6
McGaw & Co.	2	2	0
J. Scott, Ltd.	1	1	0
Buchanan & Curwen	1	1	0
A. H. Gilling	1	1	0
W. Marchant	1	1	0
O. Goldstein	2	2	0
F. J. Launcham	2	2	0
G. Pattison	1	0	0
F. W. Parkinson	1	1	0
I.C.E.S.		12	0
J. W. L. Robb	1	1	0
Berkeley & Young, Ltd.	1	1	0
New British Electric Supply Co.	1	1	0
A. W. Prangnell	1	0	0
T. P. Marsh		10	0
F. J. Chapple	1	1	0
H. Walker & Son, Ltd.		10	6
Osborne & Hunter	1	1	0
T. B. & W. Cockayne, Ltd.	1	1	0
Everett, Edgcumbe and Co., Ltd.	2	2	0
Marshall, Sons & Co., Ltd.	1	1	0
J. W. Powell	2	2	0
Nettlefold & Sons, Ltd.	1	1	0
Drake & Gorham, Ltd.	2	2	0
J. H. Holmes	2	2	0
Wippel Bros. & Row		10	6
T. W. Ward, Ltd.		10	6
C. H. Worsnop	1	1	0
R. O. Whipple	1	0	0
H. Smith	2	2	0

OUR HALF-YEARLY INDEX.

The Index to Vol. 83 of the Electrical Review, which has now been printed, will be supplied for 3d., post free, to those who, through the post, specially apply for it. Applications should be addressed to the Publisher, Electrical Review, 4, Ludgate Hill, London, E.C. 4.

NOTES.

American General Electric Strike.—There was a strike of 20,000 employés of the General Electric Co., at Schenectady and Erie, in December, following upon the dismissal of 200 men at Erie Works (including 10 Union men), as a result of the cancellation of orders following the signing of the Armistice. It appears that the Union demanded the reinstatement of the men, and other matters, such as the recognition of the Union, were raised. According to an article in the *Electrical World*, the company's orders in 1917 aggregated $247,000,000, whereas orders received during the seven weeks prior to December 14th, 1918, were at the rate of $157,000,000 a year. In the last two weeks of this period they were at the rate of $125.000,000.

Institution and Lecture Notes.—Institution of Electrical Engineers (North-Western Centre).—At Manchester, on Tuesday last week, Mr. Ll. B. Atkinson delivered the tenth Kelvin Lecture on "The Dynamical Theory of Electric Engines" before this Centre. Mr. A. P. M. Fleming, O.B.E., chairman, was in the chair. Mr. J. A. Robertson, who was associated with Lord Kelvin at one of his most active periods, in moving a vote of thanks said that was the first time in ten years that a Kelvin Lecture had been given in the North-Western Territorial Centre, and he hoped that in future years they would have the Kelvin Lectures given regularly at all the Local Centres. He thought that they, as an Institution, ought to be conversant with what Kelvin had done, and he could imagine nothing more unfortunate than that the younger members should be able to use his knowledge and his inventions without having any proper idea of the work he carried out or what he contributed to the business in which they were all engaged.

(Scottish Centre). At Edinburgh, on Tuesday last week, Prof. Miles Walker, D.Sc., read his paper on "The Supply of Single-phase Power from Three-phase Systems," before this Centre, Mr. J. F. Neilson, chairman, being in the chair.

Association of Mining Electrical Engineers.—At a meeting of the Yorks. Branch of the Association, held at Doncaster last Saturday week, a paper was read by Mr. W. Jones, of the "C. O." Co., on "The Working of Miners' Electric Lamps," in which he strongly advocated more systematic methods in lamp cabins, and the better supervision of lamps by duly qualified and adequately paid men. A visit to the Lofthouse Colliery is to be made on February 15th.

Belfast Association of Engineers.—On the 17th inst., at the Technical Institute, Belfast, Mr. Kendrick Edwards, gave a lecture on "Electric Arc Welding," and the great advances which had been made in the process during the war. Welding plant was demonstrated by a number of lantern slides, covering a broad field of work. A discussion followed.

Nottingham Society of Engineers.—On Wednesday, last week, Mr. H. M. W. Royce, of the British Westinghouse Electric and Manufacturing Co., read a paper on "Industrial Electric Motor Control."

Manchester Association of Engineers.—At the meeting to be held to-morrow, to discuss "The Past, Present, and Future of Electricity Supply"—a vast enough subject, in all conscience—Mr. S. L. Pearce and Mr. J. G. Robertson will open the proceedings. Mr. Pearce will deal with past legislation, the position of electricity supply abroad, as contrasted with British practice, the various memoranda and recommendations of committees on the interconnection and reorganisation of supply undertakings, and the question of future policy in the development of the industry in this country, including the technical problems connected with power stations and transmission. The occasion will clearly be one of considerable interest and importance.

Volunteer Notes.—Royal Engineers Volunteers, London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 4, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Monday, January 27th, to Saturday, February 1st, drills as usual.

C. Higgins, Captain, R.E., *Adjutant*.

Fatalities.—A verdict of "Death from electric shock—misadventure," was returned at an inquest at Hyde on Ernest Wimpenny (10). The deceased, with other boys, was playing with a telephone wire which had fallen across three cables belonging to the Turbine Gears, Ltd., which ran from the Joint Tramway Board's sub-station. Arthur Hudson, engineer at the sub-station, said the voltage was 230.

T. J. Derman, an electrician in the employ of the King William's Town, Cape Province, Municipality, whilst working on the overhead wires. made contact with his face on a live wire, and was instantly killed.

We read in a South African paper that a boy was killed recently at a bungalow at Humewood, Port Elizabeth. It appears that his parents and he had rigged up an extension to the existing lights, but certain defects had developed, and on the boy's bare feet coming in contact with the damp sand, he received a shock that killed him instantaneously.

A Milnsbridge man, J. Lindley, aged 28, was on Tuesday last week killed at the mills of Messrs. James Shires & Sons, Lockwood, near Huddersfield. The gate of a hoist-cage had become electrified by the displacement of the lock, and Lindley, in attempting to open the gate, lost his life through receiving a shock at 400 volts. Verdict, "Accidental death."

British Trade with Greece.—Major Kennard, representative of the Federation of British Industries, is returning from Greece to England to report on his investigations as to openings for British trade in Greece. His report will be entirely favourable.—*Times.*

Standing Conference of Electricity Supply Associations.—Mr. W. B. Woodhouse has been elected chairman of this Conference for the ensuing year in place of Mr. C. P. Sparks, who has occupied the chair during the past year. Mr. J. W. Beauchamp has been elected honorary secretary of the Conference for the ensuing year in place of Mr. H. Faraday Proctor. The Conference is formed of the four Associations as follows :—Incorporated Municipal Electrical Association (Mr. H. Faraday Proctor, hon. sec.); the Conference of Chief Officials of London Electric Supply Companies (Mr. F. J. Walker, hon. sec.); the Incorporated Association of Electric Power Companies (Mr. A. de Turckheim); the Provincial Electric Supply Committee of the United Kingdom (Mr. T. W. Cole.)

Appointments Vacant.—Shift engineers (60s. + 12½ per cent.), wiremen (50s. + 12½ per cent.), for the War Department Power Station, Upton Lovell, Wilts.; power station staffs for the Northern Command; station fitters (57s. 6d. + 12½ per cent.), engine drivers (steam and internal combustion), (42s. 6d. + 12½ per cent.), wiremen (45s. + 12½ per cent.), linesmen-jointers (57s. 6d. + 12½ per cent.), for the Southern Command Generating Stations; lecturer in Electrical Engineering (£250), for the University of Bristol; cable jointer (55s. + awards), and draughtsman with electrical knowledge, for the Epsom U.D.C. Electricity Works; two overhead linesmen, plumber jointer, and boiler-house mechanic, for the Kilmarnock Corporation Electricity Supply; armature winders, controller fitters and electricians, for the Manchester Corporation Tramways. See our advertisement pages to-day.

Disabled Men as Drivers.—The Home Secretary has appointed Mr. A. L. C. Fell, general manager of the London County Council Tramways, to be an additional member of the Committee on the subject of the licensing of partially disabled men as drivers of public motor-vehicles.—*Times*.

Inquiry.—Makers of single-phase A.C. generators from 8 to 30 KW. are asked for.

Berlin Troubles.—The *Times* correspondent at the Hague, telegraphing on Tuesday last, referring to reported trouble that night in Berlin, said:—"The workers of the A.E.G. struck work at 5 o'clock, and Berlin is in darkness. The telephone also is not working for private conversations."

American Priorities Cancelled.—The *Electrical World* notifies that an official circular, addressed to all concerned, reads as follows: "Effective, January 1st, 1919, all rules, regulations, and directions of every nature whatsoever issued by the Priorities Division of the War Industries Board are hereby cancelled, and all pledges heretofore made on the suggestion or request of the said Division are hereby revoked."

It is also said that the lamp conservation programme involving restrictions upon inefficient incandescent lamps has been abandoned.

Chief Engineers' Salaries.—The Assoc. Mun. Electrical Engineers (Greater London) have communicated with London electricity supply authorities, asking that the following scale of salaries be adopted for chief engineers, as being the minimum that can be accepted: Where the number of units sold per annum is less than two million, £600 per annum; between two and five million, £650; between five and ten million, £700; between ten and twenty million, £750; over twenty million, £800. Additional payments are also to be made, based on the maximum demand, number of consumers, and units sold, also war bonuses granted to workmen are to be extended to chief engineers. The application requests that the scale be dated back to March 21st, 1918, that no member shall suffer any reduction thereby, that other appointments held shall not affect a member's salary as electrical engineer, and that the results up to March 31st each year determine the salary to be paid during the ensuing year.

Electrical Contracting Industrial Council.—The *Times* states that the Joint Industrial Council of the Electrical Contracting Industry, at its first meeting at Leeds, on Wednesday, agreed to establish for the industry a uniform 47-hour working week, payable on a basis of a 53-hour week, to begin on the first full working week following January 27th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with th technical or the commercial side of the profession and industry also electric tramway and railway official , to keep readers of th Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. H. C. Babb, for three years resident engineer and manager at the Bo'ness electricity works, has been appointed general manager of the Musselburgh District Tramways and Lighting Co. He is meantime to retain supervision of the Bo'ness station.

At Lancaster, last week, Private P. Taylor, M.T., A.S.C., assistant electrical engineer to the Darwen Corporation, was married to Miss A. T. Taylor, of Lancaster.

Barnsley T.C. has appointed Mr. J. Wetherell, of Upton Lovell (Wilts.), as electrical assistant at the electricity works at £215 per annum.

Aylesbury T.C. has granted £100 to the electrical engineer (Mr. W. A. Turnbull) for extra work in connection with the installation of a gas producer plant.

The marriage took place at Christ Church, Epsom, last week, of Mr. E. H. Manley, chief assistant engineer to the South Metropolitan Electric Tramways Co., Ltd., and Miss G. M. Pritchard. The presents included a bookcase from the company.

Inspector Smalley, of the Oxford Electric Tramways Co., Ltd., has been appointed traffic superintendent for the Musselburgh Electric Tramways, and on leaving has been presented with a cigarette case.

Mr. T. Roles, the Bradford city electrical engineer, who recently experienced a breakdown in health, is again back at his duties.

Wolverhampton T.C. has increased the salary of Mr. C. O. Silvers, general manager of the Corporation tramways, from £450 to £600 per annum. It was stated that with this advance Mr. Silvers will have had an increase of £400 during six years.

Shoreditch B.C. Law and Establishment Committee recommends that the salary of Mr. W. Weekes, chief assistant electrical engineer, be increased from £250 to £350 per annum.

The Heywood Electricity and Tramways Committee has increased the salary of Mr. D. H. Davies, borough electrical engineer and tramways manager, by £50 per annum.

Mr. W. E. Claret has resigned the position of chief engineer of the power plant of the British Xylonite Co., Ltd., Hale End, London, on accepting an appointment under the County Borough of Stoke-on-Trent electricity supply department.

General.—Prof. C. A. Middleton Smith, of Hong-Kong University, will be leaving Hong-Kong at about the end of March for a period of leave in England. He hopes to reach home early in May.

Mr. H. J. Fell, manager of the Chelmsford works of Messrs. Crompton & Co., Ltd., who is retiring after 15 years' service, has been presented by the employés with a fitted suit case.

Mr. P. Frampton, late of Messrs. Bottomley, Frampton and Co., Blackpool, has commenced his duties as works manager for Mr. George Morrison, 24, Birley Street, Blackpool.

Mr. R. B. Hand has left Messrs. Scholey & Co., Ltd., having entered the service of Messrs. Thacker, Bell & Co., Ltd., 44, Leadenhall Street, for whom he will take control of their electrical department.

By public announcement, Mr. E. Herman Friedrich Hotoff, of Beckenham, a British-born subject, has changed his name to Ernest Frederick Holden.

As the advent of peace has terminated his duties at the Admiralty, Major J. Caldwell resumes his position with his firm (James E. Sayers & Caldwell, Glasgow), and, as from Monday, 3rd prox., will establish himself in London at Parliament Mansions, Victoria Street, S.W. In addition to general consulting work, Major Caldwell will devote particular attention to electric welding, which, during his service with the Admiralty, he has been engaged in developing and extending at munition factories and shipyards, both in this country and abroad.

Mr. C. W. Hill has now been demobilised from the Navy and has resumed his position of director of Messrs. Scholey and Co., Ltd.

On Thursday evening, January 16th, a social evening was held at the Woodland Works (Chadwell Heath) of Messrs. John C. Fuller & Son, Ltd., when Mr. George Fuller, chairman and managing director, met the members of the staff at a reception. The guests were welcomed by Mr. and Mrs. Fuller, and numbered about 150. Refreshments were provided in the new canteen, which was specially decorated for the occasion, and a high-class concert was given conducted by Miss Mabel Dawkins. During the evening there was a surprise presentation of a bouquet to Mrs. Fuller, on behalf of the staff. The directors and some of the principal shareholders were present.

Roll of Honour.—The Military Medal has been awarded to Private V. H. A. Kimberley, A.S.C., who was formerly in the employ of the General Electric Co., Ltd., at Witton.

Corporal V. M'Glynn, of Pendleton, Manchester, who has been awarded the Military Medal, was an employé of the British Westinghouse Co., Ltd., Trafford Park.

Sergeant H. Dennis, of the 1/5th Loyal North Lancashire Regiment, mentioned in dispatches, was formerly employed at the Bolton Electricity Works.

Sapper T. Livesey, R.E., who has died at Salonica from dysentery and malaria, was formerly engaged with Messrs. William Gaskell & Son, electrical engineers, of Wigan.

Private J. W. Manser, Tank Corps, formerly a member of the Ealing Borough electrical engineer's staff, has returned after five months' captivity in Germany.

Obituary.—Mr. Albert Edwards.—The *Times* records the death of Mr. Albert Edwards, who was one of the first telegraph operators in England. "He worked on the old private lines in the West of England, South Wales, and Scotland before the telegraph service was taken over by the State. For many years he was in charge of the telegraph office at Dover Admiralty Pier. Mr. Edwards was a voluminous writer to the various postal service magazines."

We desire to tender our sympathy to Dr. and Mrs. S. Z. de Ferranti in the sad loss they have sustained through the death of their third daughter (aged 16), which occurred at their residence at Baslow, on January 16th, after an operation for appendicitis.

Mr. C. R. Walker.—The death has taken place at Torquay of Mr. Charles Robert Walker, manager of the Mansfield and District Tramway Co., Ltd., and of the Notts and Derby Tramway Co., Ltd. He was 48 years of age, and was a prominent Freemason.

Mr. J. B. Mason.—The death occurred on January 13th of Mr. John Bancroft Mason, electrician in charge of the installation on the estate of Mr. H. A. Colefax, K.C., of

Old Buckhurst, Withy Lane, Tunbridge Wells. Deceased, who was 50 years of age, died from paralysis caused by a fall last September.

Captain G. Whitaker.—In the *Times* "Deaths" column we read that on December 19th, 1918, there passed away, at the age of 34 years, at Namtu, Burma, Capt. Gilbert Whitaker, M.I.M.E., M.I.E.E., chief engineer, Burma Mines, Ltd.

NEW COMPANIES REGISTERED.

Manufacturing Engineers, Ltd. (152,605).—Private company. Registered January 13th. Capital, £2,000 in £1 shares. Consulting, civil, electrical, constructional, marine, aeroplane, cycle, motor, and general engineers, &c. The subscribers (each with one share) are:—S. Wallace Wilkins, 19, Lanhill Road, Maida Vale, W., electrical engineer; C. S. Sizer, 295, Gray's Inn Road, W. 1, electrical engineer. Permanent directors: E. P. Barfield and S. W. Wilkins. Registered office: 283, Gray's Inn Road, W.C.

Electric Vehicles, Ltd. (10,197).—Private company. Registered in Edinburgh, January 6th. Capital, £5,000 in £1 shares. Agents for the purchase, sale, and hire of electric vehicles, &c., constructors and repairers of and dealers in automobiles, &c. The subscribers (each with one share) are:—S. A. J. Grimes, 11, Bothwell Street, Glasgow; C. J. Seller, 144, St. Vincent Street, Glasgow. The first directors are not named. Registered office: 144, St. Vincent Street, Glasgow.

Birr Electric Light & Power Co., Ltd. (4,643).—Registered in Dublin, January 10th. Capital £8,000 in £1 shares. Objects, as title. The subscribers are:—T. R. Garvey, Woodville, Birr, 100 shares; D. P. Proctor, Green Street, Birr, 500 shares; E. C. Dooley, Main Street, Birr, 100 shares; J. Dooly, Wilmer Road, Birr, 100 shares; W. J. Meara, Main Street, Birr, 100 shares; W. A. F. Barry, John's Place, Birr, 100 shares; A. Wright, Birr, 50 shares. First directors: T. R. Garvey, D. P. Proctor, E. C. Dooley, J. Dooly, and W. F. Meara. Registered office: 7, Ross Row, Birr.

CITY NOTES.

The Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers has been as under:—

	1918.	1917.
Four weeks ended September 27th	2,761,058	2,354,138
Four weeks ended October 25th	2,488,926	2,240,246
Five weeks ended November 29th	2,829,274	2,479,429

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Dividend of 6 per cent. per annum, less tax, on the preference shares. Funded preferential dividend certificates purchased, £11,187; to renewals, depreciation, reserve, &c., £12,310; carry forward, £2,525.

Liverpool Overhead Railway Co.—Final dividend (for the half-year ended December 31st last) at the rate of 5 per cent. per annum, less income-tax, on the preference shares, and 4 per cent. per annum, less income-tax, on the ordinary shares, making for the year 5 per cent. on the preference shares and 3½ per cent. on the ordinary shares.

Montreal Light, Heat & Power Co.—Quarterly dividend 2 per cent.

STOCKS AND SHARES.

Tuesday Evening.

There is no slackening in the volume of Stock Exchange activity, and business broadens daily amongst the Industrial sections. Labour restlessness is having very little effect upon the anxiety of investors to buy shares from which a good return is obtainable. Only in the railway markets does this factor make for any appreciable caution. With the termination of the period for the National War Bonds there has come an unloosing of purse-strings for other securities. Many stocks and shares are easier to sell than they are to buy.

The Underground Railway group has reacted from the best. Underground Incomes rose to 96, but the enthusiasm became a little abated on the businesslike statement issued by the board in reply to the plea put forward by the Bondholders' Committee, in which the latter suggested that—in plain words—more money should be distributed to the proprietors. The board point to the necessity of providing funds against renewals, repairs, and other such items of expenditure. Their reply was read as a hint that the income bondholders will do well not to expect too much at present, but the reaction of 1½ in the price is, after all, very trifling.

To the holder of the season-ticket on the District, to the traveller on the Piccadilly, City & South London, and Hampstead Tubes the constant wonder presents itself at the avoidance of accidents. To deal with the problem of London transportation must involve the continual hope that more men may be quickly released for the work of repairs and renewals. As things are, the conditions seem to grow daily more congested and the crowding more dangerous.

Districts have risen to 29. Metropolitans advanced to 32½ before reacting to 31. Underground "A" shares have been up to 12s., and are now 11s. The £10 issue hangs fire, and at 3⅝ the shares look relatively less expensive than those of the shilling class. Contingent certificates have attracted a certain interest at about 1s. 7½d. They are a gambling counter.

Publication of the terms proposed for the reconstruction of the London United Tramways show that previous years of a drastic lopping-off of capital were well-founded. The debenture holders are asked to consent to an exchange of their present £100 stock into £52 new debenture, £52 new 6 per cent. preference, and £5 new ordinary. To put the concern on its legs as a remunerative company the cut is probably not worse than necessary. Over-capitalisation has dogged the London United Tramways for years past, and reorganisation of the finances ought to have been taken in hand long ago. The scheme is regarded in the Stock Exchange as a fair proposition, and, with revised fares, the payment of debenture interest on the new stock is considered assured, while there is reasonable hope of the preference dividend being duly met.

Metropolitan Tramways 4½ per cent. debenture is 2 higher at 73½. British Electric Traction has risen to 50½: a "tip" is going round to buy the stock. Any low-priced tramway shares are wanted.

Electric lighting shares remain quiet and firm. The manufacturing group is hard. Edisons are 9d. up at 20s. Rumour busies itself with possibilities of amalgamations in electrical circles. Electric Constructons eased off to 23s. 9d. General Electric preference are ⅛ weaker. Callenders have risen to 11, and Babcocks to 4. Edmundson's are better at 13s. 6d., and the 6 per cent. preference at 30s.

Foreign traction issues are dull and heavy. Mexicans show little life. Monterey Fives advanced to 49, but Mexican Electric Light Fives are lower at 54. British Columbia Electric descriptions remain depressed. Canadian General Electric recovered to 114½.

No fresh features have developed amongst telegraphs and telephones. Marconis keep about 4½, Americans 29s., and Marines 3½. There is not much doing in them. Rubber shares are strong throughout, with a big business in all the Dutch descriptions.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Jan. 21, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7⅜	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref...	4½	4½	8½	—	6 8 7
Chelsea	8	5	4	—	6 5 4
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref. ..	6	6	10⅛	—	5 18 5
County of London	7	7	11	— ⅛	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref...	4	5	4	—	6 5 0
Metropolitan	8	4	8	—	6 13 4
do. 4½ per cent. Pref. ..	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	8	9	7¼	—	6 4 2
South London	5	5	9	—	6 18 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	7⅜	—	6 2 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½xd	—	6 1 10
do. Def.	1½	1½	22xd	—	7 12 0
Chile Telephone	8	8	7½xd	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15½xd	—	*5 3 3
Eastern Tel. Ord.	8	8	157	—	*5 1 7
Globe Tel. and T. Ord.	7	7	14½	—	*4 18 6
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	24	22	32½	—	6 15 0
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4½	—	4 0 0
Oriental Telephone Ord.	10	10	2⅛	—	4 0 0
United R. Plate Tel.	8	8	7⅞	— ⅛	*5 1 7
West India and Panama	6d.	1/8	1¹¹⁄₁₆	—	*9 12 6
Western Telegraph	8	8	16⅝	—	*4 16 3
Home Rails.					
Central London Ord. Assented ..	4	4	65½	—	6 2 2
Metropolitan		1	31	—1	3 4 6
do. District	Nil	Nil	29	+1	Nil
Underground Electric Ordinary..	Nil	Nil	3⅝	— ⅛	Nil
do. do. "A" ..	Nil	Nil	11/-	+9d.	Nil
do. do. Income ..	6	4	93½	—1½	*4 5 7
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	3⅞	—	—
do. do. 2nd Pref. ..	5½	—	3½	—	—
do. do. 5 Deb... ..	5	5	72½	—	6 18 0
Brazil Tractions	—	—	56	—	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	67½	—	7 11 5
do. do. Preferred	Nil	Nil	48	—2	Nil
do. do. Deferred	Nil	Nil	45	—	Nil
do. do. Deb. ..	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds..	Nil	Nil	66	—1	Nil
do. 6 per cent. Bonds..	Nil	Nil	52	—	Nil
Mexican Light Common	Nil	Nil	38	—	Nil
do. Pref.	Nil	Nil	48	—	Nil
do. 1st Bonds.. ..	Nil	Nil	59½	— ½	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	4	+ ⅛	3 15 0
British Aluminium Ord.	10	10	1¹⁄₁₆	—	5 8 1
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref. ..	7½	7½	2⅛	—	6 0 0
Callenders	20	25	11	+ ¼	5 18 8
do. 6½ Pref.	5	5	5⅜	—	5 2 4
Castner-Kellner	22	20	9¹⁄₁₆	+ ¹⁄₁₆	5 16 8
Edison-Swan, "A"	—	—	20/-	+9d.	7 10 0
do. do. 4 per cent. Deb. ..	4	4	74½	—	5 6 0
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10¼	— ⅛	6 6 10
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2¾	—	5 11 2
do. 4½ Pref..	4½	4½	4	—	5 12 6
India-Rubber	10	10	17¼	—	*5 16 0
Telegraph Con.	20	20	48	—	*5 0 0

* Dividends paid free of Income Tax

Exports and Imports of Electrical Goods during October, November, and December, 1918.

The official returns of electrical exports and imports for the last quarter of the year record, as regards exports, values of £263,501 in October, £229,031 in November, and £307,370 in December, as compared with £232,708 in July, £246,080 in August, and £280,438 in September, giving a total of £799,902 for the December quarter, an increase of £40,000 on the preceding three months, principally in the item for electrical machinery. The figures for electrical exports for the past month totalled £3,223,959, or an average of £268,600 a month.

The electrical imports for the past three months show a further falling off in values, the figures being, for October, £143,092 : November, £124,077 ; and December, £85,416 ; as compared with £152,091 in July, £116,656 in August, and £124,233 in September.

The figures for re-exports of foreign and overseas electrical material show a slight increase, the totals being—October, £6,196 : November, £10,092 ; December, £1,332 ; as compared with—July, £3,078 ; August, £3,331 ; September, £6,630.

Exports and Imports of Electrical Goods and Machinery during October, November, and December, 1918.

	October.			November.			December.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.
Electrical goods and apparatus unenumerated	£35,508	£40,447	£2,392	£33,008	£33,014	£4,300	£39,660	£14,721	£1,070
Insulated wire and cable (not telegraphic or telephonic)	24,617	2,279		14,541	1,932	500	26,019	—	—
Electric glow lamps	5,269	53,831	1,637	6,125	25,883	4,193	4,172	5,977	—
Arc lamps and parts (not carbons)	1,152	8,714	—	159	10,945	—	1,363	2,621	51
Meters and instruments	8,436	570	—	16,615	3,853	196	12,366	8,126	—
Electrical machinery (including switchboards and transformers)	102,930	27,097	398	87,547	33,725	822	73,799	31,294	211
Batteries	15,647	7,669	—	6,445	8,746	—	12,102	11,487	—
Carbons	616	799	725	552	2,792	—	638	2,676	—
Telegraph and telephone cable, wire, and apparatus	69,326	2,496	1,044	63,739	3,187	81	137,251	8,514	
Totals	£263,501	£143,902	£6,196	£229,031	£124,077	£10,092	£307,370	£85,416	£1,332

ELECTRICITY SUPPLY PROGRESS IN WAR TIME.

(*Continued from Vol. 83, page 643.*)

BOLTON.

The electricity department of the Bolton Corporation (Mr. W. J. H. Wood, borough electrical engineer) has been very active during the war. Although the call for munitions of war has not brought new industries to Bolton, the established engineering works very soon adapted themselves to producing war material, and their output has been considerable. As the recognised home of cotton spinning, Bolton has also produced a large proportion of the yarn required for the manufacture of aeroplane and balloon cloth.

The electricity department has been responsible for supplying the motive power required; the output for the year ending March 31st, 1914, was about 13¾ million units, whereas the output for the year ending March 31st, 1918, was just over 23 million units.

The plant extensions include a turbo-alternator of 8,000-KW. capacity, and two water-tube boilers rated at 34,000 lb. of steam per hour each. The main switchgear has been extended, and a considerable amount of work done in connection with the distribution system.

The demand for electrical energy for all purposes keeps on increasing, and in the very near future the department will again have to extend and install additional plant for dealing with the requirements of prospective consumers.

BRIGHTON.

Owing to the geographical position of Brighton, the Corporation's electricity undertaking (Mr. John Christie, engineer and manager) has been very severely hit with regard to lighting restrictions. Shortly after war broke out the whole of the street lighting was absolutely discontinued, no outside shop or window lighting of any sort being allowed, and the lighting on the piers was also entirely discontinued, with the result that there was a very serious falling-off in the higher-priced lighting units.

Munition works, aeroplane factories, and clothing industries, however, were established in the area, and the increased power load derived from these sources practically maintained the output at the pre-war level, the ratio of lighting and power units being now about 20 and 80 per cent. respectively, as against 43 and 57 per cent. before the war.

The Corporation has also had to supply urgent temporary power for works in connection with the Admiralty, putting down some special plant to meet it.

A large diamond-cutting factory is now in course of erection, and already partially running. When this is completed it is estimated that some 600 H.P. will be required. The supply to be given is A.C., three-phase, and a special sub-station is being provided for this purpose on the premises, to house three 300-K.V.A. transformers with the necessary switchgear.

Now that the restrictions are partially removed, the street lighting is being reinstated and generally lighting throughout the town substantially increased, and there is every possibility of considerable development of industry in the area in the near future. To provide for this, a new 4,000-KW. turbo-alternator is on order for early delivery. It is to replace a 1,800-KW. double-flow Westinghouse turbine installed some 14 years ago, which is now obsolete.

No extension to the boiler-house plant has been made, but in order to deal more efficiently with the poor-quality fuel supplied during the past few years, three of the boilers have been equipped with the latest type underfeed travelling-grate stokers with forced draught.

KILMARNOCK.

Up to the year 1914 the Kilmarnock electricity supply area only covered the burgh of Kilmarnock. The generating plant in the station consisted only of high-speed engines and direct-current generators, and the whole system of supply was direct current, three-wire. The maximum plant capacity was 1,030 KW., and the highest maximum load recorded during the winter of 1913 was 1,300 KW. At the beginning of the year 1914 the Corporation (Mr. W. C. Bexon, burgh electrical engineer and tramway manager) applied for powers to extend the area of supply, and the new area scheduled consisted of approximately 180 square miles of the county of Ayr, including the burghs of Troon, Irvine, Galston, Newmilns, and Darvel. This extension was sanctioned, and the work was commenced in March of 1914.

A 1,500-KW. generator was installed in August, 1914, together with a new boiler-house plant. A further 3,000-KW. set was installed in December, 1915, and a 5,000-KW. turbo-alternator and two 30,000-lb. boilers were installed in March, 1916.

The work of laying mains in the above-mentioned burghs, and the erection of the extra-high-tension lines to supply them, was commenced in June, 1914, and a supply was available in all the burghs by November, 1915. The burgh of Irvine was connected in February, Troon in April, Galston in March, Newmilns in August, and Darvel in November. In addition, during this period a number of factories and coal pits *en route* were connected up to the supply.

Early in the spring of 1917 an extra-high-tension loop transmission line was erected to meet the increased demands at Irvine and district. Since the beginning of 1914, 10,000 KW. of plant has been installed in the power station, and 2,500 KW. of rotary-converter plant in the sub-stations and on consumers' premises. Some 50 miles of extra-high-tension, 11,000-volt transmission lines have been erected, and approximately 10 miles of underground cable laid. Unfortunately, owing to the restrictions, the connecting-up of the mills in the Newmilns and Darvel districts, has been postponed since 1916, but the work will now be proceeded with immediately.

At the present time the undertaking has applications for supply to the extent of 5,000 H.P., and in the scheme of extending its present area of supply, application already having been made, which includes two other burghs, a further 3,000 H.P. is anticipated.

During the war the output has increased from 2,500,000 to 14,000,000 units per annum.

ROTHERHAM.

Much activity and important extensions are taking place in the Corporation electricity supply department (Mr. Edward Cross, engineer and general manager). For the year ending March 31st last, the number of consumers was 949, an increase of 146 during the last four years, and the total units sold reached 21,490,165, or an increase of 5,943,016 in the same period. During the war the old station has been nearly doubled in capacity, two turbo-alternator sets having been added, each of 5,000 KW. Difficulty was experienced in finding room for these sets, one of which overlaps two of the older sets, it being placed between and above them. In the boiler-house extensions had also to be made to deal with the increased load, besides which a new pump-house was built, and extra coal-handling facilities were provided. Further, a tunned was excavated beneath the boiler-house, and a conveyor installed to deal with the ashes. The excavation necessitated the under-pinning of three boilers, which work was carried out while the boilers were on load. It soon became evident that further extensions were necessary, and in view of the cramped position of the old station it was decided to build a new station on the opposite side of the road. The then Director of Electric Power Supply placed at the disposal of the Corporation, free of charge, a complete set of drawings, specifications, &c., of the Melbourne power house (designed by Col. McLellan's firm for the Victorian Government) to enable the Corporation to save months of delay. This new station, now in course of erection, will contain two 12,500-KW. turbo-alternators and a 30,000-KW. set, together with the necessary switch gear, auxiliary, and boiler-house plant to steam the whole. On completion, the new station at 6,000 volts and the old one at 3,000 volts are to be interconnected through a bank of Ferranti transformers of 5,000 K.V.A. The plant capacity of the undertaking on June 30th, 1914, was 5,150 KW. From that date to October 31st, 1918, the additional plant installed or authorised was of a total of 65,350 KW., so that the two stations, when the new one is completed, will bring the capacity of the undertaking up to 70,500 KW. This extension for the purpose of priority was graded P.2 by the Director of Electric Power, and some idea of the future size of the undertaking can be formed from the fact that several thousand pounds are being spent on laying mains to one consumer—a large rolling mill—who will alone account for 60 millions of units per annum. It has been estimated that the new plant will be available for operation by the coming summer.

BRISTOL.

The Bristol Corporation electricity department (Mr. H. Faraday Proctor, chief engineer and general manager) has had the satisfaction of being able to report considerable expansion during the war period. Under the following headings a summary of the developments of the undertaking from 1915 to date is given :—

	1915.	1916.	1917.	1918.
Units generated	22,156,500	26,686,000	30,103,957	32,414,990
Max. peak load (KW.)	8,478	9,874	9,599	10,918
Plant installed (KW.)	15,050	15,050	15,050	18,050
Coal used (tons) ...	35,984	44,623	51,983	44,785
Coal per unit generated (lb.) ...	3·638	3·756	3·868	3·095

Although a considerable amount of improvement in demand, output, and economy is evidenced from the foregoing figures, Bristol has not had the good fortune of some of the Northern and Midland towns which, owing to the steel industry, have been centres of operations during the war. It has, however, had demands made upon it by the Admiralty using the Avonmouth Dock, inasmuch as the dock being admirably equipped, it was selected as one of the ports of embarkation for troops and materials of all descriptions. In addition to war supplies, the requirements of the civil population have been dealt with through the port of Bristol, the loads on the clothing, boot, and tobacco factories, especially the latter, bearing ample testimony to this effect. In the same district as the docks, munition works and factories for the manufacture of explosives have been erected, whilst the National Smelting Works also find a place in the vicinity. The Admiralty also selected a site on the opposite side of the river for the construction of a standard shipbuilding yard. The combined demands from these developments have necessitated the electricity undertaking purchasing a further 6,000-KW., 3,000-R.P.M., three-phase British Westinghouse turbo-alternator complete with condensing plant. This additional plant is being installed in a portion of the engine room which was originally intended for a workshop, as owing to war conditions it was found impossible to interfere with the smaller units of plant. The boiler-house capacity of the station was, however, too small to meet the increased demand anticipated during the coming year, and a further extension is in course of erection. This extension provides for the installation of four vertical water-tube boilers, each 5,400 sq. ft. heating surface, by Messrs. John Thompson, Ltd., fitted with Ferguson superheaters. These boilers are placed two in a battery, with Green's standard economisers placed above the boilers and the induced-draught plant over the economisers. One stack will be provided for the four boilers, and the induced-draught plant divided into two. The stokers are "underfeed" travelling grate of the integral type, *i.e.*, each stoker is fitted with its own forced-draught plant complete. It is hoped that this equipment will deal with a greater variety of fuel, as owing to the geographical position of Bristol anything from coke-breeze and anthracite to bituminous coal is at its disposal.

(*To be continued.*)

CARBON BRUSHES: CONSIDERED IN RELATION TO THE DESIGN AND OPERATION OF ELECTRICAL MACHINERY.

At Leeds, on January 14th, Mr. P. Hunter-Brown's paper (an abstract of which appeared in our issue of December 27th, 1918) was read and discussed before the North-Midland Centre of the I.E.E.

Mr. R. H. Campion, chairman, in opening the discussion, said they were all indebted to the author of the paper for giving them such a full description of the behaviour of carbon brushes. It was over twelve years since he had standardised all the dynamo brushes under his care, with small brushes and aluminium holders with copper gauze flexible gear, and had attained very satisfactory results. He knew of one manufactory where three different departments recommended three different types of brushes, and he had come to the conclusion that manufacturers generally preferred purchasers to experiment and find out the most suitable size, even after they had given all the details about the machine. He believed that a good deal of the trouble which had arisen had been due to a very poor, inefficient, and cheap type of brush gear adopted by one manufacturing firm, and copied by many others, because they thought it was standardised. What was the author's definition of "sparkless"? He (the speaker) had been amused at various times at seeing different dynamos sparking, and had been generally told : "That is a harmless spark, that is something else." Interesting points of the paper were the particulars given of the two sets of brushes supposed to be working at 40 amperes per sq. in., and which had eventually come out at 24 and 56. He considered a good deal of the trouble resulted from not paying sufficient attention to the bedding. Personally he found that they had always to make their own spring balance if it was to be of any use. The cutting of mica was favoured, perhaps, because mica caused trouble to brushes, but on the whole it was found that it paid to cut the mica. He would like more information about the partial vacuum existing under the brushes. He considered that small, narrow brushes were the best for engine-driven dynamos. For turbo dynamos one must have a box-type brush, and for radial commutators they required something with a good spring.

Mr. T. Carter (Newcastle-upon-Tyne) said it was necessary for the manufacturer to be as expert as possible about the brushes he put on his machine. The matter of brush grades was often very casually treated even by those who should know better. All that mattered to a manufacturer was to get a brush that suited the great majority of his machines, irrespective of its cost; the best brush might occasionally be the worst, that was the cheapest, from the brush-maker's point of view. Standardisation was a complicated matter as regarded carbon brushes. The author took an essentially sane view, and pointed out the insuperable difficulty of standardising quality. Size was comparatively a simple matter, but to standardise size without quality would land the inexperienced user in greater difficulties than at present. Each maker's standard machine, having its own peculiarities, should be fitted with brushes of a grade selected by the maker. If dealers were going to stock standardised brushes they would keep one or two grades only which would be sold as "just as good" as those the user wished to replace, and disastrous results would probably follow. The very fact that each maker had his own shape and size of brush in the same way as he had his own shape and size of bearings compelled the user to go to the maker for spares, with the result that the user got the right articles every time. The Admiralty had standardised sizes of brushes, and also mentioned a grade as a sort of reference. This had been done with successful results, but it was due rather to the easy conditions specified as regarded density and other factors than to any special merit in the standardisation. By all means let standardisation be achieved if possible, but let it be thrashed out to the last detail by those who were experts in the technical side of the subject, and adopted, if at all, only after the broadest possible view of the whole subject had been taken. He considered it was possible for each manufacturer of a standard line of machines to find, at most, two grades and perhaps one grade only, which would suit, say, 80 per cent. or 85 per cent. of his machines. There could, therefore, be a more or less universal brush for each maker's requirements, but it was not reasonable to expect a universal brush for all designs. The matter of contact drop was an exceedingly important one; he knew of a case where increased pressure on brushes actually reduced the commutator temperature because the contact drop was so much smaller that the total commutator losses were reduced in spite of the increased friction loss. There was, he believed, a very considerable difference between the positive and negative contact drops; which was the larger of the two? and by how much did the two drops differ from each other? Recently he had come across a dynamo with graphite brushes where the negative brushes heated very considerably more than those on the other pole. The matter was complicated by the swelling of the graphite brushes—a feature not to be lost sight of in designing brush holders—which caused them to stick one by one in the boxes, and so overloaded those which remained free until all were more or less stuck.

Curiously enough, the negative brushes which, on the quasi-electrolytic theory, should have worn more than the others actually wore very much less, and there were other altogether unusual features. Years ago he had come across a case, which was never satisfactorily explained, where a graphite brush was tried to improve commutation on a dynamo, but could not be adopted because it converted a previously normal machine into one hopelessly under-compounded, almost as though the brush deposited a semi-insulating skin on the commutator. He (Mr. Carter) was inclined to think that the brush holders should be set even less than ⅛ in. away from the commutator; they should be just far enough away to get in the emery or carborundum cloth for bedding the brushes, which would mean about 0.05 in. only. The importance of the insulated brush top in cases where there was vibration could not be over-estimated, as it prevented the pressure finger digging into the brush. In fact, if the whole of the brush box could be insulated from the brush in such circumstances much of the difficulty would probably disappear. Loose brushes implied chattering, which, sooner or later, led to a mechanical break up of the brush with disintegration of the flexible connection, and other disagreeable results. What was the maximum voltage of a machine using a copper graphite, mostly copper, brush? He had found difficulty even with interpoles in a plating dynamo giving 15 volts, but was inclined to put the limit at about 10 volts. He preferred not to groove mica, but to use a brush sufficiently abrasive to keep it down. If mica tended to come up in a new machine persistent scouring with fine carborundum cloth—emery was no good for the purpose—for two or three weeks would often entirely save the trouble, and only if it persisted, in spite of everything, was it necessary to try different brushes or, as a last resort, to groove the mica. In any case the grooving, if well and cleanly done, need not be more than 1/32 in. deep, as the prevention of wear it ensured would mean that the copper would disappear only very slowly, and the mica need not be regrooved for a long time. On no account must lubricant ever be used on a commutator; if brushes were noisy they should be changed for others which would run more quietly. He had occasionally found only one or two brushes picking copper on a machine, and merely cleaning the contact surface was not a cure. But if the picking was due to the commutator being new, and not having a good skin developed on it, this isolated picking could frequently be cured merely by substituting a new brush for the one which had been giving trouble. It would almost appear as if the copper particles were carried some small distance into the brush, thus altering it for a little of its length behind the contact surface, so that cleaning still left a surface of too low a resistance, which tended to produce abnormal current density in that same brush again, so causing picking to continue; whereas if a new brush were put in, and the commutator had begun to get a new skin on it, the tendency to start picking would have disappeared.

Mr. Brown (Bradford) remarked that he had over 250 types of brushes to tackle, and at times the thing was really unwieldy. Brush-holders were wrapped up with the question of brushes themselves. He wondered whether something could not be done to bring out a standard holder which could be adapted to a good many machines at least, but he was afraid that state of affairs would not come about until those who built motors and dynamos gave up building and making them, and started manufacturing. With regard to brushes, brush holders and commutators generally, a great deal could be done to simplify matters and to make the motor and dynamo much cheaper than they were at present. When he talked to his assistants about brush troubles they suggested that an effective way out of the difficulty was to scrap all the D.C. machines and put in A.C. There was common sense in that. He thought that tests must be made on the machine itself by the user. Although a machine might run well on a six- or eight-hours' test at the makers' works, the full results were not seen until the machine had been in the user's works, and had been in service for some time. It seemed to him that some concerted effort ought to be made by the users or manufacturers, or both of them, to try to find out whether some of the difficulties which did arise could not be cleared away by some effort between the two by giving the machines a long test, or something of that nature. He wondered whether three qualities of any good type of brush could not be made; soft, medium, and hard. Many mixtures were made up to suit one or two particular machines—that might have to be done in order to secure effective running—but that suggested something wrong with the design of the machine. With regard to the author's statement that "If a small proportion of copper is added, the effect is actually to increase the resistance," he (the speaker) would like to know why that was so. He had been told that by adding a small amount of copper to a brush the resistance was sensibly decreased. Apparently the author's opinion was that it was not quite so. The question of mica was, as the author truly said, a most important matter. In the majority of cases he had found that if the machine did not run well, grooving the mica assisted it considerably, and in some cases entirely overcame all difficulties. He remembered a case where three fairly large-sized machines would not run beyond a few weeks at a time without the commutator being skimmed up. It did not matter what sort of brush was used, it was an absolute impossibility to make the machine run well. The makers spent many months over the problem, but had to give it up. As a last resort the mica was grooved, and no more trouble had been experienced with the machine. Cutting the mica was becoming a common practice. It was a good thing to do if one was getting trouble with hard mica. He would like to put in a plea for some real effort to be made, particularly in the smaller sizes of machines, to see whether it was not possible out of all the multiplicity of types of holders in the country to get down to half a dozen patterns. He did not know two makers who both used the same kind of holder. He was certain that if something could be done on those lines, if it did not cheapen the machine itself, it would make for satisfactory work.

Mr. Shaw desired to put in a plea for standardisation. They should standardise the sizes, the pigtails, and the tops, even if the qualities followed later on. The space devoted to brushes in his stores was simply amazing. On all the large machines he had anything to do with they found it essential to cut the mica; the running was more satisfactory. They had had a lot of trouble with slip rings on 1,500-kw. rotors. One grade of brush caused trouble, and the next brush seemed to tear the slip ring; there seemed no mean between the two.

Mr. Walker observed that there was plenty of scope to improve the proper use of brushes. The box-type brush-holder was the best to use for industrial motors. He endorsed the expression with regard to the standardisation of brushes; personally he thought they ought to be standardised with regard to section and length. His employers had 1,500 motors on hire, and it could be imagined the trouble they had in sending out to faults, which were very numerous so far as brushes were concerned. He believed there were 300 types of brushes. Whenever a brush fault occurred it meant a double journey for the motor inspector. He considered it was essential to standardise to one, two, or three types of brushes in sizes only.

Mr. Hunter-Brown, replying to the discussion, said that sparkless running, in the true sense of the term, probably was not sparkless running; he called it sparkless when one could not see the sparks, though in reality he did not think it ever was sparkless. He thought that the passage of current from a fixed box to a revolving commutator or slip ring necessarily meant that there were minute arcs underneath the brush. That accounted for the peculiar shape of the contact-drop curve, and for the fact—at all events he maintained it was a fact—that there was a minimum voltage below which no current would flow. With regard to cutting mica, it was not a fair demand to put on a brush, which had to run on a commutator running at a speed of 9,000 ft. per min., the duty of grinding down the mica, especially when the mica was an unknown quantity. He did not advocate recessing the mica in some cases; in some cases it was difficult. At speeds, say, of 4,000 ft. per minute he considered there was a great deal to be said for recessing, and in many cases it was essential. If it was done an abrasive type of brush might be used, and that meant a longer life for the commutator and for the brush, and he thought the method of trying the machine first of all with mica flush was good; it was impossible to predict with certainty whether it would be ultimately necessary to recess the mica on a particular machine or not. With regard to the curious phenomena of suction, the definite fact was that when the friction was reduced the coefficiency was greatly increased. His theory was that it was due to atmospheric pressure on the top of the brush. He agreed with Mr. Carter that price was not an indication of suitability or quality. People sometimes advocated very strongly the using of the best quality of brushes. What was generally meant by that was a high-grade brush with a high price; that did not mean it was the best brush to give the best results on any given machine. Suitability must be determined from quite a different point of view. Mr. Carter remarked that they had succeeded in using a single quality of brush for about 85 per cent. of their machines. That was a very interesting fact, but the curious thing was that he (Mr. Brown) could mention several other firms in the country who had succeeded in doing the same, but in every instance each firm had its own particular quality of brush. No two firms' brushes were the same quality; that was an illustration of how subtle the differences in brush qualities were. As to the difference between the drop at the positive and negative brush that was a point which he had very carefully avoided touching upon in the paper. The reason was that he did not find any consistent behaviour in some types. With regard to copper-graphite brushes, and brushes made of graphite, the drop at the positive brush, speaking in a motor sense, was greater than the negative. That was particularly so in copper-graphitic brushes, the drop was very much greater in that instance. With carbon brushes it varied very much indeed, often the negative was greater than the positive. A completely insulated holder would get over certain difficulties, but it would introduce a greater one, that is such a holder, or rather the brush inside such a holder, would be thermally insulated as well as electrically insulated. Unless the heat was got away a destructive temperature rise was bound to occur. With regard to circulating currents, he thought they were troubled much more by local circulating currents than they were by circulating currents between spindles. He did not quite know how some would define a highly-marked brush, but assuming the brush to consist of 75 per cent. of copper, he would not expect to be able to use it on a machine above about 10 volts. As regarded copper picking, he fully confirmed the remarks made to the effect that once a brush acquired the habit of copper picking it would do it for ever, or, at all events, until a lot was cut off from the contact surface, perhaps half an inch. He thought it was probable that the brush, when picking copper, carried high currents, at least local, and that those spots in the brush were graphitised, which, due to their low resistance, took an undue share of the load even after the copper had been thinned off. A B.E.A.M.A. Committee was sitting on the standardisation of holders question. Naturally there was a good deal of diversity of opinion, but he thought that definite steps would be taken in the direction of standardising a holder, both as to design and the size of the brush it should carry. There would probably be a couple of widths and at least three or four thicknesses of brush in each width. As to why a small addition of copper increased the resistance of a brush, he imagined that the reason was that if no copper was used the whole of the graphite or carbon, or combination of various substances used, would become well bonded together in a homogeneous mass, and they got complete continuity in the direction from end to end of the brush, but if a small quantity of copper was put in the particles seemed to have the effect of breaking up that continuity, making a series of little contact resistances throughout the length of the brush. If the process was continued, and the quantity of copper increased, a point was reached where the benefit of the conductivity of the metal put in was felt, and the conductivity of the brush went up.

THE NAVIGATIONAL MAGNETIC COMPASS CONSIDERED AS AN INSTRUMENT OF PRECISION.*

By M. B. FIELD, O.B.E., M.Inst.C.E., M.I.E.E.

(Continued from page 67.)

In view of the difficulties experienced in the adjustment of the standard compass of the "Great Eastern," the errors which arise from the length and arrangement of the needles were carefully studied experimentally by Commander Evans, and mathematically by Archibald Smith, the results of the investigation being given in a combined paper in the *Philosophical Transactions*, 1861. By this investigation, the authors arrived at a remarkable result, namely, that by a certain arrangement of needles on a compass card, in place of a single needle, the errors due to length-of-needle very nearly disappeared, and that the particular arrangement necessary for the fulfilment of this condition was the very one which had been adopted in the construction of the standard Admiralty compass, entirely on account of other considerations.

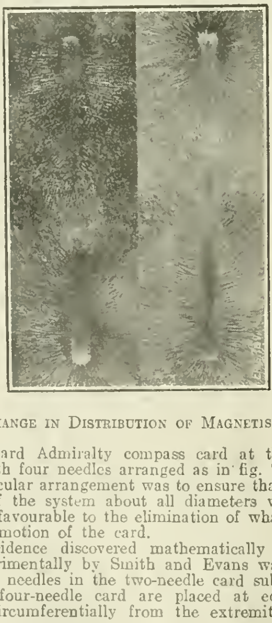


Fig. 6a.—Change in Distribution of Magnetism with Time.

The standard Admiralty compass card at that date was provided with four needles arranged as in fig. 7. The object of this particular arrangement was to ensure that the moment of inertia of the system about all diameters was the same, a condition favourable to the elimination of what was termed "wobbly" motion of the card.

The coincidence discovered mathematically and demonstrated experimentally by Smith and Evans was that if the poles of the needles in the two-needle card subtend 60 deg., or in the four-needle card are placed at equal distances measured circumferentially from the extremities of the 60 deg. chords, as, for example, in fig. 7, the magnetic errors due to length-of-needle largely disappear.

For the purpose of producing steadiness, one naturally inclines to some method of fluid friction damping, but for definite practical considerations, to be later discussed, Lord Kelvin dismissed the idea of fluid damping. He rather sought to render the card inherently stable under ordinary seagoing conditions.

The other intensely practical considerations from the mariner's point of view were, as usual, prominently before Lord Kelvin. The card must stand rough handling, it should be capable of deformation and yielding to stresses and of recovery without damage. It must stand the weather of all climates, intense heat and cold, prolonged dryness and humidity without warping, while the pivot, jewel, or even the card itself, must be capable of replacement at a moment's notice, in case of emergency, by spares usually provided with the outfit; and this must be possible without liability of damage by a not very delicate-handed navigator under unfavourable conditions at sea.

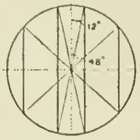


Fig. 7.—Standard Admiralty Compass Card.

I cannot do better than to repeat here Lord Kelvin's own words:—

"The problem of obtaining a compass which shall be steadier at sea, and shall also be better adapted for the perfect correction of the error due to the iron of an iron ship, or of cargo carried by the ship, requires:—

"1. For steadiness, a very long vibrational period with small frictional error.

"2. Short enough needles to allow the correction to be accurate on all courses of the ship for the place where the adjustment is made.

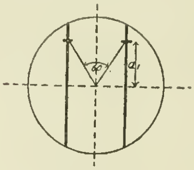


Fig. 7a.

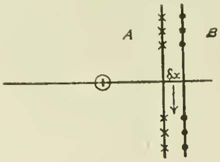
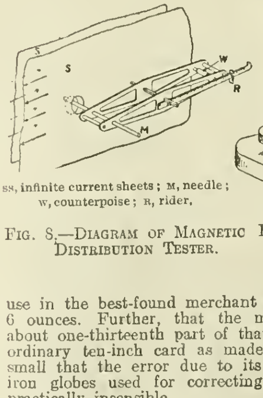


Fig. 7b.

"3. Small enough magnetic moment of the needles to allow the correction of the quadrantal error to remain accurate to whatever part of the world the ship may go."

Lord Kelvin then proceeds to describe his well-known compass card and compass. Speaking of the card, he states that the weight of his design was one-seventeenth part of the weight of the ordinary 10-inch card hitherto in common use in the best-found merchant steamers, which was about 6 ounces. Further, that the magnetic moment was only about one-thirteenth part of that of the two needles of the ordinary ten-inch card as made at that date, and was so small that the error due to its inductive influence on the iron globes used for correcting the quadrantal error was practically insensible.



ss, infinite current sheets; m, needle; w, counterpoise; r, rider.

Fig. 8.—Diagram of Magnetic Distribution Tester.

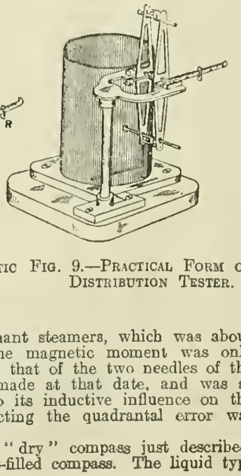


Fig. 9.—Practical Form of Distribution Tester.

As an alternative to the "dry" compass just described, we have the liquid or spirit-filled compass. The liquid type is undoubtedly favoured by some navigators, on account of its extreme deadbeatness, especially for steering purposes. In small, light craft, it becomes a necessity in rough weather, and whenever space restrictions do not permit of the use of a 10-in. dry card, the spirit compass should be resorted to.

---

* Abstract of lecture delivered before the Institution of Electrical Engineers, London, January 9th, 1919.

This type, however, is by no means perfect, and suffers from the disadvantage that it is very much overdamped, necessitating an undesirably great magnetic moment, and, consequently, a great mass in the moving system.

Some idea of the strength of needles and the great masses employed in the cards of liquid compasses may be formed by a perusal of the following table, comparing a 10-in. Kelvin card (dry) with various makes of card for liquid compasses.

Comparison of Standard 10″ Dry and Some Liquid Cards.

	Diameter of card.	Max. length of needle.	Weight in air. Grammes	Mom'nt of inertia. C.G.S.	Magnetic moment. C.G.S.	Time of half period at Glasgow. Seconds.	
Standard 10″ "dry" card	10″	3½″	13	1,200	300	16 (in air)	
Naval liquid compass	6⅔″	3¾″	82	1,060	1,600	16	Liquid: 50 % alcohol, 50 % water at 20° C.
U.S.A. Naval ditto (Ritchie)	7½″	4½″	100	2,910	2,400	21	
Ritchie	9″	7¼″	152	3,270	5,160	20·5	
Common steering compass	9″	7″	135	5,110	2,300	30	

In the case of the liquid compass the card is deviated 45° and released; the time interval between the 1st and 2nd transit of N-point of card past the lubber line is the half period.

In order to reduce the requisite magnetic moment, one naturally considers how to reduce the moment of inertia of the card. But when the moment of inertia has been reduced to the furthest possible limit, the *magnetic* moment must still be considerable, if we are to have a moderately quick-acting card. The reason is that the effective moment of inertia does not reside solely in the card, but partly in the fluid. As the card oscillates, the liquid in the immediate vicinity of the card is dragged backwards and forwards with it, and this has the effect of apparently augmenting the moment of inertia of the card itself.

Thus, when we have reduced the moment of inertia of the solid moving system to the furthest possible limit, we may find the effect of the liquid dragged by it is equivalent to a moment of inertia several times as great as that of the card itself.

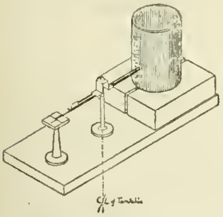
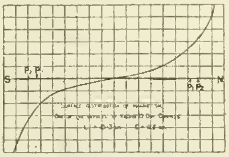


Fig. 10.—Magnetic Balance for Testing Distribution.



One of the Needles of a Kelvin Dry Compass; length 8·3 cm.; diameter 0·122 cm.

Fig. 11.—Surface Distribution of Magnetism.

We have, in fact, a total effect of:—

First, loading the card with an additional moment of inertia;

Secondly, retarding it by a damping torque at every instant proportional to the velocity.

Both of these effects are proportional to a quantity $\sqrt{\mu\rho}$, where μ is the coefficient of viscosity and ρ is the density of the liquid. If we can materially reduce this quantity, we shall materially improve the behaviour of the compass. In my opinion, a real improvement is to be looked for in the spirit compass by finding a more suitable substitute for the liquid now commonly employed.

In elaborating his theory, Smith assumed that the magnetism might be considered as concentrated at points near the ends of the needles; while this is legitimate when we are considering the couple exerted on the needle in a uniform field, it is not strictly legitimate when we are dealing with non-uniform fields.

Let us assume that the needle is symmetrically magnetised about its centre O, and that we have an amount of magnetic matter $(\sigma\,\delta x)$ on an element situated at a distance x from O; then

$$\sqrt{\Sigma x^3(\sigma\,\delta x)/M} = a_1$$

where M is the magnetic moment of the needle and a_1 is a certain length.

We measure a_1 off from the centre of each needle, and so dispose them that the points thus found subtend an angle of 60 deg. at the card centre (fig. 7A).

This is the necessary modification of the Arch. Smith theory when we take into account distributed magnetism on the needles.

It now remains for us to see how we determine the amount of magnetic matter on each element of the needle.

Imagine that the element x is bounded by two transverse planes, and that we can in some way create a uniform field of unit intensity vertically downwards between these planes. The magnetic matter on the element in question will then experience a force vertically downwards equal to $(\sigma\,\delta x)$ dynes. If we weigh the force in dynes, the reading of the balance will be the quantity of magnetic matter in C.G.S. units.

Next consider the transverse boundary planes are infinite current sheets with current flowing away from us in the left-hand plane, and towards us in the right-hand plane, as shown by the crosses and dots (fig. 7B); suppose that the current in the current sheets is uniform and has a density of $10/4\pi$ amps. per cm.; we shall have no magnetic field in the space A to the left of the current sheets, no force in the space B to the right of the sheets, and a uniform field of unit intensity directed vertically downwards in the space between the sheets. We may thus picture to ourselves a magnetic balance for weighing the amount of magnetic matter on each element of the needle. Such a balance is represented conventionally in fig. 8. In a practical apparatus, however, we have to get round the difficulty of using infinite current sheets.

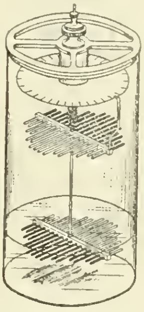


Fig. 12.—Torsion Dynamometer for Magnetic Moment.

Fig. 13.—Torsion Dynamometer in Use.

Fig. 9 shows a further development of the balance by which we arrive at the desired result. Here we have two cylindric current sheets of convenient dimensions as a substitute for our infinite plane sheets.

These cylindrical sheets are obtained by taking a piece of brass tube as a former, and overwinding by a layer of fine wire uniformly spaced, so that current flows uniformly down the outside surface of the cylinder, and uniformly up the inside surface.

If the distance between the cylindrical current sheets be small compared with their radii, we have:—

No field inside the inner cylinder,
No field outside the outer cylinder,

and practically a uniform field in the annular space between the current sheets, the lines of force being circles concentric with the cylinder, and lying in transverse planes.

A small hole is drilled through the sheets through which the needle under test passes. The magnetic matter situated in the annular space between the sheets is urged laterally by the magnetic force existing there, and the force is weighed by the small adjustable weight on the balance arm.

Another form of apparatus which I have found convenient for the purpose is shown in fig. 10. In this, the force on the element is balanced against the earth's directive force on the whole needle. The complete stand is mounted on a graduated turntable, and rotated in azimuth until balance is obtained.

If H = earth's horizontal force,
M = magnetic moment of the needle.
θ = angle measured from the meridian at which balance is obtained,
F = known magnetic force in the annular space,
l = distance from pivot to mid point between current sheets, we have

$$H\,M\sin\theta = F\,l\,(\sigma\,\delta x),$$

hence the amount of magnetic matter on the element δx.

Fig. 11 shows the character of the distribution obtained in the case of some needles used in compass construction.

In making use of the arrangements described, we must satisfy ourselves that the effect of the bulging of the magnetic field out of the small hole through which we pass the needle does not produce a large error. But if the apparatus be properly designed, we can get accurate measurements up to about 5 mm. from the end of these needles.

Having determined the magnetic distribution, we have all the necessary information to enable us to determine the length a_1, and hence correctly to dispose the needles in the card.

Figs. 12 and 13 show a very convenient apparatus for measuring quickly the magnetic moments of cards without removing them from their containing bowls. It consists of a glass jar inside which a needle, arranged to be astatic in the earth's field, is suspended from a torsion head. Each element of the needle has a strength of about 600 C.G.S. units, the elements being separated by about 10 cm. The lower one swings clear of the bottom of the jar, and is immersed in damping fluid. The spindle is supported on a fibre and controlled by a torsion spring, the ends of which are attached to the spindle and the torsion head respectively. The spindle carries a pointer which moves over a graduated dial, attached to, and moving with, the torsion head, but arranged to be independently rotatable, so that it can be set to zero when the tension of the control spring is zero.

The jar is placed centrally on the compass bowl glass, and in this position the lower element of the astatic combination comes within range of the sensible force of the card needles. The torsion head is rotated until the card is deflected into the E.-W. position. We then know that the earth is acting upon the card with a torque equal to H M, and since the astatic needle is co-axial with the card, the torques mutually exerted between card and astatic system are also H M. This, however, is the only magnetic couple acting upon the astatic system, and it must, therefore, be balanced by the torsion of the control spring. Since the one end of the spring is virtually attached to the dial, and the other to the pointer, the position of the pointer on the dial represents the amount of torsion of the spring.

The torsion head may, therefore, be calibrated to read M direct for any place where H is known, it being understood that M is indicated on the dial when the torsion is such that the card under test is deflected into the E.-W. meridian.

Where a very powerful card is under test, it may be deflected by only 30 deg., in which case the readings of the torsion head must be doubled. It will be observed the accuracy of the device depends upon:—

1. The astaticism of the system, which is readily tested and adjusted from time to time; and
2. The calibration of the control spring. It in no way depends upon the strength of the needles of the astatic system, or upon their distance from the card.

For the purpose of measuring moments of small magnets, the apparatus is completed by the addition of a special dry bowl and card (without magnets) provided with a cradle upon which any small magnet may be placed.

Having measured the magnetic moment, the moment of inertia is most easily determined by calculation from the period of vibration.

(To be concluded.)

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

299. "Joint box for connecting armoured electric cables." J. Hoggan. January 6th.

317/8. "Sparking plugs for internal-combustion engines." J. E. Barrows. January 6th.

336. "Electric lampholder with insulator contacts and lamp-locking device." F. S. Sargeant. January 6th.

352. "X-ray apparatus for dental use." W. H. Thwaites. January 6th.

355. "Primary batteries." H. S. Hatfield. January 6th.

357. "Primary cell." H. S. Hatfield. January 6th.

361. "Electric starters for internal-combustion engines." A. H. Midgley and C. A. Vandervell & Co. January 6th.

362. "Deflection of electric arcs." L. Lombardi. January 6th.

364. "Electric furnaces." Armour Fertilizer Works. January 6th. (U.S.A., January 28th, 1918.)

370. "Protective devices for alternating-current electric distribution systems." British Thomson-Houston Co. & E. B. Wedmore. January 6th.

378. "Electric switches." R. K. Damey. January 6th.

390. "Manufacture of carbon-electric conductors." Soc. Electro-Metallurgique Francaise. January 6th. (France, January 26th, 1918.)

407. "Apparatus for recording reaction times by means of electrically-controlled signals and chronoscope." L. E. Stamm. January 7th.

454. "Ignition devices for internal-combustion engines." T. Moore. January 7th.

466. "Electric batteries." Commercial Truck Co. January 7th.

496. "Sparking plugs for internal-combustion engines." L. Macquaire. January 7th.

510. "Terminal connections for electric accumulators, batteries, sparking plugs, &c." C. C. Bryan. January 8th.

511. "Sparking plus." C. C. Bryan. January 8th.

512. "Electric lamps for motor vehicles, &c." G. A. Edman. January 8th.

517. "Portable electric lighter for pipes, cigars, &c." J. E. L. Wright-Ashworth. January 8th.

524. "Electricity meters." G. Watson. January 8th.

537. "Synchronous electric motors." G. C. Martin. January 8th.

558. "Fuse for high and low-tension electrical circuits." G. B. Fawcett. January 8th.

581. "Sparking plugs." Soc. Industrielle de Delle. January 8th. (France, March 2nd, 1918.)

615. "Controlling dynamo-electric machines running at varying speeds." H. F. Foster & A. W. S. Pocklington. January 9th.

622. "Obtaining single-phase alternating electric currents from three-phase or *vice versa*." A. M. Taylor. January 9th.

638. "Electrically-operated valve for control of steam, gas, air, liquids, &c." G. Wilkinson. January 9th.

642. "Magneto motor acting by repulsive movements between double poles." D. Suchostawer. January 9th.

644. "Equaliser connections on armatures of electrical machines." E. Bolton. January 9th.

668. "Electric batteries." G. N. Antonoff. January 9th.

683. "Electrically-heated melting furnaces." L. C. Harvey. January 9th.

694. "Telephone circuits." B. S. Cohen. January 9th.

721. "Apparatus for electro-deposition of iron." S. O. Cowper-Coles. January 10th.

722. "Means for coating articles with zinc." S. O. Cowper-Coles. January 10th.

723. "Manufacture of iron tubes by electro-deposition." S. O. Cowper-Coles. January 10th.

730. "Electric lampholders." H. Bey. January 10th.

765. "Electric contacts." S. G. Brown. January 10th.

806. "Electrical earthing devices." R. S. Woods. January 11th.

827. "Magnetos." H. de la Valette. January 11th. (France, February 27th, 1918.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

13,251. Telegraphic relays. J. S. Withers (K. C. Cox). September 18th, 1916. (121,489.)

1917.

894. Construction of electric generators and motors for working under water or other liquid. J. S. Highfield. January 18th, 1917. (121,490.)

13,746. Ignition devices for internal-combustion engines. W. G. Ikin. September 24th, 1917. (Cognate application 5,191/18.) (121,493.)

14,664 Electrically-heated clothing suitable for aviators, the drivers of and passengers in automobiles, and others. A. A. Lemercier. October 10th, 1917. (121,495.)

16,717. Methods of and apparatus for transforming the frequency of electric currents. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 14th, 1917. (121,500.)

1918.

210. Wire-attaching device for the sparking plugs of explosion motors. A. Jouveau & C. Tournoud. August 11th, 1916. (112,463.)

3,105. Methods of manufacturing cylindrical magnet frames and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 21st, 1918. (121,547.)

6,563. Electric furnaces. T. H. Watson & Co., H. A. Greaves & H. Etchells. April 18th, 1918. (Addition to 106,626.) (121,563.)

7,581. Overhead time-limit relays for electric circuits. British Westinghouse Electric & Manufacturing Co. May 7th, 1917. (116,276.)

The War and the Nitrogen Industry.—In a paper read before the American Electrochemical Society, Mr. W. S. Landis states that, according to the best available statistics, ten years ago, or in 1908, the world's production of nitrogen in the form of Chilean nitrate and of sulphate of ammonia was equivalent to only 503,000 short tons of nitrogen. In 1914, at the outbreak of the war, the producing rate of the world in short tons of chemical nitrogen, according to the best available statistics, is given in the following table:—

	Nitrogen, short tons.
Nitrate of soda	425,000
Sulphate of ammonia	285,000
Arc process products	11,000
Cyanamide products	31,000
Synthetic ammonia and miscellaneous ...	12,000
Total—short tons nitrogen	764,000

In 1919 the producing capacity of the world, including the United States Government nitrate plants now under construction, is estimated to be as follows:—

	Nitrogen, short tons
Nitrate of soda	520,000
Sulphate of ammonia	330,000
Arc process products	15,000
Cyanamide products	360,000
Synthetic ammonia and miscellaneous ...	116,000
Total—short tons nitrogen	1,341,000

As relates to the world as a whole there has not been the great over-expansion of producing capacity that most people believed. The available nitrogen supply expanded under the influence of war only to the point any one would have predicted in the spring of 1914 from a study of its past statistics. Undoubtedly the demand will drop off somewhat with the advent of peace, but with the anticipated high food prices continuing for some time afterward, this drop in nitrogen consumption should not be excessive. On the other hand, many plants erected under the wartime emergency are so located geographically and economically that operation after the emergency is past will be impossible. We may, therefore, expect a material reduction in producing capacity. That the decrease in demand and in production will be somewhat of the same order is at least a plausible assumption.

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. JANUARY 31, 1919. No. 2,149.

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THE INDUSTRIAL SITUATION AND "WHITLEYISM."

NOBODY in the industrial world is surprised that, hostilities against the Central Powers having ceased, we find ourselves amid wars and rumours of wars at home. It was quite expected that it would be so, though perhaps some of us had imagined that we should have been permitted to dwell together in comparative unity until Peace was actually signed. The reason for our disappointment is, doubtless, to be found in the conditions that have proved to be inseparable from the more or less sudden cessation of war manufacturing; but, if we may be permitted to be quite frank, the cause is also to be found in the selfishness of our human nature. We are reluctantly driven to the view that we never should have preserved the semblance of a solid front, enabling us to defeat the most abominable of foes, unless the "working classes," as we used to call them, had received plenty of money and practically every demand that they had thought fit to present. We are a great people, but we are the same people, in some important respects, as before the war, notwithstanding all the purifying influence of our common losses and our common anguish. We are racking our brains to secure a League of Nations to prevent international catastrophe by establishing the framework around which a common brotherhood may grow, but no League of Nations can prevent internal disagreement and strife; only a league of all the classes and interests within the British nation can safeguard us in this respect. Who at this moment intelligently reading the signs can say positively that we are ready for that? Yet unless we can move more rapidly than we have been doing in such a direction, prosperous living will be impossible for anybody before very long. We are all advancing our needs and our claims—sometimes legitimately, *sometimes not*—for "something more." Where, in the last stage, is it to come from? Perhaps the most general demand is for a larger share of the return made as the result of the employés' efforts, a demand made for reducing the employer's share of the profit on his capital, original or increased, as the result of labour's activities, or for lessening the rate of the dividend on the capital invested by outsiders whom we call share or stock holders. But, as matters stand, those reductions cannot be introduced without capital, the life-blood of industry, being alienated and enterprise starved, unless the cost of the articles of which we are all consumers is raised to remunerate both Labour and Capital. We have seen scores of times during the war how this sort of thing operates, and now that we are "settling down" (save the mark!) to Peace, we see it again. The miners make demands for higher wages and shorter hours, which, in the absence of more efficient service per man, means that we all pay still more per ton for our household fuel and so much more per thousand feet of gas. The educational authorities put up the salaries of teachers, municipal employés gain their advances, and they and we together grumble because our local rates have reached unconscionable figures. The railway men make their demands and we pay more for travel; the rates for goods traffic will also bear the burden, and industry must be handicapped by costlier fuel and costlier transport. We tax house property to such an extent that it reaches almost the breaking-strain point, and at the first opportunity the landlord must transfer the burden to the tenant, or the property will not be worth the holding. Yet we all live in the hope that the cost of living will go down—some day! We seem to be in a glorious state of chaos, and the end is not in sight. Indeed, perhaps we are but at the beginning of our troubles—are there not public prophets who say that "two months hence," or, "at any rate, by next October," we shall be at the maximum point of unrest?

It is easy to be gloomy deans; to review the situation and the tendencies thus: to criticise each other; yet while we watch the barometer, it is incumbent upon us also to prepare to weather the storm or avoid for the people generally the effects of some of its ravages. We might prevent even the storm itself if we, as a nation, sat down in the right spirit and with a very definite determination to that end. Some effort along that line has been made—it was very slow and half-hearted at first, though it is more progressive and spirited now—by the propagation of what Judge Parry has aptly described as "Whitleyism." Industrial Councils have been set up in a number of important industries, and good influences are at work in consequence. But some other leading industries will not touch it. Who is to blame? The Government was right at the beginning very slow in bringing out for exhibition its Whitley baby; yet its spokesmen praised its juvenile merits, and believed it to contain elements of great promise when it became more fully developed. And then what did the Government do? Left it to starve so far as Government sincerity was concerned. What was the reason for such action? Why did not the Government prove to the industrial people of the kingdom that its beliefs in Whitleyism were so sincere that it would adopt it for Government industries—for Government departments which could be considered fairly comparable with private undertakings? According to Judge Parry's most excellent criticism at last week's meeting of the Industrial Reconstruction Council, it is the Treasury, and the Treasury alone, that is responsible for the turning down of Whitleyism for Government departments. Let the Treasury consider, then, in these serious times how much it has, or may have, to answer for. It is inconceivable to us who do not know the whole story, that permanent officials—even a department which is hoary with age, doubtless has settled down in a rut, and needs blowing out with explosives—should be permitted to obstruct, because of precedents, or objections to new departures, or because of inability to face the fresh breezes, the newer atmosphere, of these days, the course of a movement which might, if the Government example were available, make a far more speedy advance. Who can pretend to be surprised if some reply to the Government commendation of Whitleyism, "Physician, heal thyself!"?

If masters and men are to co-operate in the efficient conduct of industrial undertakings, through Industrial Councils and Committees, which should be able to obviate many disturbances such as are now prevalent in many directions, the employés require to have confidence in the proposed principle. The men will have nothing to do with Committees which are to do nothing but talk. There is an inclination still to leave them alone as traps or devices which will prevent the fulfilment of what they regard as their legitimate right—a larger voice in the conduct of the business in which they are employed, and a reasonable share in the profits which it can be made to produce. If they can be brought to see that in Whitleyism there is to be found the only practical scheme yet announced for securing that end, their indifference or opposition may be transformed to sympathetic listening and possibly active support. But the Treasury—a Department of the Government itself—Government which ought to be bringing its whole mind and influence into the task of securing industrial peace, is blocking the way in this very necessary enterprise, as it has too often done with others in the past. How long will men put up with it? The Treasury seems to have unlimited authority—even a decision of the War Cabinet that the Whitley principle be applied to Government Departments where operations were similar to those of outside industries, was set aside! As Judge Parry remarked: "The Treasury needs to be converted"; and a right spirit has to be renewed within the bureaucracy.

So long as Whitleyism is taboo in Whitehall who can wonder that it is taboo elsewhere also?

A NATIONAL INDUSTRIAL COUNCIL FOR THE ELECTRICITY SUPPLY INDUSTRY.

The electric supply industry is at the present moment at the cross roads of what is in essence a most revolutionary venture. The proposed constitution of a National Industrial Council for the industry is now before the various Associations and Trade Unions. The industry is practically committed to the formation of a representative Council, but the crucial question of the scope of its activities is now up for decision. Curiously, however, there exists in the minds of many who are vitally interested in the electric supply industry a great vagueness as to exactly what is an Industrial Council, and even a greater uncertainty as to what practical bearing it will have on the every-day working of individual undertakings. Needless to say, therefore, there seems to be a none too serious appreciation of the importance of settling the constitution on the most politic and judicious lines. In the narrowest limits the Industrial Council (consisting of representatives from the Employers' Associations and from the Trade Unions) would settle rates of wages and conditions of labour. In its widest scope it extends to problems of co-partnership and what is practically a share in the administration of the undertakings. The industry is at the present moment called upon to define what the limitations shall be. But in dealing with the matter, it is very necessary that a broad politic outlook should be maintained. The Industrial Council is the solution, proposed by the Ministry of Labour, of the present difficulties of dealing with Labour troubles. The ever-increasing conflict between Capital and Labour threatens all industries alike with disaster. The Ministry of Labour find that the only palliative is the formation of Councils where both sides may meet and come to some sort of temperate settlement on the various questions raised by Labour. The new Industrial Council would, of course, supersede the present Conference of Electric Supply Associations, which, in a tentative way, is at present exercising certain of the functions, so far as its limited consultative powers will allow. Incidentally, it is interesting to note that the question of the Council is raising a somewhat novel problem. Old-fashioned labour trouble was a case of "masters" *versus* "men." In the electricity supply industry, consisting of municipal undertakings or limited companies, there are no masters in this sense. The question has come up (as in the E.P.E.A. controversies) as to whether chief engineers are "masters"—or where the line is to be drawn. The modern problem has virtually shifted from a controversy between masters and men to one between Labour (including even the highest ranks) and Capital in the abstract. The proposed Industrial Councils are, in fact, practically called into being to adjudicate on the very advanced economic problem of the proper proportion of profits claimable by the providers of capital only as against that equitably due to the workers whose energies resulted in the producing of such profits over and above normal interest. A glance at the scope of the Industrial Councils will show that this is practically the basic idea. It is in this sense that we say that the industry has now before it a quite revolutionary measure, and one which cannot be dealt with by the one-time convenient expedient of "shelving."

Electrified Seed.

Last week we published an interesting statement regarding the electrical treatment of seed, which has been so widely adopted in the south-west, from the pen of Mr. H. H. Dunn, a well-known seed expert; to-day we print the views of Dr. Charles Mercier, who has taken a prominent part in the development of the process during the past three years. We are very pleased to place these articles before our readers, first, because we have received many inquiries regarding the subject, and, secondly, because we have for very many years devoted special attention to the uses of electricity in agriculture, and wish to keep our readers informed about every new development in connection with it.

The evidence that has accumulated with regard to the results of the electrical treatment of seed must be admitted to have attained considerable volume, and the subject is clearly well worth careful investigation; the process described is simple and inexpensive, and the increase in yield is of unquestionable importance. Hence, whatever, be the true cause of the increase, the advantage of employing the process appears to be beyond dispute. Our only doubt is whether, in fact, the result is due to the electrification or merely to the chemical action of the treatment. We find that some half-dozen patents have been taken out by the promoters, Messrs. C. E. de Wolf and H. E. Fry, nearly all of which possess in common the feature of soaking the seed in a solution of nitrate of soda, sulphate of ammonia, or other artificial fertiliser, followed by a drying process. Variations are mentioned—such as spraying with petroleum, the use of radio-active solutions, exposure to ultra-violet rays, &c., and usually the passage of a small current (½ to 1¼ amperes, at 200 volts) through the mass of the grain in a wooden tank for a few hours is specified; but in one case (in 1914) no electrical treatment is used. We should like to know whether any considerable fraction of the current passes through the substance of the grains; and, if it does, whether it exercises any beneficial effect upon the organism. The simplest way of putting the matter to the test appears to be to subject two similar samples of seed to the process, omitting the electrical treatment in the case of one of them, and to sow them, with a third sample wholly untreated, under identical conditions.

We do not deny the possibility that the electrical treatment may be essential to success: but we should be glad to have the fact demonstrated by trial.

[Since writing the foregoing we have found that in a letter to a contemporary, Dr. Mercier states that the test suggested, and other tests, have been carried out repeatedly by Mr. Fry, and have proved conclusively that while simply soaking and drying the seed produces an increase in the crop, the effect is not nearly so great as it is when the electrical process is employed.]

National Electricity Supply.

Receiving the report of the Committee appointed by the Council of the I.E.E., on Tuesday, last week, we were unable to give its terms mature consideration before going to press; hence, while we drew attention to its leading features, we were obliged to defer our comments for the time. Since then we have considered the matter at leisure, and have come to the conclusion that in certain respects it is by no means satisfactory.

In the first place, the constitution of the Committee was distinctly one-sided; it was very unfortunate that the two municipal associations that were invited to take part were not represented on the Committee, but even if they had been, their four representatives would have been far too few adequately to impress the views of the municipal authorities upon the Conference. Moreover, these are not the only municipal bodies which, in view of their importance and of the constitution of the Committee, might justly have claimed representation upon that body. Thus the Committee was composed almost entirely of manufacturers and companies engaged in electricity supply and traction, and was thereby laid open to the charge which was immediately levelled against it—that it represented not the electrical industry as a whole, but the commercial branches of it, whose unanimity, we are informed, was "impressive."

The accuracy of the conclusions arrived at and embodied in what we may call the preamble of the case stated by the Committee in Sec. 7, paragraphs *a* to *d*, is unimpeachable; the views there expressed are in the main identical with those formulated by the Board of Trade Committee on Electric Power Supply, which have been amply endorsed by the great mass of opinion in electrical circles throughout the whole country. But in paragraph *e* the brake is put on pretty hard; and while the statement that the Board of Electricity Commissioners should be set up immediately will meet with almost universal approval, which will extend also to the definitions of duties to be assigned to the Board contained in paragraph *f*, the next paragraph, if adopted by Government, would knock the bottom out of the whole scheme. "The functions of the Board should be exclusively judicial and advisory. Strenuous objection is urged against the granting to the Board of administrative powers. . . . The powers of the Commissioners should be limited to examining schemes brought before them." Have we not long enough been governed by King Log, that we should have another wooden idol thrust upon us? The Committee goes on to say (par. *h*): "The preparation of such schemes . . . should be left as a matter of free and natural development to the initiative of undertakers . . . opponents would be entitled to be heard against such Bills in the usual way," and, of course, the Parliamentary counsel would receive the usual fees—"business as usual," in fact. Yet the Committee has declared the necessity of drastic reform in spirit and letter, of the treatment of the problem of electrical generation and distribution on broad lines, and of the provision of simple forms of procedure in obtaining powers for electrical utilities of all kinds. How can drastic reforms be obtained by substituting for the existing system of administration its counterpart? or national problems be treated on broad lines by way of local schemes? or procedure be simplified by merely varying it in appearance without changing the substance?

Admirable as are the expressed intentions of the Committee, these recommendations appear to us to be but lame and impotent conclusions. We feel that the policy advocated by the Committee, while ostensibly in accordance with the scheme of the Committee on Electric Power Supply, would in fact to a great extent rob it of its vitality and effectiveness. The country needs—and demands—a fundamental root and branch reform, such as can only be carried out by a competent authority armed with executive powers, and it wants it quickly. Under this nerveless figurehead of an authority the hope of reform would be deferred till most of us were in our graves.

Let us have a vigorous, determined, self-reliant body of expert Commissioners to tell us what to do—and *to see that it is done!*

We may add, for the benefit of possible correspondents, that we are acquainted with Æsop's Fables.

Electrical Engineers' War Memorial.

The proposal of the Committee appointed for the purpose by the Council of the Institution of Electrical Engineers, to establish a War Memorial Fund in honour of the members who have made the supreme sacrifice in the war, is one which must meet with a cordial response in the hearts of all their brother members. Particulars of the scheme are given in our "Notes" to-day, from which it will be seen that, in addition to a permanent record in the Institution building, a fund is to be provided to assist the wounded and disabled, and the dependents of those who have suffered or have been killed in the war—a plan which will command approval.

The cost of the permanent memorial will be a fixed and final amount; the maintenance scheme will be a running charge, continuing for many years, and it behoves us all who are members of the Institution to do our utmost to ensure that the fund shall be worthy of the Institution and of the great cause to which it will be devoted. Our comrades have cheerfully given all that it was in their power to give—and in doing so they have also mortgaged the happiness and welfare of their loved ones, whom we still have with us; let us honour the sublime trust that is laid upon us, let us discharge this sacred debt, so far as money can discharge it, to the uttermost farthing, and let us not forget that money alone can never make good the loss that these have undergone. We should rejoice that, in the absence of our comrades, these their dear ones remain to us; upon them we can bestow the tokens of our admiration, affection, and gratitude, not as a burden but as a sacred duty which it is an honour to fulfil.

THE SIEMENS & HALSKE CO. ON THE SITUATION.

We recently reproduced an abstract of the speech which Herr Walter Rathenau delivered at the annual meeting of the A.E.G. It may now be of interest to quote also from the address which the chairman of the Siemens & Halske Co. submitted to the shareholders. He said :—

The changes which had taken place since the beginning of August had brought about conditions which were of very serious significance to the whole of German industry. The Armistice and the immense demands of the Allied Powers, the occupation of the left bank of the Rhine, and the standstill of a large part of the industry on the right bank of the river, had placed all industries in a critical situation, which was greatly accentuated through the revolution. The past two months had not been characterised by devotion to work in order to reconstruct industry, but they represented a growing process of dissolution of industrial work and of anarchy. The works were no longer centres of production in the old sense of the word. Political agitation, election meetings, strikes and demonstrations, occupied the time of the workmen. A wages movement of the most extreme violence had proceeded simultaneously with an increasing indisposition to work, and a rapid decline in the average efficiency of the workmen. Whilst wages movements were accustomed to take place in times of active and remunerative employment, the present agitation started when the war orders, which had formed the principal source of activity, were cancelled.

An approximately adequate substitute for war contracts in the form of peace orders, however, was not forthcoming ; it would not arrive so long as everything in the country was topsy-turvy and until the danger of Bolshevism was removed. The number of workmen employed, who received large additions to their ranks through the return of men from active service, and the amount of the wages and salaries which the company was compelled to pay, were in a still greater disproportion to the work performed. This disproportion already endangered most seriously the maintenance of working much longer. On the other hand, demands were put forward which implied an increase of about 50 per cent. in wages and salaries. The concessions thereupon made were of considerable extent. If the efficiency further declined simultaneously with these constantly-growing expenses—an efficiency which had already receded to one-third—and if orders continued to come sparingly to hand while great difficulties stood in the way of raising sale prices, an equilibrium between receipts and expenditure was not possible, and the industry would be no longer able to provide employment for its workmen and officials. It would be immensely difficult to repair the damage produced by these conditions.

The restoration of order and confidence, safety, discipline, sense of duty, and industry was the most earnest question of the hour ; without such restoration it would no longer be possible to maintain the population in some measure sufficiently.

The chairman concluded by remarking that the bringing down of the high costs of production and the prices of goods would be considerably protracted and rendered difficult, and that would continue so long as the exchange of goods with other countries, which was indispensable for the existence of the nation, remained at a standstill.

The "Safety First" Movement.—The British Industrial "Safety First" Association, in a circular just issued, states as evidence of the necessity which exists for immediate action, that the latest published returns show that in 1914 969 persons were killed, and 147,015 were injured by accidents in workshops and factories alone, a large proportion of which would undoubtedly have been prevented had those who became casualties been educated in matters pertaining to their own safety. Millions of pounds paid in compensation, and huge sums of money lost to workers as wages, might have been saved. Many of the largest firms and trade unions in the country, the circular says, are actively supporting the "Safety First" movement, and it is hoped to proceed at once with the preparation of "Safety" notices and literature specially suited for individual industries.—*The Times.*

BRITISH ELECTRICAL TRADE IN CHINA.

III.—The Rewards.

By PROF. MIDDLETON SMITH, M.Sc., M.I.Mech.E., Hong-Kong.

A director of one of the great Japanese steamship companies recently said :—"The Chinese are great buyers, but what they are buying to-day is but a bagatelle of what they will buy to-morrow." For the next 30 years the country of China could, if administered by some international league with European officials on the lines of the Chinese Maritime Customs Service, absorb all of the machinery manufactured in Great Britain, America, and Japan. China, in return, could supply all of the raw materials needed by the world during that period.

The industrial era is just commencing in China. It is in evidence at the Treaty Ports and in Hong-Kong, but those places are only the fringes. Yet one set of figures will give some idea of what stimulus will do in China. In 1916 the value of the tin ore sent from the Yunnan province to Hong-Kong was about £200,000. In 1917 it was valued at more than £600,000. Already for nine months of 1918 the value has been over £2,500,000. That is just one metal. But the mineral resources of Yunnan are almost feeble as compared with those of some of the other provinces.

All over China the natives are demanding electric light. Lamps and accessories are coming from Japan and Britain—it is hoped that more and more will come from "the old country." The Chinese are demanding railways—they have in a few years enormously extended the postal and telegraph systems. The vast plains of Manchuria have trembled beneath the steel of the steam-plough, the rivers re-echo to the noise of steamers and motor boats. Mining machinery has been already imported into China, but the possibilities of this market for such plant are beyond description. Modern mining work inevitably means electric power. A request came to the writer only a few days ago from one of the big mining companies in China, managed by the British, for a graduate in electrical engineering. The plant, as described in the letter, was quite up-to-date. It ought to be possible to equip many such plants in China in the next few years.

Docks and Shipping.

It is worth noting that during the last few months of the war hard-headed business men and engineers in China have advanced schemes and suggestions for the extension of the existing harbours of China. The Hon. Mr. David Landale, head of the largest merchant business house in the Far East, and a member of the Legislative Council of the Colony of Hong-Kong, recently mentioned in that assembly the matter of the local harbour, which to all appearances could now almost hold all of the shipping of America and Europe. But Mr. Landale wisely warned the Government to be prepared. The Chinese authorities have issued reports from a capable European engineer, Capt. Olivecrona, upon the improvement of the Port of Canton and the West River, that great artery of trade in Southern China. In Shanghai three expert engineers have produced a most voluminous report for the Whampoa Conservancy Board, which says, among many other things of great interest to manufacturers, that "the trade between Asia and other continents will in the immediate future increase enormously," and "when the Chinese harbours are provided with deep-water quays, the handling of cargo will be done by mechanical appliances in spite of labour conditions." Again, all of us in China who know Europe and America agree with the words in the report: "It is to be expected that the world will no longer fail to obtain the co-operation of China in the development of intercourse on the oceans." Tientsin and other ports of China have schemes for improvement. At the least, all of this means modern methods of electric lighting for the wharves and the go-downs. In reality it will mean all sorts of electrical appliances for the handling of cargo, and the thousands of other ways of using electricity.

Quietly and almost unobtrusively about 100,000 Chinese "over there" were doing spade work, and at the critical moment all of them in Picardy seized the rifles handed out to them by the American engineers. Then they fought like men. They take as kindly and as quickly to engineering appliances as to the rifle. They cannot yet produce the industrial leaders; the writer very much doubts that they will do so in this generation. But they do want to see their country developed, and they would rather that Anglo-Saxons did it than any other race.

The phenomenal growth of the Japanese trade during the war shows what could have been done by British manufacturers in the Far East if they could have sent out supplies. The figures available do not include the whole of the period of the war. But the authorised capital of the electric enterprises in Japan increased from 500 million yen (say £54,000,000) to 644 million yen (say £69,000,000) at the end of 1916. The generating capacity of the companies increased by 200,000 KW. The production of electric bulbs increased from about three millions in 1913 to over seven and a half millions in 1916. But the Chinese do not like Japanese electric bulbs—too many have been shown to be defective. Yet the exports of electric apparatus—nearly all of it to China—went up from one million yen to nearly twelve and a half million yen in three years. British electrical exports to China could have been enormously increased if only the goods could have been delivered.

"It is a fact," said an American leader of industry recently, "that at the present time there is no place where creative genius is more needed, or as much needed, as in the scientific production or utilisation of food." China is essentially an agricultural country. It is unlikely that costly machinery will be used by the small agricultural farmers, but the problem of communications affects electrical manufacturers. The only solution of famine troubles in China involves improved communications. They must be made, and they will be made; light electric railways have not yet been introduced, but there must be plenty of scope for such cheap methods of construction. It is astonishing to see how quickly the Chinese have taken to joy-rides in motor cars and on the local tramways. It is the same in Shanghai.

Nobody doubts that there will be a rapid development of the vast railway programme for China which was hung up by the war. That will be taken in hand at once. We shall be disappointed in Hong-Kong if, in three or four years' time, the railway from Canton to Hankow is not completed. That will enable us to go all the way by rail from this colony to Calais.

The two big trade centres of China are Shanghai and Hong-Kong. The former has a magnificent electricity supply system, with many of the details of which readers of this journal are acquainted. Hong-Kong will soon have a thoroughly up-to-date generating station, and it is the intention of the management to push extensions forward as rapidly as possible.

The directors of the supply company for the city of Canton recently sent orders to America for quite an extensive plant of turbo-alternators. But what a chance Canton presents to the far-sighted engineer who knows anything at all about electricity! City of a million without a wheeled vehicle, almost without a wheel at all, it is a hive of industry carried on as it has been done for centuries. The only difference is the kerosene lamp in some shops and electric lamps in the gay restaurants and other places lucky enough to be connected to the limited supply system. But the management has been very unenterprising, and Canton carries about one-tenth of the load that a real "live" Britisher with capable Chinese assistants could connect to the generating station. Moreover, Canton is like the hub of a wheel, all around the rim of which are many towns and villages—what a chance for a distribution system! History tells us that for a year or so the British administered Canton. At present the place is in political chaos—if only the British could establish law and order there, and introduce electrical machinery and goods! The Chinese would very soon buy them and apply modern scientific methods to their own particular industries. They very quickly follow an example. There is no merchant in the world to beat the species of Canton. Throughout the Straits Settlements, the Federated Malay States, you will find Cantonese owners of the mines and the rubber estates. The Cantonese has the business acumen of the Jew, the industry of the ant, and the tenacity for trade of the Englishman. Canton has been always the centre of political unrest in China since Good Master Weddell, nearly 300 years ago, first planted the British flag on the old forts at the mouth of the Canton river. He went out there to trade; thousands of Britons have followed in his footsteps. But our Government must give us moral support.

The changes in China during the last 10 years have been in the intellectual realm. They are the forerunners of material changes. A few weeks ago there was a conference of Cantonese merchants at Shanghai concerning the establishment of a hospital on Western lines. One of the old literati—the type still exists in Great Britain—wanted to stop the wheels of progress; he began to quote the Chinese classics. The Cantonese merchants so far forgot their usual suavity as to shout him down. They subscribed money for the Western hospital. The Republic may not have been a success in the way of producing good government, but it has broken down the intellectual bondage of the Chinese.

Before the war the Chinese merchants talked about modern science, and they sent their sons to Europe and America to learn all about it. The struggle has made the name of Great Britain much more respected in China. "Nothing succeeds like success" in China. The millions of pounds spent by the Germans in the Far East have been wasted. Let the British electrical manufacturers spend a few thousands and come into the greatest market that is to be found in any part of the world. Then will the romances of the early pioneers—Jardine, Dents, Mathesons, and the others—who came out to Canton exactly 100 years ago, be repeated. These men worked in anticipation of the expiration of the old East India Company's monopoly; they made fortunes for themselves and their heirs. The engineering manufacturers of Great Britain can with the national pluck, energy, and prestige—the latter is to-day at its highest—reap in the fields made fallow by those early pioneers. Let them work in readiness for the amazing industrial revolution which is even now commencing in China. There is room for all competitors—the field is so vast.

Transmutation of Metals.—The Spanish daily Press of January 14th makes mention of an "important discovery." A medical student, of Alicante, Don Germán Botella Pérez, has discovered an electrical process by which mercury can be decomposed, leaving a residue of gold and a certain amount of radium. The discoverer, "a modest youth of 24 years," is very reticent on the subject, and will give no details until he has read a paper before the Alicante Academy of Sciences. In the meantime, he is busy selling gold to the jewellers of the city. The inventor's reticence is not surprising.

THE ELECTRIFICATION OF SEED.

By Chas. MERCIER, M.D., F.R.C.P.

Many efforts, extending over many years, have been made to stimulate the growth of plants by means of electricity. Forty years ago, Sir W. Siemens conducted experiments for this purpose, and at many places on the Continent experiments extending over many years, and of the most varied character, were made during the last century. Both static and dynamic electricity have been applied to this purpose. Among the early experiments were attempts to capture the natural electricity of the air by means of a kind of lightning conductor, and direct it upon or into the crops. The next step was to generate static electricity to reinforce or replace that derived from the air, and to direct it upon the crops. Another method was to bury plates of zinc and copper in the ground, and to connect them by metallic conductors. Then, when dynamic electricity came to be generated in large quantities and to be generally employed, it was applied in various ways to growing crops, usually in such a way that the crop might be placed in an electric field. Wire netting or a system of parallel wires was suspended over the growing crops, and kept in connection with an active dynamo, and experiments on this plan are still in progress, and are the subject of reports in recent issues of the *Journal* of the Board of Agriculture.

All these methods obtained a measure of practical success in accelerating the growth of the plants subjected to the electric influence, or in increasing the vigour of their growth, or the amount of their yield, and in many instances the effect was remarkable; in some it was astonishing; but in all, the methods were attended by practical inconveniences which have prevented the adoption of the methods except upon an experimental scale. In some, the expense is prohibitive. In all, complicated apparatus is necessary; and in most, this apparatus is so connected with the ground as to interfere with agricultural and horticultural operations, and to necessitate its removal and re-erection at least annually, and usually at more frequent intervals. In addition, they all require some supervision, many of them require skilled supervision, during the whole time the crops are growing; and this is not only inconvenient, but also is a heavy item of expense. For these reasons none of the systems of applying electricity to growing crops has been used commercially, or upon any considerable scale. Some of them are restricted to greenhouse use, a few have extended to the garden, and one or two have been employed on small acreages of agricultural land; but none has been taken up as a part of regular farming routine by a farmer working on a commercial scale for profit. In other words, though they may be, and some of them are, practical successes, between practical success and commercial success there is a great gulf fixed; and up to now this gulf has proved impassable to every system of electrifying growing crops.

In these circumstances it occurred to a practical electrician who had already made an important invention in electricity, and who lives in an exclusively agricultural district of a predominantly agricultural county, to try whether the electrification of seed before it is sown would not yield results similar to those that follow the electrification of the growing crops. If it should do so, it would obtain these advantages free from the disadvantages that have hitherto proved fatal to the adoption of electricity on a commercial scale for the stimulation of plant growth.

The experiments were made at first tentatively in a few pots. The result was so encouraging that they were repeated on a plot of garden ground. Again the experiment was unmistakably successful, and a neighbouring farmer was prevailed upon to sow electrified seed on a few acres of a field in which other seed from the same bulk, but unelectrified, occupied the larger portion. The farmer had the usual farmer's distrust of innovation, and utter disbelief in everything emanating from an amateur or from a "scientific" source. He knew the thing would fail, and since he has found salvation he has confessed that he intended it to fail, and worked to that end. But lo! it was successful. The electrified seed produced a distinctly, and even a strikingly, better crop than the rest of the field. Some of the farmer's prejudice was removed. He consented to try the electrified seed again, though he was strongly of opinion that its success was only a fluke. However, it was successful again, and his scepticism began to crumble in earnest. Now he sows with electrified seed the whole of his arable, extending to some 300 acres, reserving only a small plot in each field for comparison.

Meanwhile, the news had spread. Neighbouring farmers became curious, and desirous to try the treated seed. The first farmer therefore installed a plant for electrifying not only his own seed corn, but that of his neighbours also, and this plant has ever since been fully employed.

The inventor, Mr. H. E. Fry, of Godmanstone, near Dorchester, has all the caution as well as the enthusiasm of the scientific experimentalist. He was in no hurry to see his system adopted. He made no effort to spread the knowledge of it until he had proved incontestably and beyond the possibility of doubt that it could be relied upon to give an increase in the yield of the seed, and for a long time there was such a want of uniformity in the results that, in spite of striking successes, he hesitated to recommend it for general adoption. In time, however, and by prolonged and patient experimentation, the causes of this lack of uniformity gradually became apparent. It was found that different kinds of seed require very different lengths of treatment to produce in them the best effect. It was found that certain subsidiary operations have a great effect upon the results, and that unless these subsidiary operations are properly conducted, the result may be disastrous; but it was found that if these things are all attended to, and the operation is in every respect properly conducted, an increase in the resulting crop is a certainty.

The process is as simple as possible. It consists merely in passing a weak current of electricity through the seed for a certain length of time. In order to render the seed permeable by such a current, the seed must be steeped in a conducting solution, a weak solution of some metallic salt. As it cannot be sown when it is wet, and as, moreover, if left wet the seed would be apt to heat, to become mildewed, to sprout, and to suffer in other ways, it is necessary to dry it, and the drying is a very important part of the process, for in nearly every case in which the result has been unsuccessful, the ill success has been due to faulty drying. The seed has been dried too much or too little, at too high a temperature, or not soon enough, or there has been some other fault in the drying. The electrification is scarcely ever at fault. Hitherto, the seed has been dried in a malt kiln, which requires the services of a skilled maltster, and during the war the services of such a man were not always to be had; but a new method of drying is now in course of evolution, and if this answers expectation, no more failures from faulty drying will occur.

The electricity may be generated by a dynamo, or may be taken from a town supply. In any case, the current required is but little, varying, of course, with the quantity of seed under treatment. For purely experimental purposes, in which packets of small seeds, such as those of tobacco or tomato are treated one at a time, a pint jar and an accumulator are sufficient. For a tank of a capacity of

100 sacks of corn, the amount of current required is relatively large, but it is not absolutely large as amounts of electricity are now estimated. The sojourn of the seed in the electrifying tank varies, according to the kind of seed, from an hour to seven or more hours.

The effect of electrification on the crop that grows from the electrified seed is very important. There is an increase in the yield of grain, varying from 4 bushels to 20 or more bushels per acre, or from a sack to 5 sacks or more, or from 10 per cent. to 60 per cent. or more. In addition the straw is increased both in length and strength. This is very important, for it enables the crop to stand up against storms that lay flat the adjacent crop from unelectrified seed.

Up to the present, the process has been worked out only for wheat, oats, and barley, but equally good results have been obtained with many other seeds—turnip, mangel, cabbage, tomato, tobacco, cotton, and many more. When the proper duration and strength of current, the proper strength of solution of the proper salt, and so forth, have been determined in each case, the treatment of these seeds also will be placed on a commercial footing. Evidently, there is a great future before the electrification of seed.

PLANNING A WORKS RESEARCH ORGANISATION.

By A. P. M. Fleming, O.B.E., M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

No plans for the future development of industry are now considered complete unless they provide for scientific research, and in no industry is there such scope for research as in the highly technical electrical industry. During the past few years there has been a great deal of research directly controlled by or associated with industry. An increasing amount of work is being done in universities and technical colleges, and in various other laboratories and organisations. In a national sense, the Department of Scientific and Industrial Research is endeavouring to develop co-operative research in various industries, with the initial assistance of Government funds. In many instances it is advisable for firms to establish research organisations in connection with their own factories.

The purpose of this paper is primarily to outline the scope of such a research organisation, the features which underlie its effective planning, its requirements with respect to staff; the design of the buildings and the initial outlay and cost of maintenance of the organisation.

It is necessary to draw a clear distinction between research work in pure science and industrial research. Both are essential to industrial progress. The justification for undertaking research in pure science in a research laboratory associated with an industrial concern lies in the almost inevitable industrial applications which follow rapidly in the wake of a new scientific discovery. Much of this work, however, must be carried on by scientists working in private, university, co-operative, or national laboratories.

Research laboratories partly or wholly supported by the industrial firms may be broadly classified according to the particular interests they are intended to serve, as for example:—

1. Industrial research laboratories self-contained and serving one particular works.
2. Central industrial laboratories each forming the scientific focus of an industrial organisation comprising several works, often in different industries, and linked up by control laboratories at the individual works.
3. Laboratories planned to serve a wide range of interests in various industries in connection with isolated problems.
4. Laboratories designed to serve the needs of one particular industry working on a co-operative basis. The laboratories of the proposed research associations in Great Britain would fall into this class.
5. State laboratories carrying out researches occasionally of an industrial character, but not necessarily for any particular firm, such as the National Physical Laboratory, the Bureau of Standards, U.S.A., and various university laboratories.

Most firms find it expedient to combine necessary routine testing with research work, at any rate in the initial stages of development. Both routine testing and research have much in common.

The functions of a works research organisation may be classified thus:—

1. Testing of raw material supplies and the establishment of a suitable technical basis for purchasing.
2. Production of new materials or substitutes for those already in use.
3. Investigation of difficulties arising in the manufacturing organisation.
4. Investigations necessary for controlling and maintaining technical processes in manufacture.
5. Development of new and improved processes and their establishment on a manufacturing scale.
6. Development of methods for the treatment of factory waste and scrap for by-products.
7. Investigation of fundamental data for designing new apparatus.
8. Development, improvement, and standardisation of tools, appliances, and methods of testing.
9. Investigations of operating troubles and service for customers.
10. Investigations for the information of financiers of the possibilities of new scientific projects.
11. Physiological and psychological investigations relating to vocational selection and for determining the most efficient means of employing human services.
12. Research in pure science.

The character of the industry determines mainly the scope and nature of the work to be done, and, consequently, the number of sections of the laboratory. To illustrate these divisions the author, in the original paper, discusses special lines of research. Reference is made to work involved in the improvement of technical progress, and the application of physchological and physiological tests. The prevention of the repetition of work done elsewhere is emphasised; collection of such data must not be undertaken promiscuously by the research workers themselves, but by a small, specially trained staff. All information to be centred in the Research Library. A systematic record of all costs, stores, breakages, and wages is of great importance.

In routine testing for works departments the nature and number of the tests carried out form a series of sections, each having a departmental chief responsible to the director, and a staff of senior and junior assistants. There should be regular conferences of the departmental chiefs and research workers to prevent overlapping and duplication of work. The closest co-operation should exist between the staff engaged more specifically in research and those engaged in routine work, and especially also between the whole of the laboratory staff and the works staff.

The most important feature of a research organisation is that of the staff. There has been a lack of technically-trained young men who are able to apply the results of scientific research in industry. For a considerable time to come, the supply of men will be totally insufficient for the needs of industry. It is an error to suppose that industrial research cannot be carried on without men of genius. Such a type, indeed, is generally not at ease in an industrial works where research can be reduced to the character of a business, where procedure can be organised on systematic lines. With the exception of those actually engaged in directing research, the staff should comprise comparatively young men and women capable of distinguishing cause from effect, able to observe keenly, and possessing sound technical training, preferably of university standard in the faculty pertaining to the industry they propose to enter, followed by some practical experience.

In addition to serving as a nursery for research workers, the laboratories should undertake part of the training of those young men who in a large organisation are being trained for higher industrial positions. The research department should work in close contact with the educational portion of the organisation now becoming an essential feature in industrial concerns. Every possible step should be taken to reveal latent talent, and to provide opportunities for acquisition of the necessary education and experience.

The staff of an industrial research organisation, comprising sections as indicated above, will generally include a director, sectional heads, senior and junior assistants, with possibly a number of individual research men responsible to the director. The director must appreciate the possibilities of applying new knowledge to industry to commercial advantage, and be able efficiently to direct specialised research workers, avoiding aimless research having no ultilitarian objective. Besides a wide scientific knowledge he must have in addition considerable organising capacity, commercial instinct, and a thorough knowledge of the manufacturing processes of the industry. He must have sufficient breadth of view to be willing to employ expert assistance whenever occasion for this arises. The sectional heads will, in general, be men of high scientific standing. These, and the senior staff, should be men of university education and training.

In designing laboratory buildings the advice of a competent architect is necessary in all matters of a purely architectural character. These, however, should be subservient to the considerations which decide some forms of construction and some arrangements most appropriate to the laboratory as such. The research laboratories should be contained in a building separate from but centrally situated in relation to the works departments. The size of the laboratory will be determined mainly by the number and character of the sections, the volume of work, size of staff, margin allowed for extension, and the amount of money available for initial outlay and maintenance.

The importance of providing a liberal amount of space initially to permit of extension without undue cost or inconvenience is emphasised. The type of building may be determined by the gross floor area needed, also possibility of extension must be borne in mind. Factors affecting the selection of a fabric are elimination of vibration, lighting, fire risk, &c. A flat roof readily lends itself to any partition of the building into sections; it offers no exposed parts to corrosion, and hence both the first cost and maintenance cost are low; it secures the most equable temperature under external fluctuations, and it is the best form for artificial lighting. Further, a flat roof can be utilised as a proving ground, where weathering properties of materials have to be tested.

Constant use of delicate instruments demands freedom from vibration, and its reduction depends to a large extent upon the choice of fabric. A reinforced concrete skeleton and flooring for two-story and multi-story buildings gives the least response to disturbing forces. All buildings, however, vibrate to some extent, and precautions taken against vibration depend on internal construction.

The problem is twofold: (1) the building has to be screened from the disturbing forces set up by its own contained machinery; (2) special apparatus may require to be screened from disturbances communicated to the building from outside. The former necessitates the isolation of unbalanced machinery in reference to the main structure. For this purpose the machinery may be housed away from the main building or situated on the ground floor or basement, preferably supported by piers built from the ground and separate from the rest of the building. In some cases it may be necessary to avoid the use of line shafting. The screening of apparatus may only require the provision of rigid tables which will not vibrate themselves, and which can be placed in positions where the vibration taken up from the building will not be serious. In this case a table top in reinforced concrete, slate, marble or like material supported from the floor by substantial piers in brick or concrete forms a satisfactory arrangement. An example of special supports is afforded by the laboratories of Andre Citroen et Cie. Here special balances, photo-microscopic and electro-magnetic apparatus are situated on the first floor, and carried on marble tables. A typical table has four india-rubber feet which rests upon the tops of two piers rising through the basement from a common foundation of concrete and brick. Each pier consists of sections in brick, concrete, and compressed cork, the latter being capped by a plate on which the india-rubber feet of the table rest. Much may be done to remove vibration troubles by providing apparatus with flexible supports loaded with a sufficient mass.

Special treatment of the problem of natural lighting is required in planning a research building, on account of the close and accurate observation which is necessary. It is important to appreciate the relative values of the intensity of illumination in the vertical and horizontal planes required for different kinds of work.

Capital Outlay and Maintenance Costs for Laboratories.

	6,000 sq. ft. Type 1. Single story.	12,000 sq. ft. Type 2A. Single story.	Type 2B. Single story.	52,000 sq. ft. Type 3. Multi-story.
Building	£4,000	£7.640	£6,930	£28 500
Furniture	1,050	2.100	2,100	9,100
Apparatus	3,900	7,800	7,800	33,800
Total capital outlay, excluding land... ...	8,950	17,540	16.830	71,400
Total annual maintenance, including salaries ...	8,700	17,400	17.400	75,500

From pre-war costs considered under the following heads: (*a*) building; (*b*) furniture; (*c*) apparatus and equipment; (*d*) maintenance, including salaries, the author arrives at the collected data shown in the above table. Excluding the cost of land, the cost of the building for the fabric assumed is slightly less than half the total capital outlay. The normal annual maintenance cost is about equal to the capital outlay. These relations, confirmed by American data, show that the cost of the buildings is of secondary importance.

Discussion in London.

Mr. C. C. Paterson, in opening the discussion, said that the paper described foreign organisations, which he understood it was intended to do, but in this country they were not altogether without similar institutions. In his opinion the heads of such organisations should be very highly qualified men: they should confine themselves to actual research work, and not have to bother themselves with the management or administration of the laboratories. The author had not made it clear as to the scope of work that would be permitted; the speaker thought it should not be limited to industrial research, but should deviate therefrom when profitable results were likely to accrue. The working hours of such organisations could not be set as in a works; a man might be in the middle of an important experiment which, if interrupted, would have to be commenced all over again. Further, research workers must be free to attend lectures, discussions, &c., even if they took place in ordinary working hours, or at some distance away; this was important, it was essential to have freedom. The holiday question was also an important one. Research work, if carried out in the manner it should be, imposed a considerable strain on the worker, and after 12 months of such work it was quite unreasonable to expect that a couple of weeks' holiday was sufficient to enable the man to recuperate. The speaker did not agree that multiple-story buildings would have to be adopted where 12,000 ft. or over of superficial area was required. He preferred single-storey buildings which could be more easily extended, and better lighting, &c., could also be obtained by such. The efficiency of a research organisation would greatly depend on the workshop facilities available, by which test specimens could be prepared and special machines and apparatus built. He thought that 10 to 15 per cent. of the total cost of such an organisation should be expended on the provision of an adequately equipped workshop. An up-to-date and well-stocked library was also an essential item, and it should be centrally situated where it would be accessible to all. It was a mistake to place the library at the top of the building; very often it was thought to be too much trouble to go a distance every time an item required to be looked up.

Dr. E. P. Hedley thought that more money should be spent in this country on research, and that there were many lessons to be learned from the U.S.A. In any such organisation team work was an essential feature, and it would be found to be more economical than individual work. There was a danger that such organisations would be used as training grounds for men who would be later on transferred to the works. This should be strictly guarded against as success would never be attained if men were moved to another department as soon as they became efficient in a particular line of work. It was important that research workers should be paid adequate salaries, the figure mentioned in the paper would never attract suitable men (to which the author replied that the figure given was only meant to illustrate the proportions into which the various items of expenditure were divided. In practice he would expect such men to be on a par with university professors). Dr. Hedley said that in his opinion even university professors were by no means adequately paid. The payment of a bonus for individual work was an easy matter, but for an idea developed and worked up by a number of men it would be extremely difficult to apply the system, therefore team work was essential. The bonus should be pair to the whole, and divided amongst the individuals according to their salaries.

Sir Robert A. Hadfield, F.R.S., said that practical men would confirm much of what had been said. Not so little had been done in this country as was thought by some. This war had shown that when they put their mind on a thing they got there in spite of all obstacles. "They might be mean, but they got there all the same." Sir Robert then described his visit some years ago to Krupp's works at Essen. £180,000 had been spent on the research organisation there. He was shown all over it, from top to bottom, and it was a wonderful place. It was a curious fact that everything was fully explained to him, and all questions he had put were fully answered. He had no idea why that had been done. When he left the works a lengthy, illustrated catalogue, in which every room of the research department was described, was presented to him. He had had it translated, and if it would be of any use to the institution he would have pleasure in putting the translation at its disposal. Sir Robert exhibited an interesting model of the research building at his works, and explained its principal features. He thought all research workers' salaries should be on a generous scale, and, in conclusion, he paid tribute to the "noble band of men" who had done their bit in the way of research in this country during the war.

Dr. C. C. Garrard said that the head of such an organisation should strive to get all routine work done as cheaply as possible. A research department was similar to the costing department; the latter looked after the financial side, while the former should do the same regarding labour and materials. It should be looked upon as a sort of development department, and provide suitable labour and materials so that production in the works could be made as cheap as possible. With regard to the buildings described in the paper, he thought they were much too costly; in his opinion suitable concrete buildings could be erected at a cost no higher than 8d. per ft.

Mr. E. Sachs, speaking from an architect's point of view, commended the buildings described in the paper. Fire risk should not be dismissed lightly; buildings ought to be subdivided much more than they were. It was bad practice to have numerous long corridors by which fires could be communicated from one part of a building to another. There was much to be said in favour of concrete buildings in respect of freedom from fire risk and vibration. In all good modern buildings it was essential to provide ducts through which all piping, wiring, &c., could be carried. He was also in favour of the openwork type of furniture, as there was less fire risk. In his opinion not much would result from secretive work; team work was undoubtedly the best. Freedom of the worker was essential; such an organisation would never be a success unless freedom as to working hours was allowed. Personally, he was in favour of ordinary roofs—not flat ones—but if the latter were provided, they should be double, with an air space between.

Mr. H. **Rottenburg** thought that the most important division of any research department was its library. Most libraries to-day were practically useless; good libraries should be able to provide, when asked, all the latest and most up-to-date information on any subject, no matter in what part of the world that information originated. The library should also contain complete references, and an index to all research work carried out. This would avoid duplication, as an investigator, before commencing new work, would be able to see without waste of time, exactly how far the matter had been carried in the past, and just what had gone before. Of course such a library as he had in mind could not be provided for each separate works, but one central depot, where all who wished could apply for information, would soon prove its value. Some firms might perhaps object to information being distributed broadcast in such fashion, but there was much which at present was hidden away that could be made public with beneficial results, and, of course, certain things need not be gone into in detail. A further point was that many special and costly machines and apparatus made for research purposes, after being used, was, he was sorry to say, put on one side, and left to rust away into oblivion. Now, if an inventory of all such apparatus, with full particulars, was kept at the central library, other experimenters could, instead of building fresh apparatus of their own, obtain machines which with slight alteration might be used over again. In this way the costs of experiments could be largely reduced. Co-operative work was very essential in his opinion. In support of this contention he instanced what had happened in Russia. That was a hugh co-operative effort on the part of the people to bring about a certain thing. What had been the result? Certainly not what was expected, instead, two individuals had come out on top. The same thing was likely to result from co-operative research; individualism would certainly not be killed.

Dr. W. **Rosenhain** thought that research work and production should be kept entirely separate and away from one another; routine testing was part of production, and should, therefore, not be included in the duties of the research department. The laboratories should not be at or anywhere near the works, if they were they would be dominated by the influence of the latter, whose sole aim was production. The two things were entirely different, and should be kept apart. He did not favour the buildings described in the paper; such buildings ought to be designed by the men who were going to work in them, and not by architects. He knew of certain buildings in Germany, quite perfect from the architect's point of view, which when completed were discovered to be quite unsuited to the work it was intended to carry out in them. He entirely disagreed with the author's statement that research could be reduced to a business, also working hours could not be governed. A great deal depended on leadership, the man who leads the work was the one who made it a success or otherwise.

A speaker, whose name was missed, gave some details, and exhibited plans of the research organisation for which he had been responsible. He agreed that all routine testing should be excluded from the research department, and took exception to the author's statement that "much could be done with the ordinary man." Surely a man possessing qualities and qualifications such as the author had enumerated was not an ordinary man? The right type of men were very difficult to find, especially now, when so many of the best had been lost, but when such were found they should be placed in the right environments and allowed to go right ahead with their work, and not be bothered with minor details. All depended on what sort of a start was made. Regarding the financial side, the amount that was spent annually on research work would be known; it would also be known on what it was spent, it therefore did not matter how it was spent. If the heads of such organisations were required to furnish detailed accounts of all expenditure they would have an intolerable state of affairs. They would have some of the finest brains in the country occupied with matters of £ s. d. instead of getting on with the legitimate work.

Prof. C. R. **Darling** inquired as to the percentage of the turnover that it was proposed to spend on research. If some idea of this were given, small firms would be able to co-operate. Large firms who could afford to set up such organisation individually were, after all, not in the majority. He would also like to know where it was proposed to get the staffs that would be required for such research organisations. Now that so many of our best had been lost, those who were left would immediately be absorbed for production where there was great need of them. In his opinion the scarcity of the right type of men would be the greatest obstacle to the scheme; it was a problem where these men where going to be obtained, it would be some time before the output would meet with the demand. He did not agree that the recruiting ground for such men should be restricted to the Universities, that would considerably narrow the ground. All good technical colleges should be included; some of the best men, quite equal to university men, were turned out from these colleges. It should be remembered that Faraday and others were not university men.

Owing to the lateness of the hour, other members' contributions as well as the author's reply to the discussion were reserved to be published later in the *Journal* of the Institution.

Discussion at Newcastle-upon-Tyne.

Mr. A. P. M. **Fleming**, O.B.E., delivered his lecture before the North-Eastern Centre on January 15th. Mr. A. P. **Pyne**, chairman, in opening the discussion, said that the question of research was a vital one to this country. Those who knew what was being done in Germany and America knew also how far we were behind in this country. It was true that during the war we had picked up some leeway, but we had a long way to go before we reached the position that we ought to occupy. Small firms were in a worse position than were the large ones, for they could not hope to run such organisations as Mr. Fleming had referred to, but, on the other hand, there was that need for research carried out on general lines.

Sir **George Hadcock** (Armstrong, Whitworth & Co., Ltd.) said the lecture and discussion were very opportune, for the air was full of schemes of reorganisation, and, naturally, industrial research formed a large part of that reorganisation. Probably few firms could run such buildings as had been shown; that should not discourage them, because those buildings, although desirable, were not necessary. At Elswick they had done a great deal with a building of much more modest dimensions, and with very little apparatus. There were many operations that could be carried out in the regular course of industry. Research, however carried out, might be divided roughly into two sections—investigation made of a purely scientific character, which was done at the National Physical Laboratory, and that which referred to the improvement of technical details, construction, &c. He thought the right policy would be to make as much as they could, and that was the policy that they ought to grasp and take advantage of. Referring to co-operative research, Sir George said the system was an excellent one, but it had the drawback that it meant that each manufacturer must disclose all his trade secrets. That might be desirable for the country at large, but if they had co-operation they would not have any competition. Shops were becoming more and more specialised, that was necessary to enable them to compete; they must specialise. As a result, promotion in the executive branch was naturally confined largely to shop experience, with high technical training, but there were few with any scientific training. If research workers could be sure of promotion, university graduates would look more favourably on the work. As to the buildings, he thought Mr. Fleming had gone too far. To have them carried out on a co-operative scheme would not be so bad, but for individual firms the system would be out of all question.

Dr. **Michie** had little to criticise, it seemed to him that the scheme was very complete. He was glad to see that the chemical section was placed first. He was much interested to notice the psychological section, and he wondered what would happen if, in these democratic days, some of the subordinates thought that those above should be examined. The provisions to eliminate vibration were very good; it was a matter that was not generally given the attention that it ought to have. Also the question of illumination had, in the past, been greatly neglected.

Mr. H. W. **Clothier** could confirm from the small works point of view that a great deal of research work was being, and always had been done by manufacturers without elaborate provision. He could very well conceive that they could go too far, and soon find themselves with a "white elephant." In a small switchgear supply works they had their routine testing apparatus for all electrical tests. He found that the General Electric Co., of America, was testing up to 12,000 amperes, 200,000 volts. Some years ago he took part in some tests at 12,000 amperes, and they had routine tests at 8,000 and 10,000 amperes, although not at 200,000 volts. Very shortly, however, they would be in a position to carry out 250,000 or even 300,000-volt tests. Although they had not those great buildings they were able to produce in England apparatus which, in many cases, excelled that which came from other countries. He thought there was also great danger of working too much in isolated compartments, and one would sometimes get better results if the research work were carried out in ordinary manufacturing works; the work was thus done in a more flexible way. The English method, he thought, encouraged better individual initiative. As to the question of publicity, he was of opinion that the Americans used their research establishments as advertising media. There were arguments for a co-operative research establishment, for instance, they wanted the breaking capacity of a switch, and needed a million k.v.a. to test it. Of course no single firm could contemplate such a thing as that.

Mr. **Cooke** was glad that so much attention had been given to the building. He had been associated with research work for many years, and, generally, found that special provision was made for special work, instead of organising the department for research in general. It was an important point, nothing cramped research work like want of room. He did not think that a firm would be justified in following Mr. Fleming's elaborate classification of subjects of research as the basis of such an establishment, nor did he favour an excessive amount of plant which would probably soon become obsolete. His opinion differed also from Mr. Fleming's as to the costing office.

Mr. A. **Fawssett** said that individual organisations would lead to great duplication of work, and it seemed to him that it would be better if there were a central authority which would be impartial in dealing with difficult problems. A co-operative laboratory was much needed on the north-east coast, to deal with the more difficult and unusual problems which required so much plant that they could not expect one firm to undertake it.

Mr. Fleming, replying to the discussion, said that large buildings and equipment might be unnecessary, but the work had to be done somewhere, and a time would arise when it would become more economical to set aside a special staff, and not to hamper the works department. He did not agree with the suggestion that if some of the trade "secrets" became common property competition would cease; for his part, he thought that competition would then really commence and become more intense.

THE NAVIGATIONAL MAGNETIC COMPASS CONSIDERED AS AN INSTRUMENT OF PRECISION.*

By M. B. FIELD, O.B.E., M.Inst.C.E., M.I.E.E.

(*Concluded from p. 112.*)

The lecturer next pointed out the effect of magnetic dissymmetry of a card. If one of the needles of a two-needle card were materially weaker than the other, no deviation would be noticed when testing the compass in the usual way in a uniform magnetic field. In such a field both needles, no matter what their strengths might be, would tend to point along the lines of force, and the card would point "true." When, however, the compass was placed in a non-uniform field, such as those already illustrated, an effect would arise due to inequality of magnetic strength of the two needles. Dissymmetry of this character could not be detected by the usual tests made in a uniform field.

A further instance of dissymmetry might occur if the magnetisation of either needle was unsymmetric about the central plane of that needle; an illustration of this effect was given by reproducing the iron-filings diagrams of a "bad" permanent magnet (*a*) immediately after magnetisation; (*b*) six weeks after magnetisation (figs. 6A, p. 110). The field of force, which was symmetrical immediately after magnetisation, had become exceedingly unsymmetric during the interval. Apparatus were exhibited by means of which needles might be rapidly tested in the workshop:—

(*a*) For equality of magnetic moment.

(*b*) For symmetry of magnetisation about the central plane of each needle.

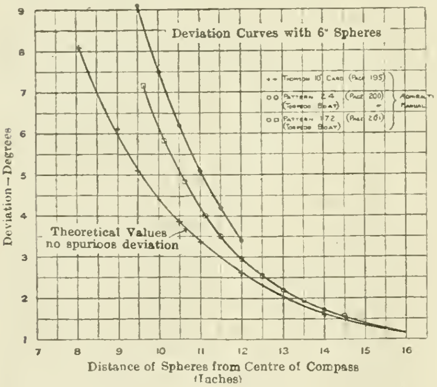

Fig. 14.—Admiralty Measurements of Deviations.

The lecturer had intended to speak about the magnetisation of the ship, and how the various correctors performed their functions, but, owing to lack of time, had to conclude with a reference to the effect of employing undesirably great magnetic moments:—

Briefly, we may say that the earth's horizontal force induces magnetism in the ship, which in general produces an east-westerly force at the compass station, and gives rise to deviation. The function of the quadrantal globes is to neutralise this east-westerly force. If the globes be properly proportioned and placed, no deviation of the resultant field, due to the cause under consideration, exists at the centre of the compass. Nevertheless the card does not necessarily point "true", it depends on the magnetic moment of the needles.

We may readily test this on shore. Take a binnacle with, say, 8½ in. globes set 12 in. from the central axis, and turn it round until the diameter passing through the spheres is in the N.E.-S.W. direction. We can easily calculate that the direction of the resultant field at the centre of the compass is N. 7.3 deg. E., the deviation from the meridian being due to the deflection of the lines of force by the action of the spheres. Further, this deviation of 7.3 deg. east would be the same at whatever part of the earth we might be experimenting—it does not depend on the value of H. The following table represents a series of tests made at Glasgow.

Deviation produced by 8½-in. Spheres 12-in. from Vertical Axis, on N.E. and S.W. Diameter.

	Reading	Inductive deviation (approx.).
Standard 10-in. dry-card ...	7·3°	—
Standard naval compass ...	10·0	2·7
Torpedo boat "	10·0°	2·7°
U.S.A. naval "	11·65°	4·35°
Ritchie... "	18·9	11·6
Common steering "	13·2	5·9

The only card which takes up the direction of the resultant force is the small-magnetic-moment dry card. The standard naval liquid compass is attracted 2.7 deg. further in the direction of the spheres, and so on. These attractions are due to the magnetism induced in the spheres by the powerful needles, reacting on the needles.

If we were to repeat this test at Singapore, where the value of H is about 2.3 times the value at Glasgow, we should get the same deviations, only in the case of the small-moment card; the others would be different. In fact the third column of the above table shows the portion of the deviation, the amount of which depends on geographical position. The quadrantal deviation produced by the iron work of the ship does not depend on geographical position, but the amount of compensation provided by the spheres does depend on geographical position, if the needles are strong enough to produce sensible magnetisation of the spheres.

The excellent manual published by the Admiralty on the deviation of the compass gives tables setting out the actual observed deviations of different compasses in the presence of globes of different sizes, and situated at different distances on a quadrantal diameter. A formula is also given by which we may calculate the deviation of the resultant force due to the globes. Fig. 14 shows the Admiralty measurements when using 6 in. spheres. The observations for the "Thomson" (dry) card lie on the theoretical curve, while those of the naval liquid types all lie above. The difference is the amount of the attraction towards the globes, caused by the strong magnetic moments necessarily involved in the liquid compass.

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* Abstract of lecture delivered before the Institution of Electrical Engineers, London, January 9th, 1919.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following is a further list of contributions received in response to the appeal made by Mr. Hunter:—

	£	s.	d.		£	s.	d.
A. Cohn	2	2	0	M. McCulloch & Co. ...	1	1	0
Anon.	1	1	0	Credenda Conduits Co., Ltd.	2	2	0
A. Warden & Co.	1	1	0	White, Jacoby & Co., Ltd.	1	1	0
J. Wilkins & Co.		10	6	Maxim Lp. Works, Ltd.	2	2	0
J. Shepherd	1	1	0	J. F. Poynter	1	1	0
C. Jermyn Ford	5	5	0	Geo. Rice, Ltd.	10	10	0
Acme Elec. Manfg. Co. ...	1	1	0	County of London E.S. Co., Ltd.	1	1	0
Sunlight Manfg. Co. Ltd.	2	2	0	S. A. Russell	1	1	0
W. B. Williamson	1	1	0	Baxter & Caunter	2	2	0
B. Handley	1	12	6	John Gray	5	5	0
H. F. A. Kinder	1	1	0	Wholesale Elec. Co., Ltd.	2	2	0
Lamb & Sons		10	0	R. O. Martin		10	0
J. Oakey & Sons, Ltd. ...	2	2	0	E. E. Lloyd	10	10	0
F. J. Down	5	0	0	A. H. Gilling	1	1	0
Stanford & Co.		10	6	E. Erskine Murray	1	1	0
A. P. Trotter	1	1	0				
Everitt & Co.	5	5	0				
A. T. Morris		10	6				

The contribution of £1 1s. 0d. recorded last week as from Messrs. Marshall, Sons & Co., Ltd., was a personal contribution by Mr. W. V. Waite, of that firm.

Renovation of Discoloured Arc-lamp Globes.—The globes of arc lamps often show considerable discoloration, owing to the action of the actinic rays. Mr. A. Hertz, in the *Electrical World*, says such discoloration can be entirely removed by a careful heat treatment. The globes should be first washed with muriatic acid to remove the iron particles and brown powder that have been spattered on to the glass from the electrodes. They should then be placed in a gas-heated annealing oven, and raised in four or five hours to a temperature of 480 deg. to 540 deg. C., which should be maintained for about one hour. The oven is then allowed to cool off for twelve to fifteen hours, care being taken not to open it until the temperature has fallen to 50 deg. C., as otherwise the globes are liable to crack. After washing the globes with soap and water they are again perfectly clear. The cost of the process per globe, including gas and labour, is given as about 35 cents.

BUSINESS NOTES.

Our Letters from the Forces.—" Lieut., R.E.," writing from France, says :—"I wish to take this opportunity of expressing my most sincere thanks to you for the weekly copy of the Electrical Review that you have so regularly sent me since the early days of the war. I can assure you that it has been appreciated both by myself and by all my R E. friends more than mere words can describe, and now that hostilities have ceased, and we are returning to our 'civvy' jobs again, it is to the Electrical Review that we can trace our present touch with affairs electrical. I wish to express my very great thanks for many happy hours of reading 'out in the wilds.'"

A correspondent who has just returned to his pre-war interests in electricity supply writes :—" I am probably only one of a large number who have benefited from and enjoyed your free weekly gift, but I am certain your kind action in continuing the supply over such a period will not be forgotten, and the good old Review will be waited for more eagerly than ever on Friday afternoons. In offering to you my very best thanks for your kindness, permit me to wish yourselves and the Review every best wish for the continued good work you are doing in the electrical world."

Export Restrictions Removed.—The *London Gazette* for January 24th contains a further list of export restrictions which have now been removed.

Swedish Electrical Industry.—It is interesting to review the measures taken by the Swedish electrical trades to provide suitable substitutes for materials which were in short supply during the war.

Copper has, to a great extent, been substituted with other metals, first and foremost, steel, iron, and zinc. For transmission steel cables are now used to advantage. Svenska Metalverken (Swedish Metal Works) recently exhibited a large collection of these cables of all kinds. The installation material is generally made of iron and zinc covered with copper or brass. Both the Allmänna Svenska Elektriska Aktiebolaget (Swedish General Electric Co.) and Böhlmarks Lamp Factory are making installation material of substitutes. The Motor Factory Eck exhibited some samples of oil switches where substitutes for copper have been used to advantage. This development is still more strongly marked in the armature industry. Substitute materials are used with excellent results for cheap as well as expensive lighting apparatus of all kinds. Cheaper lamps are mostly made of iron plate, electrolytically covered with copper or brass ; the more expensive lamps are mostly made of zinc and lead well moulded and ornamented, and then covered with pure copper or an alloy thereof.

In commenting recently on the industrial exhibits at the Goteborg Fair, the United States Commercial Agent remarked on the enormous growth in the manufacture of electrical material in Sweden during the war. In a number of articles, especially installation material and casings, foreign competition had the upper hand before the war, and at the prices then prevailing there was no chance for Swedish manufacture. Now Swedish manufacture has taken the market entirely, owing to the increased demand, the disappearance of foreign competition, and the change in prices. "Before the time when foreign competition will again have to be met Swedish manufacturers should be able to meet it. In this connection it may be mentioned that wood-casing, the cheaper as well as the more expensive qualities, has gained more and more ground. Even electrical measuring instruments, which formerly were made only abroad, were exhibited at the Fair, but these are not yet perfect."

Opening for Small Electric Plants in Jamaica.—According to the United States Consul at Kingston, there is a good opening in Jamaica for small electric plants furnishing light for isolated country houses and power for doing the ordinary operations on the farm, such as grinding, pumping water, making butter, &c. Owing to the lack of development of water power, electric current is available only in the larger centres, and there is a good demand throughout the island for individual plants at a moderate price. There is one outfit on the market at present which retails at about £80, and is capable of carrying 20 to 30 18-c.p. lights at 32 volts. The outfit should consist of a kerosene engine and a dynamo mounted on the same shaft, preferably, and a bank of storage batteries. The operation should be as simple and as nearly automatic as possible. Only oil-burning engines should be considered, as gasoline is altogether too expensive at the present time. Attention should be given to the method of packing and shipping, so that the outfit can be set up by an ordinary mechanic.

Brazil.—Market for Telegraph Material.—The Brazilian Department of Telegraphs are stated to be desirous of purchasing their material in the United States, instead of in Europe, which hitherto largely supplied their requirements, save for certain wire. United States manufacturers are keenly alive to the possibilities of trade in this direction, and arrangements have been made for samples of the wires, tracings of the posts, arms and pins, together with photographs of iron arms and fittings, wooden arms and fittings, porcelain insulators and pins, and miscellaneous tools, to be on view at the New York office of the United States Bureau of Commerce.

Trading with the Enemy.—The *London Gazette* for January 24th contains further lists of persons and bodies in foreign countries with whom trading is prohibited or whose names have now been removed.

Dissolutions and Liquidations.—Leitner Electrical Co., Ltd., Maybury, Woking.—Meetings of the creditors and shareholders were held on January 21st, at the Carey Street offices of the Board of Trade, Lincoln's Inn, W.C. The company was formed in September, 1911, to acquire from Mr. Leitner a licence to work automatic electric lighting for trains and vehicles on a royalty basis. A winding-up order was made against the company in October, 1914, under which accounts were lodged showing liabilities £31,566, assets valued at £11,301, and a deficiency of £42,663 as regards contributories. Mr. W. J. Warley, Official Receiver, reported that the meetings had been called at the request of creditors to consider the appointment of a liquidator in the place of Mr. Corfield, who had died. The proofs of debts lodged numbered 127, and amounted to £30,326, but only a small proportion of those had sent in proxies on this occasion. There were eight general proxies, representing £460, and 10 special proxies, representing £15,276, in favour of the appointment of Mr. Albert Cripwell, accountant, Balfour House, Finsbury Pavement, E.C., whilst the general proxy had been sent to the Official Receiver to vote for himself, and two special proxies, representing £7,608, also for the appointment of the Official Receiver, were made out to other persons, who did not appear to be present at the meeting. Mr. Baker (Kenneth Brown, Baker & Co.) said he represented J. Stone & Co., Ltd., creditors for £7,545, and his clients wished the liquidation to be left in the hands of the Official Receiver. Mr. Davis (Greenwood & Batley) wished to move that Mr. Cripwell should fill the post, but it appeared that he had no power to do so, and the chairman announced that although on the figures Mr. Cripwell had a majority, there was no one present qualified to move a resolution for his appointment ; consequently, the motion to leave the liquidation in the hands of the Official Receiver carried the day at the creditors' meeting. Then the shareholders had sent in four proxies, representing 8,586 shares and 10,131 votes, for the appointment of Mr. Cripwell, whilst the proxy, representing 11,001 shares and 13,301 votes, declared in favour of the Official Receiver, who thus had a majority at the meeting of shareholders, and would, therefore, hold the office of liquidator.

Asked regarding the prospects of a dividend being paid to the unsecured creditors, the chairman said it depended largely upon the Russian assets. There were some outstanding foreign claims, and there was a sum of 16,000 Romanoff roubles lying at a French bank in London. The present value of those roubles was 3d. each, but if things improved in Russia there might be a higher price forthcoming for them ; consequently, they had been held in hand in the hope of an improved market. Then there was a claim to 5,000 roubles against a State railway in Russia, and, having regard to the present condition of things in that country, it might be an exceedingly long time before anything could be settled. There was a further claim to £350 against a German firm, and something might be got from that source, as the assets of that firm were in the hands of the Public Trustee. That comprised the assets, and, of course, no dividend could be declared for the present.

The proceedings then terminated.

Macintosh Cable Co., Ltd.—This company is winding up voluntarily, with Mr. A. R. Handley, Tib Lane, Manchester, as liquidator. A provisional agreement was entered into in November for the sale of the undertaking to Messrs. William Rickard, Ltd., and the name of the latter is to be changed to the Macintosh Cable Co., Ltd.

Home-Morton & Gibson, consulting engineers and industrial works designers, 224, St. Vincent Street, Glasgow, and 2, Eldon Street, London, E.C.—Messrs. D. & A. Home-Morton and Mr. G. H. Leckie Gibson have dissolved partnership. Mr. D. Home-Morton will carry on business, under the name of Home-Morton, at the Glasgow address, and attend to the Glasgow debts. Messrs. A. Home-Morton & G. H. Leckie Gibson will carry on the London office as Home-Morton & Gibson, and discharge the London debts.

Ferguson, Pailin & Co., Ltd.—A circular issued to the creditors by the liquidator of Messrs. Ferguson, Pailin & Co., Ltd., states that in connection with the very considerable extension of their business, the company have found it necessary to reconstruct and to transfer the goodwill and assets of the existing business to a new company, to be called " Ferguson, Pailin, Ltd." This involves, for technical reasons, a voluntary liquidation of Ferguson, Pailin and Co, Ltd., in connection with which it is necessary to convene a formal meeting of creditors. Any liabilities of Ferguson, Pailin and Co., Ltd., which are not discharged before the goodwill transfer to the new company takes place, will be discharged by the new company.

Tourtel Adding Machine Syndicate, Ltd.—Meeting of creditors February 3rd, at 2 and 3, Norfolk Street, Strand, W.C. Liquidator, Mr. A. Hartley, 70a, Basinghall Street, E.C.

British Westinghouse &c., Co., Ltd.—The petition for altering the objects of this company is to be heard before Mr. Justice Astbury on February 11th.

A Banker on the Engineering Trade.—In the course of his speech at the annual meeting of the Union Bank of Manchester, Ltd., Lord Rochdale reviewed the position of several trades. He remarked that in the engineering trade great changes had taken place. Most concerns were engaged on the production of war material, but this had generally been discontinued ; and many important works were reverting to their ordinary trade and supplementing them with new lines which they felt to be necessary to keep employed the largely extended plant which they had erected in order to increase their war production. The very extensive requirements of the world in general for machinery and allied productions were giving great confidence to this trade ; and there was no doubt that the important part which it had played in the past would be enhanced in the future.

Bankruptcy Proceedings.—ALFRED TAYLOR, electrical engineer, 98, Virginia Street, Southport, Lancaster.—This debtor appeared for his public examination on January 20th, at Liverpool, before Mr. Registrar Nield. The debtor said he had been a mining engineer on the Continent of Europe, and for the past 17 years he had devoted himself to perfecting a scheme for the purpose of cheapening the supply of electricity. The scheme was not yet in a position to be protected or patented, but he hoped to complete it soon, when he had no doubt of being in a position to pay all his creditors. He calculated that he had spent on the scheme, including loss of salary since he gave up his position on the Continent, at least £10,000. At present he was living on money received from his family and relations. The examination was adjourned.

C. MAYFIELD, electrical engineer, Clifton, Bristol.—First meeting, February 5th; public examination, February 28th, at Bristol.

Football.—The match between the Magnet F.C. and the Eastern Telegraph Schools F.C. was played at Hampstead last Saturday, and ended in a victory for the latter club by 2 goals to 0.

Italian Industrial Experts to Visit England.—According to the *Elettricista*, the English Government has invited a Commission of 12 representatives of Italian commerce and industry to inspect the principal industrial and commercial centres of England, with a view to exchanging ideas with English manufacturers, and framing a common programme of action for the mutual advantage of both countries.

The Industrial League.—The second number of the *Industrial League Journal* (December, 6d.) contains contributions from the Right Hon. G. H. Roberts, M.P., the Right Hon. J. H. Clynes, M.P., Mr. G. J. Wardle, M.P., and others. Among further features there is a full report of a conference on "Profit-sharing Schemes," held by the League in June last, when Mr. J. P. Thomas opened the discussion. A contributor to the debate, whose views will interest our readers, is Mr. H. Hirst, of the General Electric Co., Ltd.

German Foreign Trade Activity.—There is accumulating evidence of German trade activity in neutral countries, and also of correspondence direct from Germany to England, endeavouring to open up commercial connections. The *Times* correspondent at the Hague forwards a Berlin telegram, which is published in the *Handelsblad*, stating that the steel syndicate and other iron combinations are authorised to adapt selling prices in Holland and other countries to foreign competition, and thereby gain the business for the German iron market. From the statement it would appear that German competition will be even more severe in the future than hitherto.

The *Board of Trade Journal* says that the British Vice-Consul at Schaffhouse, in Switzerland, writing in mid-December, reported the presence in his district of German commercial travellers, who offered goods at much lower prices than those quoted in Switzerland for the same classes of goods. They also promised delivery in a fortnight. One agent offered a practically unlimited succession of trucks of glassware, earthenware, &c., but it is not known how much of this would have to be brought direct from Germany, and how much had been stored in Switzerland. It is certain, he adds, that large stocks of German make have been kept in Switzerland, waiting to be thrown on the market when prices should reach their zenith. There is a desire to get rid of these stocks now before the Belgian makers become active again. Dutch offers in these lines are numerous, but there is hesitation in fixing date of delivery.

As to German efforts in Belgium, a *Times* correspondent at Coblenz says that the determination of the Germans to re-establish commercial relations with the Entente countries as soon as possible is evident from a letter from the German-Belgian Mutual Association of Düsseldorf to a business man in Coblenz, in which he is asked to become a member of their organisation because of his personal interests in Belgium and Eastern France. "The aims of the Association are to re-establish trade and industrial relations with Belgium, to act as a medium of exchange between German and Belgian firms, and to serve as a centre of information and advice on all questions concerning Belgium and the French districts formerly occupied by German troops."

The F.B.I. and the Excess Profits Tax.—The Chancellor of the Exchequer is to receive a deputation from the Federation of British Industries on the question of the Excess Profits Tax.

The Shorter Hours' Movement.—There are some difficulties in the way of the adoption of the 47-hour working week at Manchester and districts, though it is stated that it has been accepted by the Manchester Corporation. A conference was held last week, at which it was intimated that unless there was a general stepping into line with the rest of the engineering and electrical trades there was likely to be a considerable stoppage of work by employés. Mr. J. Rowan, general secretary to the Electrical Trades Union, considers that federations of employers should exercise a control on those of their members who have bowed to the principle of a 47-hour week grudgingly, and seek to steal it back by absurd regulations.

Representatives from the Electrical Trades Unions waited upon the Bradford Corporation Wages Committee last week, with a view to altering the commencing date of the 47-hours week to January 1st instead of February 1st, as at first decided. The request was granted.

Mr. Arthur S. Murdoch, works manager for the British Electric Plant Co., Ltd., Alloa, writes locally:—"With reference to the agitation being engineered by the less responsible men in the Labour world for a 40-hours' week, may I say that the claim that this shorter week is necessary to absorb the number of men at present unemployed, is entirely controverted by the following facts: For the past eight weeks we have made every effort possible to obtain mechanics for our works. We have advertised constantly in the columns of the *Glasgow Herald*, have been in touch with the Labour Exchanges, and at the end of this period we have not been able to get a single man, and the manager of the local Labour Exchange informs me to-day (January 22nd) that he has applications for a very large number of mechanics on his books from employers, and there are no unemployed men of this description that he can offer either to us or to any other firm. It would, therefore, be interesting for the leaders of this movement to indicate where these 'thousands of unemployed' are."

Patent Restoration.—An Order has been made restoring Patent No. 3,814 of 1912, granted to Thos. Alva Edison, for "Improvements in sound reproducers."

Foreign Trade Department.—The Foreign Trade Department has been transferred from Bridgewater House to the Foreign Office, Downing Street, S.W. 1.

The South African Electrical Market.—The *South African Mining Journal* for December 21st, 1918, contained the following respecting electrical materials:—"Recently an element has been introduced into the retail trade amongst several firms, of cutting prices, hence lamps are being offered freely, per advertisements of various kinds, including extra window dressing. There is a reason for this, that may be personal or otherwise. However, it appears there are heavy stocks of lamps in town, as they have been reduced 3s. a dozen wholesale, and from 3s. to 3s. 6d. each retail. Business is very slack in a general way, and nothing much is expected until the turn of the year."

A Ministry of Commerce.—According to the *Daily Telegraph*, Sir Albert Stanley, President of the Board of Trade, announced at Huddersfield last week that a Ministry of Commerce would shortly be established. Experienced men of practical knowledge had already been invited to join the Board, to bring in a new breath of life. As to excess profits, Mr. Chamberlain had a difficult task to find money, but any impediment to the restoration of trade would be most carefully considered by him. The removal of restrictions was being closely considered. It was the deliberate policy of the Government that controls should be removed as rapidly as possible, but that did not mean that they would lock the doors of every department and throw away the key, and leave the industries to carry on as best they could. The blockade of enemy countries must continue until we had secured peace. It was important to traders to know that by the summer there would be as much world's tonnage afloat as before the war. The country might look for a big slump in shipping rates.

Socials.—The Supply Department of the British Westinghouse Electric and Manufacturing Co., Ltd., Long Millgate, Manchester, held their annual smoking concert at the Wellington Hotel, Manchester, on Friday evening, the 24th inst. Mr. J. Gibson, manager of the department, was in the chair, with Mr. G. Ellam, assistant manager, as vice-chairman. Between 60 and 70 were present, consisting of the male members of the staff and guests, the latter including both customers and competitors. There were the usual toasts, and altogether a very successful and enjoyable evening was spent. The toast of the "Army and Navy" was responded to by an ex-member of the staff, Corporal T. Taylor (home on leave), who joined up at the beginning of the war, and saw service in Gallipoli, Mesopotamia, and afterwards in France, where he gained the Military Medal.

The clerical staff of the St. Helens Cable and Rubber Co., Warrington, held a whist drive and social last week. Miss L. Evans, welfare superintendent at the works, distributed the prizes.

Trade Announcements.—MR. T. W. F. DAY, electrician, of 10, Union Street, Dewsbury, is resuming business on his discharge from the R.E.

MR. E. W. CLARKE, electrician, having been released from the Forces, has resumed business at 33, Shakespeare Street, Stratford-on-Avon.

MESSRS. A. H. TURNER & CO., electrical engineers and contractors, have commenced business at 29, Mackenzie Street, Slough.

Non-Ferrous Metal Industry Act.—The issue of the *London Gazette* for January 24th contains further additions to the list of licences under the Act.

Definition of the "End of the War."—A White Paper, issued on Saturday, contains the first and second reports of the Select Committee appointed to consider the report of Mr. Justice Atkin's Committee with regard to the provision to be made by Parliament for defining the meaning of the phrase, "End of the War," and other similar phrases used in the war emergency statutes, and for extending or shortening the period of operation of the several emergency statutes and regulations.

With regard to the first part of the terms of reference, the Committee recommend that legislation should be introduced to declare that the date of the ratification of the Peace Treaty should be the date referred to in those phrases.

On the question of extending or shortening the period of operation of the many emergency statutes, the Committee think that a new Select Committee should be set up immediately to continue the inquiry, which it has been impossible to complete.—*The Times.*

A Banker on Industrial and Trade Questions.—Speaking at the annual meeting of Barclay's Bank, Mr. F. C. Goodenough, the chairman, said that they had ample funds to meet the requirements of manufacturers and traders as soon as they could get to work and produce the goods for which the world was waiting, and so by the profits of industry make good the wastage of the war. Prompt return to peace production, with a far greater output, and an extension of foreign trade were the vital necessities of the moment. For this they must create conditions favourable to an increased output coincident with a reduced cost of production, and we must by energy and commercial insight and ability develop existing, and create new, markets.

Whatever might he the changes to be brought about by the war—and there must be many—we still must recollect that this country did not produce all that it required for the maintenance of the population, but must buy from abroad, and although through the war the component parts of the British Empire had been drawn together more closely, and there was a growing tendency to consolidation and to mutual support for purposes of exchange of raw materials and of production, as well as for the financial handling of industry and trade, still Great Britain remained the centre, and bore the greatest proportion of the burden of the debt arising out of the war. "Our export trade, both foreign and colonial, is, therefore, and will always be, a vital necessity, so that we may purchase all that we are unable to produce ourselves, and especially raw materials. We must also have such profits from our industry and trade so that, besides buying what we require, we may have a margin for ourselves, and profits will provide, through taxation, the interest and Sinking Fund on our National Debt. It is in order to organise the resources of the country for cheap production and facilities for trade so as to reduce costs without reduction of real wages or of profits that the combinations in industrial and financial institutions are now taking place. Apart from the profits of the soil, the profits which more than any other benefit the community as a whole are derived from foreign trade. Although we may individually grow richer or poorer through our internal or domestic transactions, or by shifting the burden of debt from one to another according to his or her ability to pay, the balance of the external indebtedness of the community as a whole can only be reduced by profitable sales in foreign markets."

Mr. Goodenough continued: "It is also essential that conditions both as regards cost of production and labour should be such as to enable profit to be made, because if wages reach the point where they eat up all profits the funds available for direct taxation on its present basis will disappear, and with it the trade on which the profits are earned, and, in consequence, the livelihood of the people employed in that trade. In other words, production will be prejudiced, and it cannot be too strongly emphasised that the greater the volume of production, the larger will be the proportion of actual commodities which will fall to each individual. On the other hand, any reduction in production, whether caused by inability to sell profitably or by the wilful limitation of output, affects alike the poor and the rich, the employer and the employé. The problem is, therefore, one which the wage-earner should study and understand. He should endeavour to realise the fundamental fact that as a nation we can only consume to the value of what we produce, and if production falls away then there will be less to go round, with the consequence that each individual will not only live on a lower scale, but he will have to pay more for the things that he does obtain. Profits are, therefore, essential, for, apart from the important considerations mentioned, they afford the basis of direct taxation, and it is only by maintaining profits at a reasonable level that the wage-earner can be largely exempt. In the matter of production the banks can help, without necessarily following the German plan, of which we have heard a great deal—that is to say, of investing the money lodged with them in the capital undertakings of industry, so that the whole of that country's resources were locked up. Both Germany and Austria were overtrading, and neither therefore had reserves to enable them to tide over bad times, or to give them staying power. But, with ever-increasing expenses and higher cost of living and taxation, their insatiable greed and unbridled ambition induced them continually to expand their industry, and ultimately to attempt further expansion by force."

To Restrict Imports.—A deputation consisting of Mr. G. Terrell, M.P., president of the National Union of Manufacturers, Mr. Bremner, of the British Engineers' Association, and others, waited upon Sir Albert Stanley, the President of the Board of Trade, recently to urge that the restrictions on the importation of goods of foreign manufacture should be immediately re-imposed and strictly enforced, Press reports state that Sir Albert pledged himself that the restrictions which had been lifted for three months should be re-imposed at the expiration of that period, and that the manufacturers of the country should be consulted before further removals of restrictions were ordered.

Strike.—According to the *Manchester Daily Dispatch*, a strike recently arose at the Prescot works of the British Insulated and Helsby Cables, Ltd., the point of difference being whether the night-shift men should be paid at time-and-a-quarter, as demanded, or time-and-a-fifth, as the employers had conceded. About 2,500 men were affected.

An Exhibition at Glasgow.—It is proposed to hold an Exhibition in Glasgow, under the auspices of the Corporation, for engineering, including electrical and shipbuilding. A Committee has been appointed.

New Swedish Company.—Among the new companies recently formed to establish electric lighting and power installations in Sweden are the Yttersbafors Elektriska Aktiebolag, formed at Stannur, with a maximum capital of £25,000, and the Hedesunde Elektriska Aktiebolag, Hedesuude, maximum capital, £8,500.

Book Notices.—"B.E.A.M.A. *Journal.*" Vol. V. No. 1. January, 1919. London: Oakley House, Bloomsbury Street, W.C. Price 1s. net.

"The Central," the journal of the old students of the City and Guilds (Engineering) College. Vol. XV. No. 44. December, 1918. London: The College. Price 2s. 6d.

"Annales des Postes, Télégraphes, et Téléphones." December, 1918. Paris: A. Dumas. Price 14 fr.

American Foreign Trade Plans.—According to a U.S. wireless dispatch from New York, published in the *Evening News*, Secretary of Labour William B. Wilson says that the U.S. Government has already made provision for the country's foreign trade through the establishment of commercial attachés abroad and of branches of the Federal reserve bank for foreign countries, and the starting of a shipping programme of sufficient magnitude to take care of the foreign trade.

Catalogues and Lists.—The British Ever-Ready Co., Ltd., Hercules Place, Holloway, London, N. 7.—1919 catalogue (24 pages), containing full particulars, with illustrations and prices, of a great variety of their electrical specialities—battery pocket lamps, scout and inspection lamps, torches, signalling and hand lamps, bicycle lamps, electric lanterns, electric gas lighters, motor-car accessories, and so forth.

Mr. F. J. Hastings, 59, Islington Row, Birmingham. Priced leaflet showing the "Oxford" scissors arc lamp.

Fire.—With reference to the note in our last issue respecting the fire at the works of the Siluminite Insulator Co., Ltd., it should be stated that this was due to a cause outside the building. Though the flames reached to a great height, the employés behaved most gallantly, and prevented disastrous consequences. The whole of the stock of Siluminite, which was right in contact with the fire, was saved.

LIGHTING AND POWER NOTES.

Aberdeen.—Extensions and National Supply.—The Electricity Committee has recommended the T.C. to consult Mr. J. H. Rider as to whether the extensions in progress and contemplated in connection with the electricity undertaking are upon the best lines, in view of the local conditions and the proposed centralisation of electricity supply.

Proposed Loan.—The Electricity Committee has recommended the T.C. to apply to the Secretary for Scotland for consent to a loan of £100,000, for extensions in connection with the electricity undertaking.

Battle.—Proposed E.L.—The Council has decided to consider an E.L. scheme for the town, which has been proposed by Mr. J. A. Tasker, of Park Gate, Battle.

Beccles.—Proposed E.L.—The T.C. has appointed a Committee to consider an E.L. scheme for the town.

Belfast.—Strike.—The members of the Shipbuilding and Engineering Federation in Belfast struck work on Sunday last, and as the employés of the municipal electricity, gas and tramway departments are members of the Federation, the whole of the lighting and tramway services came to an end. The Federation had been agitating for a shorter working week, and the employers offered a 47-hour week. This was not acceptable to the men, who demanded a 44-hour week within 10 days, and as this demand had not been granted when this period expired last Sunday, the men struck work at noon. At the meeting of the Strike Committee, letters from the employers asking for further time to consider the matter was read and passed over without discussion. Besides causing great inconvenience owing to the lack of any lighting, the absence of gas and electricity for power purposes in the mills and factories resulted in thousands of workers in other trades becoming idle. The strikers agreed to a supply of electricity being given to local hospitals, but this ceased at 9 a.m. on Monday. In the afternoon a joint meeting of the Electricity, Gas and Tramways Committees received a deputation of the strikers, and it was arranged for the supply to hospitals to be resumed that night, on condition that no public or private consumers were supplied, in which event the men threatened to cut the mains. Owing to the fact that most of the bakeries use gas or electric power, something like a bread famine was experienced.

On Tuesday the Lord Mayor issued a statement to the effect that there were no differences whatever between the Corporation and its employes. who struck purely in sympathy with other industries in order to force the hands of the employers. The Municipal Employés' Association instructed its members to return to work, and the Lord Mayor assured them of adequate protection if they did so.

Bexhill.—Price Increase.—The T.C. has increased the price of electricity to a flat rate of 6d. per unit, plus 25 per cent.

Bury.—Proposed Extensions. The Electricity Committee has under consideration the question of extensions at Chamber Hall power station. and has applied to the L.G.B. for the necessary borrowing powers.

Canada.—Niagara Power Merger.—The Niagara Falls Power Co., the Cliff Distributing Co., and the Hydraulic Power Co. of Niagara Falls. have been consolidated into a new corporation under the name of the Niagara Falls Power Co., thus creating the largest electric power company in the world in the point of output. Including its subsidiary, the Canadian Niagara Power Co., the company has an installed capacity of about 370.000 h.p., and is installing an additional 100,000 h.p., to be ready for operation during 1919. It is proposed to replace one of its present 100.000-h.p. plant with a new 200,000-h.p. plant.—*Electrical News.*

Continental.—Germany.—The *Handelsblad* states that matters have now reached such a pitch at Berlin, owing to the coal strikes and the attempts to Socialise the mines, that householders may henceforth use no gas between 8.30 p.m. and 11 a.m., and between 2 and 5.30 p.m. Street lighting must he reduced to 20 per cent., while restaurants, theatres, &c., may only use 50 per cent. of the electricity required in December, 1918. *Vorwäerts* learns from official quarters that the coal scarcity is so acute that, within a few days, not only will the main electric generating stations have to close down, but also all other trades requiring coal.

Strike.—The electrical workers at Berlin, who struck on Tuesday last week, resumed work on Wednesday. For one day the whole of the electricity supply of the city was suspended. Factories ceased work, and tramcars were stranded in the streets.

Owing to the strikes in Upper Silesia, Leipszig is without electricity or gas.

Italy.—Concessions have been granted for the construction of two artificial lakes in the Valley of Vogna and one in the Valley of Sesia, and their utilisation in connection with three waterfalls, so that the total plant will furnish 35,000 h.p. at Vogna, Riva Valdobbia, and Bulmuccia.

Norway.—Water Power.—From reports which have recently appeared in Stockholm. it appears that during late years the demand for electric power in Norway has increased so enormously, not only in the cities, but also in the country districts, that the water power now developed is not nearly sufficient. The shortage has been felt especially in the eastern and southern part of the country, and in the smaller counties. The delivery of 150,000 h.p. to the eastern part from the Tysso Falls, in the Hardanger district, will, however, ease the situation in this district. There seems to be good prospects of finishing the trunk line, *viâ* Seljestad and Kongsberg, to Christiania and other districts this year, commencing with 30,000 h.p. and increasing to 150.000 h.p. The promise of high Government officials has been obtained to supply a quantity of cable, of which there is a great shortage in Norway. When all the works at Tysso Falls are ready, say in three or four years, it will be possible to supply the trunk line with 275,000 h.p. When all working expenses, interest, amortisation, and taxes have been paid, the cost of production will be about 1 cent. per unit. delivered at Christiania. It is expected that the trunk line can be snpplied with 4,000,000 to 5,000,000 h.p. in the near future. In the inner Hardanger and Telemarken districts alone 1.500,000 h.p. are available near the trunk line, which may be directed toward the east and south.

The manager of the Christiania Electrical Works has been working on a plan with regard to power lines for the city. The first step was taken in January, 1916. when the municipality bought Holsvarsvattnet, estimated to deliver 100,000 h.p. The next step was the purchase. in December, 1917, of a series of waterfalls in the Hallingsdals River, giving 40,000 h.p. The purchase of Aurland Falls, in the western country, for $1,340,000, some months ago, was the last step in this plan. These falls are estimated to supply 300,000 to 400,000 h.p. The trunk line from the Aurland Falls to Christiania will be about 180 miles long.

Akershns County Council, last year. decided to exploit the Raanaas Falls, in the Glommen district, and the work is progressing. The falls will produce about 64.000 h.p. The expenses are estimated at $5,000,000. The work is expected to be finished in about four years. and only Norwegian labour is to be employed.

Canada has already been keenly investigating the Norwegian market for machinery supplies. It is obvious that there will be a big demand for cable, too. It was only in May, last year, that the first Norwegian cable factory was completed, near Christiania. All kinds of wire and cable, as well as transformers, are to be made.

Eccles.—Inquiry.—We regret that the note which appeared under this heading in our last issue was based upon incorrect information. No inquiry with regard to the electricity works is contemplated.

Edinburgh.—Strike.—Men in the electrical engineering trade went on strike on Monday, in defiance, it is stated on behalf of the employers, of an agreement arrived at last week, when it was agreed to introduce a 47-hour week. After Monday the men are understood to be striking for a 40-hour week.

Ennis (Co. Clare).—Proposed E.L.—Next month the U.D.C. is to consider an E.L. scheme for the town.

Lancashire and Cheshire.—Linking-up.—Mr. J. A. Robertson, electrical engineer to the Salford Corporation, who acted as hon. secretary to the Committee appointed to draw up a scheme for the inter-connection of the Lancashire and Cheshire electricity supply systems, states that the opposition of certain of the smaller municipal undertakings prevented the adoption of the scheme, which would have brought about a centralised system, and, besides saving an immense sum per annum in coal and labour, would have enabled the municipal authorities to meet the growing demand for power for industrial works. Had the scheme been adopted, it would have obviated the necessity for Goverument action so far as Lancashire and Cheshire are concerned.

London.—Strike.—Electricians and other tradesmen downed tools on Monday at Poplar and Millwall, in sympathy with the Port of London ship repairers who are on strike.

New Zealand.—Water Power.—A movement, supported by practically the whole of the governing bodies of Otago, is being organised to urge upou the Government the necessity for deciding upon a hydro-electric power scheme for the industrial and agricultural advancement of Otago.—*B. of T. Journal.*

Oldham.—Fuel Economy.—The B. of T. (Coal Mines Department) has congratulated the Corporation upon the fact that during the six months ended September 30th last the coal consumption per unit at the Greenhill generating station was 2·66 lb., compared with 2·71 lb. for the previous year, and about 6 lb. five years ago.

Portsmouth.—Threatened Strike.—Since August last the employés at the Corporation electricity department have been asking for a war bonus (28s. 6d. per week), but without success. On Friday, last week, they threatened that if their demand was not granted they would cease work that day. On receipt of this ultimatum the Mayor had a consultation with the chairman of the E.L. Committee, as a result of which the men were informed that their demands would be complied with.

Rotherham.—Year's Working.—The total revenue of the Corporation Electricity Department for the year ended March 31st, 1918, was £78,013, compared with £49,069 in the preceding year, while the working and management expenses amounted to £58,311, against £33,198. The average price received per unit sold was ·863d., against ·901d. ; the total cost per unit was ·651d., against ·615d., and included generation costs, ·528d., against ·452d. ; distribution, ·042d., against ·038d. ; rents, &c., ·025d., against ·074d. ; management expenses, ·044d., against ·045d. ; and special charges, ·012d., against ·006d. ; 25,457,619 units were generated during the year, against 15,612,275, and 21,490,165 were sold, against 12,949,211, including 477,561, against 482,987, for lighting, 18,575,854, against 10.176,124, for power, and 2,436,750, against 2,290,100, for traction ; 2,739,096, against 1,036,444, were used on the works, and 1,228,358, against 1,626,620, were unaccounted for. The number of consumers increased from 900 to 949, and the maximum demand from 6,000 kw. to 7,000. Of the gross profit of £19,702, debt redemption absorbed £6,426. and interest £7,714, leaving a net balance of £5,562, against £5,324 in the previous year. The renewals fund now amounts to £8,455. The total capital expenditure was £388,511.

Stirling.—Proposed Bulk Supply.—With reference to the application of the T.C. to the Scottish Central E.P. Co. for terms for a hulk supply of electricity, the company has offered to supply and install in the Council's existing power station the transformers and switchgear necessary for the conversion of the supply, in exchange for the boilers, generstors, and other plant at present in the station, with the exception of the main switchboard. The charge for energy would be £4 per kw. per annum, plus 6d. per unit consumed, plus ·015d. per unit for every 6d. increase in the price of coal over 10s. per ton. The proposal was remitted to the Council's consulting engineer (Mr. J. A. Robertson, of Salford), who reported that he did not think the Council should entertain the offer, as the rates proposed were 14 per cent. higher than the cost of generating at the Council's own works, and there was also the possibility of a central authority being established at an early date to operate all the generating stations in the district. The Council refused the offer, and the Lighting Committee is to consider the installation of condensing plant and the reduction of the costs in connection with the undertaking.

Taunton.—Proposed Price Increase.—As it is estimated that there will be a deficiency of about £2,000 on the present year's working of the electricity department, the E L. Committee recommends that the price of energy be increased before March 31st next.

Truro.—Proposed E.L.—The T.C. is considering the question of applying for an E.L. prov. order, and has been recommended to purchase electricity in bulk from the Cornwall E.P. Co.

Uruguay.—State Electric Enterprises.—The Government is extending its functions as owner and manager of electric plant for traction, power, and lighting purposes. For some time the State Electric Power Administration has controlled and operated the electric plant at Monte Video, Colonia, Canelones, Maldonado and Pando ; and the plant at Mercedes (valued at £20,000) is amongst the Government's latest acquisitions.

Wexford.—Proposed E.L.—The Corporation has decided to engage an expert to advise it in connection with an E.L. scheme.

TRAMWAY AND RAILWAY NOTES.

Australia.—Strikers Fined.—For participation in the recent strike, the Perth Tramway Union has been fined £25, and several tramway Unionists £5 each.—*The Times*.

Belfast.—The Corporation tramway men, who have been forced to cease work, owing to the failure of the electricity supply, due to the general strike, and who claimed their wages on the grounds that they were not on strike but locked out, have been given a week's notice to end their services.

Continental.—France.—Owing to the refusal of their demands for better conditions and increased pay. the employés of the Nord-Sud and Metropolitan Railways. and the tramway and omnibus services in Paris, struck work on January 24th. The demands comprised a guarantee of regular employment, an eight-hour day, increased wages of 1s. 8d. per day from January 1st, the restoration of the bonus of 2s. 6d. per day withdrawn in July last, a minimum pension of £80 per annum after 20 years' service. and an annual holliday of three weeks. The control of the profits of the undertakings, and the adoption by the Senate of the Pension Bill for light railway workers, were also demanded. On Saturday. in order to maintain the transport services, the Government decided to take over the lines affected, and urged the employers and strikers to enter into negotiations for a prompt settlement. The men were also informed that all provisionally demobilised men who did not resume work would be recalled forthwith. On the understanding that negotiations would be entered into with regard to their grievances, the men decided to resume work, and normal services were running on Sunday morning.

The arrest of the secretary of the men's Trade Union has called forth protests among the militants. The *Matin* says that other arrests are imminent.

Spain.—Proposed Electric Railway.—The Minister of Public Works is introducing in the Senate a Bill for the construction by the State of a direct electric railway from the French frontier to Algeciras.—*Financial Times*.

Application has been made by Messrs. Luis Rodriquez & J. Cassi for a concession for an electric tramway from Oiviedo to Pasala de Llanera.

Plans have been prepared for an electric tramway, 9,830 metres in length, from the Paerta del Duque. Saragossa. to the canal at Casablanca. Three 20-h.p. cars will be used, and the carriage of goods is an important element of the undertaking.

The International Commission for the building of the Trans-Pyrennean Railway. composed of French and Spanish delegates, has decided that the portion of the line through the Somport Tunnel, about seven kilometres in length, shall be electrically equipped. Energy will be supplied by the Compagnie du Midi.

Italy.—The Società delle Ferrovie Nord-Milano has decided to electrify the whole of its network. Government sanction has already been obtained for the conversion of the Milan circular railway, but the work on the Milano-Varese-Como and the Saveso-St. Pietro-Camuago lines is dependent on negotiations with the Government anent the modifications of the terms of the concession as to the date of redemption.

Coventry.—Tramway Renewals.—The city tramways are to be reconstructed, at an estimated cost of £333,616.

Dewsbury.—Extensions.—Proposals which received the L.G.B. sanction before the war for the extension of the tramway system to the Dewsbury boundary at Shaw Cross, and for lines through the Market Place, are shortly to be put into execution.

Egypt.—Owing to continuous rains. Cairo and the surrounding districts have been flooded. Tramway and other traffic was interrupted for some time, and electric light and telephones have also been interfered with.—*The Times*.

Haslingden.—Electric Vehicles.—The T.C. has appointed a Sub-Committee to inquire regarding petrol and electric vehicles, for a proposed service from Helmshore to Haslingden.

Huddersfield.—Extensions.—The Corporation has assured the Brighouse Corporation that at the earliest opportunity the projected extension of through tramways to Brighouse, *via* Rastrick, will be put in hand, steps having already been taken to further this object.

Lancashire.—Proposed Light Railways.—The Light Railway Commissioners have authorised the construction of light railways in Little Crosby, Ince Blundell, Altcar, and Formby.

London.—Traffic Congestion.—At the L.C.C. meeting, last week, the chairman of the Highways Committee said that the Committee recognised that the present tramway services were insufficient, but, owing to the increase of traffic, the absence of a large proportion of the staff on national service, and the depreciation of material, it was impossible to maintain adequate services. The employés were now being demobilised, and materials were being pressed for. The Committee was willing to spend any amount of money to restore the pre-war efficiency, and was framing estimates for a tremendous work of renewal.

The traffic superintendent of the District Railway informed a Press representative that the queue system instituted on some platforms had proved a great success, and was to be extended. The escalators were also very successful, and at some stations were used by as many as 1,500 persons per hour. A new signalling system is now being installed, which will facilitate the running of the trains.

Delays on the District Railway, early on Monday morning, were caused by a film of ice on the conductor rails in the exposed parts of the system.

Failure of Signals.—Owing to the failure of the signals between Lambeth North and the Elephant and Castle Stations, the south-bound trains on the Bakerloo Railway were held up for half an hour on Saturday.

Morecambe.—New Cars.—The T.C. has decided to purchase two "toast-rack" tramcars and two mechanically-driven 'buses.

Railway Men's Working Hours.—A conference of the N.U.R., held in London on Saturday last, issued a statement to the effect that a serious view was taken of the apathy of the Prime Minister to the national programme submitted by the Union, and if a strike on the whole of the railways on February 9th was to be avoided a Committee should be appointed immediately to negotiate with the men's Committee.

Stalybridge.—Year's Working.—The estimated loss on the tramway section of the Stalybridge, Hyde, Mossley, and Dukinfield Joint Tramways and Electricity Board last year was £4,000, and it has been decided to issue a precept for £1,000 upon each of the four constituent Corporations.

Stirling.—The T.C. has decided to obtain expert advice on the position of the tramway undertaking.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Exchanges.—The telephone service again came up for discussion at the Leeds Chamber of Commerce meeting last week, and it was resolved to advocate the installation of the automatic system throughout the whole of the Leeds area.

Cable Delays.—With regard to the prolonged telegraphic delay with England, the *Handelsblad* learns that five of the twelve cable wires are defective. In order to reduce delays, telegrams are sent to England by every mail boat. Belgian telegrams for England are sent *via* Holland owing to the defective condition of the cable between Ostend and England.—*The Times*.

France.—In order to relieve the pressure on the ordinary telegraph system between Paris and Brussels, the French Ministry of Posts and Telegraphs has inaugurated a wireless system between the two cities.

Future of War 'Phones.—Thousands of miles of telephone wires were taken across country during the war for the purpose of connecting with existing stations all the new camps, aerodromes, training schools, and factories. For the defence of London and other centres, farms and positions of strategical value were linked up in the same manner. The future of these telephone lines has not yet been finally determined, but it is highly probable, the *Daily News* is informed, that those that are not wanted for Army purposes and are considered useful by the Post Office will be retained for public use.

Mexico.—A new wireless station has been erected at Lobos Island, near Tampico, to enable the petroleum companies to correspond with ships at great distances.

Morocco.—Tenders were called for in November last for the construction of a telephone network in Spanish Morocco, the plans contemplating the service of 100 subscribers, 600 lines, and a total outlay of 39,354 pesetas. The result of the competition has not yet transpired.

Multiplex Telephony.—The new multiplex system makes use of alternating currents whose frequencies occupy a range between the frequencies of the ordinary telephone currents, which are those of the human voice, and the lowest frequencies which are used in wireless communication. This frequency range has not heretofore been commercially used. Each additional circuit in the new system makes use of some frequency within this range. At the sending end of each circuit the ordinary telephone currents are made to modulate this "carrier" frequency, so that the current sent out on the line varies with the amplitude of the ordinary telephone currents. At the receiving end the carrier current is put into a demodulating circuit, which then gives out the original telephone current. The different circuits are kept separate at each end by inserting in each circuit a combination of impedances which make up an electrical "filter." This transmits only the range of frequencies peculiar to that circuit. In wireless working it is sufficient to send and receive in "tuned" circuits. In the multiplex system, however, tuned circuits would not be sufficient since each telephone channel occupies a range of frequencies of about 2,500 cycles, and any circuit tuned to these comparatively low frequencies would be too selective to receive such a range in the proper manner. Vacuum tubes are used in the modulating and demodulating circuits, and are also used as amplifiers in the transmitting and receiving branches, and at intermediate points along the line where necessary, to prevent the currents from becoming too highly attenuated.—*Electrical World*.

Snowstorm.—The snowfall on Monday last brought down the telephone and telegraph wires at Hitchin, Woking, Manchester, and in Northamptonshire.

Uruguay.—A new underground telephone system is planned for Monte Video, and an invitation has been issued to any firms desirous of studying a suitable system.

Wireless Board.—In the January Navy List are given details of the membership of the new Wireless Telegraph Board under Capt. J. A. Slee, R.N. The Board consists of three naval members, two military members, and two Air Force members.

Wireless Telephony.—The *Daily Mail* states that aeroplanes now carrying Peace-Conference delegates and documents between London and Paris are to be fitted with wireless telephone apparatus. An American engineer from the Western Electric Co. recently visited England to investigate the wireless telephones of the Royal Air Force, and to make comparative tests with American instruments. He declared that the British wireless telephones are far in advance of those in use in the American Air Force. Pilots can speak to their ground commanders and to one another at a distance of 15 miles, and the only difficulty in communicating between machines or with the ground at greater distances is the consideration of the weight of larger instruments. Between airships, for instance, it is possible to carry on conversation at a distance of 50 miles.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney. A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

May 19th. Municipal Council. Boiler-house equipment. Specifications on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen's Gate, S.W. See "Official Notices" to-day.

Melbourne.—March 4th. Deputy Postmaster-General. Cables (schedule No. 1,504). A copy of the specification may be seen at the Inquiry Office, Department of Overseas Trade (Development and Intelligence).

March 10th. City Council. One 5,000-KW. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

Belfast.—February 6th. Midland Railway Co. (Ireland). Northern Counties Committee. Electric lamps, carbons, batteries, telegraph wire, &c., for 6 or 12 months. Mr. Ellis, Stores Superintendent, York Road Station, Belfast (Form 27, price 6d.).

February 15th. Tramways Committee. Tramway stores (including several electrical items). See "Official Notices" to-day.

February 24th. Electricity Department. Electric and hand cranes, pumps and tanks. See "Official Notices" January 17th.

Belgium.—February 14th. The municipal authorities of Herstal, near Liege, are inviting projects until February 14th, for a system of electricity distribution in the town.

Glasgow.—A.C., 1,500-KW., 50 periods, three-phase, 3,000-volt generating plant, boilers, engines, switchgear, &c. Specifications from Mr. W. D. Robertson, M.I.M.E., Glasgow. For further particulars see "Official Notices" January 24th.

Liverpool.—February 3rd. Tramways Committee. 50 electric tramcars. Mr. C. W. Mallins, General Manager, 24, Hatton Garden, Liverpool.

London.—St. Pancras.—February 12th. B.C. Two steel-cased water-tube boilers, superheaters, economisers, stokers, fans, &c. See "Official Notices" to-day.

Manchester.—February 11th. Tramways Committee. (*a*) Tramcar motors. (*b*) Tramcar trucks. J. M. M'Elroy, General Manager, 55, Piccadilly, Manchester.

New Ross (Co. Wexford).—February 20th. Gas and Electricity Supply Co., Ltd. Suction gas plant and dynamos, storage battery, main switchboard, overhead lines and street lamps. See "Official Notices" January 24th.

Stretford.—February 8th. Electricity and Tramways Committee. Electricity converter station at Old Trafford. Specification, &c., from Mr. E. Worrall, Surveyor, Council Offices, Old Trafford.

Tuamgraney, Scariff (Co. Clare).—February 15th. Messrs. Lysaghts. One hydraulic turbine, dynamo, and pipe line, electric motors and wiring. Specifications from Mr. L. J. Lawless, Rathmines, Dublin. See "Official Notices" to-day.

CLOSED.

Willesden.—U.D.C. Charging plant and equipment, £651. General Electric Co., Ltd.

FORTHCOMING EVENTS.

London Association of Foremen Engineers.—Saturday, February 1st. At 7 p.m. At Cannon Street Hotel. Paper on "Employers and Employed," by Mr. H. B. Graham.

Society of Engineers.—Monday, February 3rd. At 5.30 p.m. At Burlington House, Piccadilly, W. Presentation of premiums by Mr. W. B. Esson, and Presidential address by Mr. W. Noble Twelvetrees.

Junior Institution of Engineers (N.E. Section).—Tuesday, February 4th. At 7.15 p.m. At the Mining Institute, Newcastle. Paper on "The Construction of Large Transformers."

Roentgen Society.—Tuesday, February 4th. At 8.15 p.m. At the Royal Society of Arts, John Street, W.C. Paper on "Protection in Diagnostic Work: A Consideration of the Effects of Scattered Rays and Secondary Rays," by Mr. F. Hernaman-Johnson.

Royal Institution of Great Britain.—Tuesday, February 4th. At 3 p.m. At Albemarle Street. Lecture on "Electric Arcs and their Applications," by Prof. J. T. MacGregor-Morris.

Industrial Reconstruction Council.—Wednesday, February 5th. At 4.30 p.m. At Saddler's Hall, Cheapside, E.C. Lecture on "The Industrial Awakening," by Mr. E. J. P. Benn.

Liverpool Engineering Society.—Wednesday, February 5th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Electric and Oxy-Acetylene Welding and their Defects," by Mr. E. A. Atkins.

Chemical Society.—Thursday, February 6th. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary meeting.

Belfast Association of Engineers.—Thursday, February 6th. At 7.45 p.m. At the Municipal Technical Institute. Paper on "Ship Riveting," by Mr. A. J. Lewis.

Greenock Association of Electrical Engineers.—Thursday, February 6th. At 22, West Stewart Street. Paper, "Some Notes on the Cabling of Public Works," by Mr. W. R. Scott.

Institution of Electrical Engineers (Students' Section).—Friday, February 7th. At the City and Guilds Technical College, Finsbury, E.C. Lecture, with experimental demonstrations, on "Oscillatory Electric Discharges"; also an Exhibition of Ancient and Modern Illuminants, by Mr. R. P. Howgrave-Graham.

Manchester Association of Engineers.—Saturday, February 8th. At 6.30 p.m. At the Grand Hotel. Paper on "Principles of Jig and Tool Design," by Mr. G. H. Hey.

Birmingham and District Electric Club.—Saturday, February 8th. At 7 p.m. At the Grand Hotel. Paper on "Signalling," by Capt. F. H. Woodrow, R.E.

OUR HALF-YEARLY INDEX.

The Index to Vol. 83 of the Electrical Review, which has now been printed, will be supplied for 3d., post free, to those who, through the post, specially apply for it. Applications should be addressed to the Publisher, Electrical Review, Ltd., 4, Ludgate Hill, London, E.C. 4.

NOTES.

National Electricity Supply.—At the quarterly meeting of the Association of Chambers of Commerce, held in London, four resolutions were on the agenda, tabled by Nottingham, Barnstaple, Walsall, and Leith, with regard to the importance of effective Parliamentary legislation to secure cheap electricity supply. The meeting considered the Leith resolution only. This stated that legislation should at the earliest moment be enacted to put into effect the recommendations of the Electric Power Supply Committee, and that, with a view to economical production and distribution, a new central authority should be appointed to regulate the generation and distribution of electricity throughout Great Britain and Ireland. Mr. Atkey, M.P. (Nottingham), said they desired to give the politicians a push; also that the best brains should draft the Bill—it should not be left to the lawyers. Mr. Russel (London) complained that the B. of T. report seemed to support nationalisation to a too great extent. Sir John Maclaren (Leeds) said the recommendations of the E.P. Committee were in the main admirable. From a technical point of view the report was excellent, but not so from a commercial point of view. It would be necessary in some way to co-ordinate the two views. In Yorkshire there were a large number of electrical undertakings which would be vitally affected, and steps should be taken to conserve the interests of local companies where the services were good. Mr. Hobson (Sheffield) said that to carry out the scheme they must have legislation far more drastic than had ever been thought of before in regard to landowners' rights to wayleaves. Mr. Shaw (Newcastle) opposed any nationalisation.

Patent Law Amendment.—We have received from the secretary of the Institution of Mechanical Engineers a copy of the Memorandum on Patent Law Amendment, based upon a report prepared by the Institution of Electrical Engineers, and adopted by the Conference of Technical Institutions on this subject. Twenty-six technical institutions and societies were represented at the Conference, which met under the chairmanship of Mr. Michael Longridge, President of the Institution of Mechanical Engineers. A Committee was formed, with Mr. M. Atkinson Adam as chairman, to formulate recommendations and to arrange for a deputation to the Board of Trade, and the Memorandum formed the basis of the remarks of the speakers when the deputation was received, on October 10th, by the Right Hon. G. J. Wardle, M.P., Parliamentary Secretary to the Board of Trade. An abstract of the Memorandum was published in our issues of November 22nd and 29th, 1918.

£60,000 for Engineering Research.—Ambrose Swasey, of Cleveland, Ohio, has just given the Engineering Foundation an additional £20,000 as an endowment for engineering research. In 1915 he gave £40,000 for the same purpose, so that his entire gifts are now £60,000. Mr. Swasey's original gift made possible the establishment of Engineering Foundation by the United Engineering Society, representing the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Mr. Swasey's donations have been inspired by his conviction of the necessity for research in engineering sciences in connection with the war, and in keeping the United States in the forefront of the nations in industrial development in the new peace era.

The Pacific Cable.—A Treasury White Paper issued last week deals with the accounts of the Pacific Cable Board. In its financial aspect alone the report is interesting as showing the magnitude of the work of the board. The receipts for the year amounted to £411,061, this sum exceeding the expenditure by £112,088. The excess of receipts over expenditure was greater by £21,162 than that of the previous year. The net traffic receipts, £401,974, exceeded those of 1916-17 by £65,818, this being due to the larger amount of full-rate and Government traffic. The expenditure, excluding special appropriations, shows an increase of £16,125 over that of the preceding year, and £27,262 over the original estimate. This increase was due mainly to the greater cost and consumption of stores, and to heavier staff charges consequent upon the higher rate of war allowance and increased overtime charges. During the year over 7,500,000 paying words of international traffic were handled, and nearly 600,000 words of messages in relation to wounded members of the expeditionary forces were transmitted free. In addition 1,729,000 paying words were carried between Australia and New Zealand, and between Australasia and the Pacific Islands. The quantity of paying words of international traffic was less by 1,250,000 than that transmitted during the previous year (when the record total of nearly 9,000,000 words was established). This reduction was due to the enforced curtailment of cheap classes of traffic owing to connecting companies being unable to accept them. Cables continue to be heavily pressed with war traffic, and it is feared that no opportunity of reinstating the week-end and deferred Press telegrams will occur until the return to normal conditions. It is hoped, however, that the reinstatement of deferred ordinary may be possible in the near future.

During the year two interruptions occurred; the first in November, 1917, when the cable between Norfolk Island and Doubtless Bay was interrupted from the 20th to the 25th; the second was on the Suva-Norfolk Island cable, which developed a bad fault on March 18th, 1918. Total interruption did not occur until the cable ship cut in for repair on March 30th, and normal communication was restored on April 1st. Neither stoppage resulted in any appreciable loss of traffic. The injury in both cases was due to rock chafe and corrosion. Other cables worked without interruption, and continue in excellent condition. The landline across Canada from Montreal which the board leases from the C.P. Railway Co., suffered few interruptions of more than minor importance. The Melbourne-Sydney landline, which is allocated for the board's traffic, has continued satisfactorily. The new auxiliary schooner *Tangaroa* was completed and handed over by her builders at Sydney in November, 1917; she will make regular voyages between Fanning and Honolulu at bi-monthly intervals. The steamer *Iris* remains in first-class condition, and in addition to the two cable repairs referred to above, she carried out repairs in October, 1917, to the Cook Straits cables under charter to the New Zealand Posts and Telegraphs department. It is noteworthy that she completed the repair of the Norfolk Island-Auckland cable in less than 5½ days from the time of interruption. The vessel had to be put into commission and provisioned, a crew collected, and a distance covered exceeding 500 miles to the cable ground. In addition to cable operations, the *Iris* was placed in commission on two occasions, first for her cruise to Fiji and Fanning Island from July 11th to August 21st, 1917, and second in December, 1917, when she was requisitioned by the New Zealand Department of Defence to conduct a search for a party of German prisoners of war who escaped from internment at Auckland Harbour. They were recaptured at Curtis Island in the Kermadec group.

Volunteer Notes.—ROYAL ENGINEERS VOLUNTEERS, LONDON ARMY TROOPS COMPANIES.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 5, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Wednesday, February 5th.—Drill and Engineering Instruction for the whole Corps at 1830.

Friday, February 7th.—Range, 1830.

C. HIGGINS, Captain, R.E., *Adjutant.*

Electrical Engineers' War Memorial.—A Committee of the Institution of Electrical Engineers, of which Mr. C. H. Wordingham, C.B.E., is chairman, has issued a circular to the members, stating that "upwards of 130 members of the Institution of Electrical Engineers have fallen in the war, and many others are broken and disabled. While it would be impossible to add lustre to their names or adequately to express appreciation of their ungrudging service to the country and to humanity, it is fitting that means be taken to preserve the memory of those who have died, and to give such help as may be needed by those who are wounded and disabled. As an obligation, and in no sense as an act of charity, provision should be made whereby assistance can be given to the dependents of the fallen and the wounded, either by financial help or educating the children who are left."

The Electrical Engineers' War Memorial Fund has been initiated to attain these objects; it is proposed that the memorial should take the form of—

1. A permanent record in the Institution building in the form of a bronze memorial.

2. A fund for the following purposes: To assist the wounded and disabled: to provide help to the families and dependents of the killed and wounded: to provide for the education of the children of those who have been killed or permanently disabled.

The Committee formed to carry out the details of the Memorial now makes an appeal for help in placing the War Memorial on a basis which will adequately commemorate those who, in the full power of their manhood, gave freely and without question. It is the earnest wish of the Committee that the fund which is to be raised may be of a substantial character, and one worthy of the resources of the electrical industry.

Subscriptions may, if desired, be spread over a period of years. All remittances are to be made payable to the "Institution of Electrical Engineers," and to be sent to the Institution.

A Roll of Honour containing the names of members who have been reported to the Institution as having been killed in action, or having died of wounds or other causes as the result of service in H.M. Forces during the war, accompanies the circular.

Auction Sale.—The Assets Auction Co., Ltd., is selling by auction, on February 5th and 6th, at 129, Newington Causeway, S.E., a quantity of electrical machinery, ½-watt fittings, and various electrical accessories. For further particulars see our advertisement pages to-day.

Educational.—CAMBRIDGE UNIVERSITY.—The Syndicate on Engineering Studies at Cambridge University is of opinion that the professorship, rendered vacant by the death of Prof. Hopkinson, should be filled as soon as possible: the new professor should be, they urge, Professor of Engineering. His stipend should be £1,300. The existing Engineering Laboratory should be assigned to him and managed by him. The Syndicate favours a change from the system according to which the studies of the school have been under the joint control of the Special Boards for Mathematics and for Physics and Chemistry, and thinks it desirable that a separate Board of Engineering Studies should be appointed.

The *Times* says that owing to the lack of trained investigators in Canada with capacity for independent research in some department of science bearing on industrial progress, the Dominion Advisory Council has been able to award only eight Fellowships and Studentships out of the 25 for which provision is made.

British Scientific Products Exhibition.—A dinner, presided over by the Marquess of Crewe, the chairman, was given at Prince's Restaurant, on January 15th, by the Committee of the British Science Guild which organised this Exhibition, to the friends and exhibitors whose financial support enabled the project to be successfully carried out. The purpose of the dinner, as stated by Lord Sydenham, President of the Guild, was to give publicity to, and invite support for, the Exhibition of British Invention and Discovery it is intended to hold during the coming summer. The aim of the 1919 Exhibition will be to act as a clearing house for new ideas, processes, and appliances which, without an opportunity of this kind, might never be afforded full opportunity for their completest utilisation in industry. The project obviously had the warm sympathy of the distinguished men of science and leaders of industry who supported the chairman, and the occasion elicited from Mr. Kellaway, M.P., Parliamentary Under-Secretary to the Ministry of Munitions, the valuable promise that the resources of the Ministry would be placed at the disposal of the Guild in making the Exhibition a success.

Incidentally, Mr. Kellaway gave some striking illustrations of the strides made by those branches of the electrical industry since 1914, which previously were at the mercy of German enterprise and intrigue. In the words of Milton, he said, we had shown ourselves to be "a nation not slow and dull . . . . but acute to invent, quick, ingenious, and searching." Further instances of this inventiveness were furnished by two of the greatest inventions brought forth by the war in the air: the one the simple and ingenious sound-ranging instrument for locating aircraft; the other, that terrific and deadly weapon of attack—he was not at liberty, as yet, to declare its nature—which had rendered our shores immune from enemy aircraft, for no airman dared to face an opponent in whose hands it had been placed.

Electrical Houses.—According to the *Daily Chronicle*, Wembley Council is considering the erection of 180 houses for workmen on novel lines. The scheme is to erect electrical houses, with a central heating station—doing away with kitchen ranges—a central wash-house, central lighting, round corners to the rooms, sliding doors, and swing windows, so that the outside of a window can be cleaned from inside.

How an American Escaped from Germany.—Lieut. E. V. M. Isaacs, U.S. Navy, escaped from a German prison camp at Karlsruhe by short-circuiting all the lighting circuits of the camp, and escaping through the barbed wire under cover of darkness.

Inquiry.—Makers of "Ferrix" transformers are asked for.

Institution and Lecture Notes.—Institution of Electrical Engineers. The Council has approved the formation of a Sectional Committee, one member of which will represent the Admiralty, to deal with wireless matters, which subject, the Council feels, has not been dealt with as it should have been by the Institution. It is hoped that the new Committee will rectify this shortcoming, and that it will ensure such matters being adequately discussed before the Institution in future.

The Council has also approved the formation of a Committee, to consist of seven members, and to be known as the Informal Meetings Committee, which will be in close touch with the Papers Committee, the chairman of the latter serving on the former, and their duties being similar. The new Committee will arrange meetings, and obtain papers to be read at the same, for the younger members of the Institution, which meetings are to be quite informal; smoking will be permitted, eliminating the atmosphere of restraint which must necessarily be associated with the more formal meetings of the Institution.

At the meeting of the North-Western Centre, held on Tuesday last, Prof. Miles Walker read his paper on "The Supply of Single-phase Power from Three-phase Systems," and a discussion followed.

At the meeting of the Scottish Centre, on Jan. 14th, Mr. J. G. Neilson, the chairman, drew attention to the position of the Benevolent Fund. He pointed out that the Council was most anxious that the fund should be supported by every member of the Institution. In order that the fund should be placed on a proper footing, and local cases properly attended to, a Local Sub-Committee had been appointed for the Scottish Centre (Mr. Taylor, hon. secretary). The amount at present subscribed was very small, and he suggested an additional voluntary contribution of at least 2s. 6d. per member.

At the meeting of the Western Centre, held at the South Wales Institute of Engineers, at Cardiff, on Monday evening last, Mr. H. I. Rogers (chairman) announced that the Committee's effort to get the area of operations extended had met with success, due in no small measure to the energies of Mr. C. T. Allan (joint hon. sec.). He mentioned that the paper which was to be read that evening had not yet been read at headquarters. Lieut.-Col. W. A. J. O'Meara, C.M.G., then read a paper on "The Functions of the Engineer: his Education and Training." The author made a strong plea for closer co-operation between the employer of labour and the technical training institutes, and pointed out the necessity for reform in engineering courses in British colleges and schools. Comparison was also made with what was being done in the United States and in Germany. The status of the engineer came within the purview of the paper, and the author advocated the establishment or constitution of a General Engineering Council, possessing statutory powers analogous to those of the General Medical Council. A lengthy discussion followed the reading of the paper.

Institution of Mechanical Engineers.—On Friday, last week, a paper on "Electric Welding," by Mr. Thomas T. Heaton, was read and partly discussed before this Institution. We hope to publish an abstract of the paper at a later date.

India.—A meeting was to have been held in Calcutta, on January 3rd, under the presidency of Sir Thomas Howard, for the purpose of forming an Institute of Engineers for India.

Mr. Barker North, A.R.C.Sc. (Lond.), F.I.C., recently gave a lantern lecture on "Lightning," at the Bradford Sunday Society, in which he showed experimentally the character of the electrical discharge during a storm.

Mr. Vernon I. N. Williams, technical manager of the small tools and gauge departments of the Manchester works of Sir W. G. Armstrong, Whitworth & Co., Ltd., gave a lecture on "Fine Measurement in Engineering Workshops" before the members of the Allen West Engineering Society on the 23rd inst. The attendance was over 200, and, by the courtesy of Dr. Burnie, of the Technical School, Brighton, the Lecture Theatre at the school was made available for the Society.

National Electricity Supply.—Speaking at a meeting of the Junior Institution of Engineers, on Monday, Mr. W. J. Tennant referred to the Government Report on Electricity Supply Stations as having rather raised discussion than settled this question, so important both to manufacturers and to private citizens. Mr. W. H. Patchell gave a summary of the Board of Trade recommendations. The cost of driving factories bore, he said, in nearly all cases a small proportion of the manufacturing costs, and any possible saving on the cost of electrical driving paled before the possible saving in the cost of labour, especially in view of the demand of labour for shorter hours and increased wages. In the Government scheme the interconnection of the stations would increase their capacity and help to distribute their energy in industrial districts. Existing private plant would not be interfered with, but new private plant would be standardised with the general system. Subsequent speakers expressed doubt as to the possibility of supplying power over great distances more cheaply than by the present system.

Fuel Economy and Health.—In the concluding lecture at the Royal Society of Arts, under the auspices of the Chadwick Trust, Mr. A. H. Barker confined his attention to fuel economies and economics. He stated that the present total consumption of the country for domestic purposes was about 30 million tons per annum. This quantity could be reduced to six million tons per annum by the application of the best-known appliances in place of the existing ones. The necessary capital outlay on plant to secure this result would probably be from 30 to 50 million pounds. He believed that stringent Government regulations as to the means of using fuel would be quite practicable: means of using fuel which were notoriously extravagant without any compensating advantages should be strictly prohibited.

Analysing the advantages and disadvantages of a supply of heat, hot water, and heating power from a central station, he concluded that, in general, the proposal was not economically sound. It had been suggested that electrical power might be supplied in the future at one farthing per unit. If this great ideal could be realised, he believed that electricity would be sufficiently economical to make it well worth general adoption for cooking, to a certain extent for heating, and to a much smaller extent for hot-water supply, not on account of its financial economy, but on account of the extreme convenience with which it could be manipulated. Electricity at one farthing per unit was, in fact, the solution of an enormous series of problems.

At a meeting of the Manchester Association of Engineers on Saturday last, a discussion took place on "The Past, Present and Future of Electricity Supply." Mr. S. L. Pearce opened the discussion with a review of the subject, and many other speakers took part in it. Our report of the proceedings will appear in our next issue.

The Training of Able-bodied Sailors and Soldiers.—The fact that, as a result of the conditions brought about by the war, the majority of able-bodied men born between the years 1896 and 1901 are without vocational training for industrial or commercial life, while the weak and sickly who were unfit for active service have in many cases received valuable intensive training, possesses grave potentialities which call for prompt and energetic measures, lest the skilled trades get into the hands of the physically unfit, and the able-bodied men, who have already sacrificed so much for their country, be faced with the alternatives of emigration or descent to the ranks of unskilled labour. This is the subject dealt with by Mr. Douglas Cockerell in a pamphlet recently issued by the Arts and Crafts Society, entitled "A National Scheme for Vocational Training for Able-bodied Sailors and Soldiers" (London: John Hogg, price 6d. net). The author premises that experience in the production of munitions has shown that it is possible by short periods of intensive training to convert unskilled workers into useful producers within narrow limits; men 23 to 25 years old cannot be subjected to long periods of apprenticeship or college training; and that the interval which must elapse before such men can safely be demobilised can be utilised for vocational training. He then outlines a scheme of training adapted to the needs of the building trades, and urges that similar schemes should be got out for other industries, and put in force as soon as possible; as he says, "it is clearly the country's duty to return men to civil life in a state to earn their living," and his scheme would not only provide for this, but would also be productive. The idea certainly appears to be an admirable one.

Fatalities.—A young man named Hutchinson (20) was killed whilst employed on an electric coal-cutter at Cossall Colliery, Ilkeston Junction. He had been discharged from the Army a fortnight. The Coroner said there was no evidence to show how the machine became "alive." He hoped the matter would not rest there, but that the company would try to find out the cause. Reports in the local Press do not say whether the case was watched by the Electrical Inspector of Mines.

A sequel to a fatal accident at Messrs. Osborne, Graham & Co.'s shipyard, Hylton, Sunderland, on December 14th, when J. E. Berry (17) was killed, was the prosecution of the firm at Sunderland for three offences under the Factory and Workshops Act, for which they were fined £50 in the first case and £5 and 40s. costs in each of the other two cases. According to the report in the *Leeds Mercury*, Berry received a shock at 250 volts in lifting an electric radiator, the metal work of which had not been earthed as demanded by the Regulations. Had it been earthed the accident would not have happened. On behalf of the firm, it was stated that it was the first accident through electricity that had occurred in the yard during the past ten years. Owing to shortage of labour the electrician had been overworked, and it was probably due to this strain that the slip had been made. The Bench expressed the opinion that there had been great carelesnsess.

Appointments Vacant.—Assistant telegraph engineers (£350 + £100) for the Government of the Gold Coast; mains assistant for the Kettering U.D.C. Electricity Works; power station engineer ($150 per month, Straits dollar is fixed at 2s. 4d.) for the Singapore Electric Tramways, Ltd.; power station staffs for the Northern Command: shift engineers (60s. + 12½ per cent.), fitter driver (55s. + 12½ per cent.), engine driver (45s. + 12½ per cent.), stokers (45s. + 12½ per cent.), foreman wireman, wireman, wireman's mate (Trade Union rate plus 12½ per cent.); chief lecturer in Electrical Engineering (£300) for the Rutherford Technical College, Newcastle-on-Tyne; two junior outside distributing engineers for the Hackney B.C. Electricity Works; depôt superintendent (£250) for the Southport Corporation Tramways Department; charge engineer (£216) for the City of Norwich Corporation Electricity Works; shift engineer (£4) for the Greenock Corporation Electricity Department. See our advertisement pages to-day.

Berlin Tramways Technical Staff.—The *Times* states that exorbitant wages are being demanded by the technical staff of the Berlin Tramway service, who are threatening to strike if they are not granted

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Mr. H. C. Lamb, resident engineer at the Manchester (Stuart Street) Corporation electricity generating station, has been appointed deputy chief engineer, in succession to Mr. A. E. Mackenzie.

Mr. E. W. Sleight, who lost a leg through wounds received in action, is to resume duty as manager of the City of Carlisle electric tramways next month. Mr. Watson, who has filled the post during his absence since 1914, has left to take up a position with the Corporation tramways in Edinburgh.

Mr. J. A. Bell, city electrical engineer, Aberdeen, has been appointed to represent the Institution of Electrical Engineers in the Highland Division of Scotland as adviser in connection with the demobilisation and resettlement of officers in electrical undertakings.

Having been demobilised, Sergt. D. F. Hunter, V.C., the hero of Moeuvres, is now employed with the Fife Electric Power Co. in their generating station at Townhill.

Mr. W. Adams, of Hanley, has been appointed assistant engineer at the Llandudno electricity works, at £160 per annum.

The Bath City Council has increased the salary of Mr. A. R. Shapley, deputy city electrical engineer from £325 to £350 per annum.

General.—It is announced that Mr. E. J. P. Benn has resigned his post as Chief Industrial Organisation Commissioner of the Ministry of Reconstruction. He will continue his work as chairman of the Industrial Reconstruction Council.

Councillor Dr. Sherlock has been re-elected chairman of the Dublin Corporation Electricity Supply Committee, and Ald. Farrell deputy chairman.

Mr. A. Toms, London sales manager of the J. G. Brill Co., has now been released from Government service, and has resumed duties at the London office of the company, 110, Cannon Street, E.C. 4.

Mr. B. H. Auld has resigned his position as director of Messrs. H. T. Boothroyd, Ltd., and is not now connected with the firm.

The directors of the Vulcan Boiler and General Insurance Co., Ltd., and the Inclusive Insurance Co., Ltd., of Manchester, on January 23rd, regretfully accepted the resignation of Lieut.-Col. Sir Hamar Greenwood, Bart., M.P., on his appointment as Under-Secretary of State for the Home Office. Sir Frank Warner, K.B.E., was unanimously elected to fill the vacancy.

Mr. C. G. Nobbs, M.I.E.E., manager and engineer for the Falkirk Iron Co., electrical heating and cooking departments, has received an appointment as manager of the heating and cooking department at the head office of the General Electric Co., Ltd., London. Mr. Nobbs will take over his new duties early in February. Mr. Nobbs's chief duties will be the handling of the designing and constructional work, and principally the commercial organisation for the selling of the products made. It is nearly five years since Mr. Nobbs left the firm of Purcell & Nobbs, London (of which he was partner and manager), to assume his position with the Falkirk Co., whose electrical department he inaugurated in June, 1914. On Friday night, 24th inst., Mr. Nobbs was made the recipient of suitable testimonials and gifts from the electrical department of Falkirk Iron Co., and also from the branch managers, the commercial representatives, and foremen of the firm. Mr. Nobbs indicated there was a big future for electrical heating and cooking, and firms would be well advised to prepare for the coming rush, which, he believed, would come quickly.

Mr. R. J. Howley, M.Inst.C.E., has resigned his position as joint manager of the British Electric Traction Co. in order to take up private practice. Mr. Howley will continue to act as chairman of the Potteries Electric Traction Co. and of the Birmingham and Midland Motor Omnibus Co., and in an advisory capacity to the British Electrical Federation.

Mr. P. J. Pybus, C.B.E., managing director of the Phœnix Dynamo Co., Ltd., Bradford, took a prominent part in the discussion on the subject of "Christianity and Industrial Problems" at the York Diocesan Conference, last week.

Councillor J. C. White, chairman of the Belfast Corporation Electrical Committee, and a member of the Irish Water Power Sub-committee, has been chosen Lord Mayor of Belfast for the coming year. The Lord Mayor-elect is an authority on Irish water power legal affairs.

Mr. H. Joseph, A.M.I.E.E., having been demobilised, has resigned his position with the Urban Electric Supply Co., Ltd., as their engineer and manager at Hawick, and is starting business in Birmingham as the Midland Electric Power Installation Co., and will specialise in electric driving of factories and maintenance and repair of motors. His temporary office is 16, Holly Road, Edgbaston, Birmingham, where he will be glad to receive price lists and catalogues of motors, starters, wiring material, &c.

Mr. W. McClelland, O.B.E., M.I.E.E., has been appointed Director of Electrical Engineering to the Admiralty, in succession to Mr. C. H. Wordingham, C.B.E., M.I.E.E.

Mr. R. H. Clamflett, who, on the outbreak of war was in business as an electrical contracting engineer, at Cathedral Yard, Manchester, and had been connected with the electrification of a number of textile mills in Lancashire and Cheshire, has recently been discharged from the Army, after serving for over three years as electrician with a technical unit on the Western Front. He resides at present at 350, Colne Road, Burnley, Lancs.

Mr. S. S. Moore Ede, M.I.E.E., has joined the board of Messrs. Johnson, Matthey & Co., Ltd

Roll of Honour.—Captain Cecil J. Falk, 7th Battalion, Wilts. Regt., eldest son of Mr. Max Falk, chairman of Falk, Stadelmann & Co., Ltd., has been awarded the Military Cross. He has served in Salonica and France with his regiment for over two years.

Lance-Corpl. C. Ormsby, R.E., who was an electrician at the Leeds Steel Works, has been awarded the Military Medal for good work on the field of action.

Private C. Jackson, A.S.C. (M.T.), who was employed in the Leeds Corporation electric lighting department, has been awarded the Military Medal.

Obituary.—Mr. F. Ward.—We regret to record the death of Mr. Frederick Ward, manager in England of the Commercial Cable Co. Mr. Ward, who was 68 years of age, passed away very suddenly at Wimbledon on January 23rd. The deceased gentleman was born in 1850. In 1869 he was stationed in Sicily, and in the following year at Aden. He was in Japan as instructor in telegraphy to the Japanese Government from 1872 to 1880, and received the Order of the Rising Sun for services rendered to that Government. From 1881 to 1884 he was with the French Atlantic Cable Co. as superintendent at Sydney, Cape Breton. He joined the Commercial Cable Co. at its inception, and was appointed secretary in Paris to Count Dillon. In 1885 he was appointed superintendent of the Weston-super-Mare and West of England stations. He took the position of manager in England, which he held until his death, in January, 1896. Mr. Ward was also a director of the Halifax and Bermudas and Direct West India Cable companies.

Mr. W. Hibberdine.—We regret to record the death, while seated at his desk at Electra House on Thursday morning last week, of Mr. William Hibberdine, O.B.E. The deceased gentleman, who was 63 years of age, had been in the service of the Eastern Telegraph Co. between 40 and 50 yars, and was one of the administrative heads (secretary-accountant) of the company.

Mr. A. B. Larkins.—Mr. Arthur Brooks Larkins, late of the Indian Government Telegraphs, passed away in a nursing home in London on January 24th, aged 69 years.

Mr. J. H. Buchanan.—Mr. J. H. Buchanan, of Edinburgh, a director of the North British Rubber Co., Ltd., passed away last week.

Mr. J. E. Holland.—We regret to hear of the death, which occurred on January 23rd, of Mr. John E. Holland, who was the West of England representative for over 36 years of Messrs. Falk, Stadelmann & Co., Ltd. In recent years he has not been quite so active as formerly, and limited his exertions to the larger showrooms which were made in his district.

Mr. H. P. J. Negretti.—Mr. Henry Paul Joseph Negretti, of Holborn Viaduct, passed away on January 29th at Hampstead, in his 68th year.

NEW COMPANIES REGISTERED.

Turquand & Kew, Ltd. (152,775).—Private company. Registered January 24th. Capital, £10,000 in £1 shares. Mining and electrical engineers, and manufacturers, &c. Agreement with F. J. Turquand The subscribers (each with one share) are:—F. J. Turquand, 12, Belsize Park Gardens, N.W. 3, mining and electrical engineer; N. Webster, 17, Marine Square, Brighton engineer. First directors: F. J. Turquand and N. Webster. Registered office: Albion House, 59-61, New Oxford Street, W.C. 1.

C. Redman & Sons, Ltd. (152,684).—Private company. Registered January 20th. Capital, £100,000 in £1 shares. To take over the business carried on by C. Redman & Sons at Pioneer Works, Halifax, and to carry on the business of iron and brass founders, mechanical and electrical engineers, machine tool makers, hardware dealers, &c. The subscribers (each with 100 shares) are:—A. Denton, Derby House, Marple, Ches., machine tool merchant; A. L. Churchill, 9-15, Leonard Street, Finsbury, E.C., machine tool merchant; C. Goodchild, c/o. P. & W. MacLellan, Ltd., 129, Trongate, Glasgow. The first directors are:—A. Denton, A. L. Churchill, C. Goodchild, J. Parker and G. J. Toy. While remaining shareholders, the following have the right to nominate directors in the company, viz.:—A. Denton and Charles Churchill & Co., Ltd., two directors each, and P. & W. MacLellan, Ltd., one director. Registered office: 17, South Street, E.C. 2

Carey-Gavey Syndicate, Ltd. (152,715).—Private company. Registered January 22nd. Capital, £10,000 in £1 shares. Electricians, electrical and [illegible] engineers, &c. Agreement with E. S. [illegible] on [illegible] F. C. Shaw, 39, Gilston Road, S.W. 10, C. [illegible], 1, Chepstow Mansions, W. 2. First directors: F. S. Carey, A. Gavey, Major C. Fowler, and F. C. Shaw (all permanent). Registered office: 9, Orange Street, Haymarket, S.W.

H. T. Boothroyd, Ltd. (99,742).—Capital, £20,000 in £1 shares (15,000 ord. and 5,000 pref.). Return dated December 9th, 1918. 10,002 ord. and 2,800 pref. taken up; £2,802 paid on 2,800 pref. and 2 ord.; £10,000 considered as paid on 10,000 ord. Mortgages and charges: £9,942.

Brown, Boveri & Co., Ltd. (89,167).—Capital, £50,000 in 1,500 "A" and 8,500 "B" shares of £5 each. Return dated January 3rd, 1919. All shares taken up, 15s. per share called up on 8,500 "B"; £6,375 paid; £7,500 considered as paid on 1,500 "A." Mortgages and charges: Nil.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Bogota Telephone Co., Ltd. (69,059).—Capital, £45,000 in 20,000 pref. and 25,000 def. shares of £1 each. Return dated November 29th, 1918. 20,000 pref. and 18,607 def. shares taken up; £29,607 paid on 11,000 pref. and 18,607 ord.; £9,000 considered as paid on 9,000 pref. Mortgages and charges: Nil.

Nairobi Electric Power & Lighting Co., Ltd.—Satisfaction to the extent of £1,000 on December 31st, 1918, of debentures dated 1913-15, securing £20,000.

Mersey Power Co., Ltd.—Mortgage dated November 27th, 1918, to secure £300,000, charged on the company's undertaking and property, present and future, including uncalled capital, freeholds, leaseholds, plant, &c. Holders: Ministry of Munitions.

Allies' Electric Lamp Repairing Co., Ltd.—Mortgage debenture for £6,000, dated January 7th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: D. Hogan, 6, Sinclair Road, Kensington.

Musselburgh and District Electric Light & Traction Co., Ltd.—Satisfaction to the extent of £900 on January 7th, 1919, of charge dated November 13th, 1905, and May 11th, 1909, securing £30,000.

C. A. Vandervell & Co., Ltd.—Mortgage on eight houses at Portslade, dated December 31st, 1918, to secure moneys due to National Provincial & Union Bank of England.

Seear, Scott & Co., Ltd.—Particulars of £4,000 debentures created December 5th, 1918, and all issued January 17th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees.

Grimsby Electric Vehicle Co., Ltd.—Debenture dated January 11th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital, to secure moneys due to Barclay's Bank.

Cleveland & Durham Electric Power, Ltd.—Supplemental deed dated December 31st, 1918, securing premium of 3 per cent. on £250,000 first mortgage debentures converted by trust deed of 1913.

Drake & Gorham, Ltd. (70,275).—Capital, £125,000 in £1 shares. Return dated November 27th, 1918. All shares taken up; £85,000 paid, £40,000 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

The Siemens-Schuckert Group.

The Elektrizitats A.G. vorm Schuckert and Co., of Nuremburg, reports that it was impossible for the increase in the receipts in 1917-18 to keep equal pace with the growth in the expenses. The "suspension" of the war had not removed anxiety; on the contrary, a further advance in expenses was rather to be expected, and this would render necessary a fresh increase in the tariffs. The company was abundantly occupied with the preliminary labours in connection with new supply and transport schemes, although it would not be foreseen when these could be carried out under present circumstances. The net profits amounted to £375,000, as compared with £372,000 in 1916-17, and the directors recommend a dividend of 8 per cent. on the ordinary share capital of £3,500,000, being the same rate as in the previous year.

The directors of *Siemens & Halske A.G.*, reporting on the year ended on July 31st, 1918, state that the works were again mainly occupied on the production of electrical manufactures for the Army and Navy, and the deliveries considerably exceeded those in the preceding year. A large stock of orders still remained on the books, but their completion had been jeopardised by intervening events. After setting aside £23,000 for depreciation, as compared with a similar sum in 1916-17, the accounts indicated net profits of £697,000, as contrasted with £643,000, and a dividend of 12 per cent. has been declared, being the same rate as in the previous year. No allocation has been made to the special reserve fund, whereas £100,000 was apportioned to this fund in 1916-17. The sum of £150,000 was granted for the economic relief of the workmen, and the bonuses paid absorbed £90,000, as against £60,000, leaving £63,000 to be carried forward, compared with £64,000 in 1916-17.

The report of the *Siemens-Schuckert Werke* states that the degree of activity in 1917-18 was even greater than in the preceding year, and an improvement also took place in the central station branch, together with continued progress in new connections and extensions of installations in industrial works. Large transformers for 100 volts to 110,000 volts were delivered in considerable numbers, and the 100,000-volt transmission line from Homburg (Palatinate) fully answered the purpose. It was impossible entirely to meet the demand for minor manufactures and meters, so that large stocks of orders had to be brought forward into the new financial year. No details were available concerning the operations of the oversea offices and companies. On the other hand, business with neutral countries experienced an increase. The Siemens-Schuckert group subscribed £6,300,000 to the recent war loans, whilst the contributions made by the company and the Siemens & Halske Co. towards the relief of the officials and workmen amounted to £230,000. The accounts show the following results:—

	1916-17.	1917-18.
Share capital	£4,500,000	£4,500,000
Terminable loans	3,751,000	3,732,000
Perpetual loans	2,500,000	2,500,000
Gross profits	1,309,000	1,328,000
General expenses	122,000	144,000
Interest charges	333,000	332,000
Depreciation	74,000	78,000
Net profits & balance forward	793,000	791,000
Transferred to reserve	125,000	125,000
Bonuses	100,000	150,000
War benevolent grants	75,000	——
Dividends	450,000	450,000
Dividend per cent.	10	10
Carried forward	18,000	41,000

According to the balance sheet, the company's credit at the banks on July 31st, 1918, amounted to £4,125,000, as compared with £4,200,000 on the corresponding date in 1917; the securities in portfolio represented £1,700,000, as against £590,000, and stocks and installations in course of construction were entered at £7,025,000, as contrasted with £5,150,000. This increase is attributed to uncompleted orders from 1916-17, and to new orders received in the past year. The report states that owing to the abandonment of the Brest-Litowsk Treaty the obligation of the Russian Government to pay compensation for the State acquisition of the Russian Siemens-Schuckert works was "interrupted"; nevertheless hopes were still entertained of obtaining adequate compensation.

The Constantinople Telephone Co.

Mr. J. E. Kingsbury, director and representative in the United Kingdom of this company, has circulated from his office at 7, Serjeants' Inn, Temple, London, E.C. 4, the following circular, placing the position of the company before the share and bondholders:—

> On May 7th, 1915, a circular letter was addressed to you stating that the Turkish Government had forcibly taken possession of the company's system in Constantinople; that the general manager and the British staff had returned to England; and that a letter had been received from Mr. Salem, the company's chief legal adviser in Constantinople, with a copy of the protest addressed by the Constantinople directors to the Turkish Government. . . . . The directors in London and Paris have taken the necessary steps to place the facts of the company's case before the British and French Governments, and to claim their assistance on behalf of the Allied investors. Through the active assistance of the Foreign Office and the War Office . . . . arrangements were made, immediately after the armistice with Turkey, for the general manager, Mr. Douglas Watson, with five expert assistants, to proceed to Constantinople to place their experience at the disposal of the British authorities, and to be available to take over the plant at such time as its restoration to the company could be effected. Mr. Watson, with his party, arrived at Constantinople on December 2nd, and information has now been received from him that the plant has continued in operation throughout the period of the war, and still continues in operation, though with an imperfect service arising from deficiency of certain plant and lack of efficient management and organisation. Mr. Salem is now on his way from Paris to Constantinople, and on arrival will confer with the general manager as to the steps which should be taken for the recovery of the property, and to obtain reparation for the losses which the company has sustained at the hands of the Turkish Government. The European directors are taking every possible step to obtain a just settlement of the company's claims, but are, of course, unable to forecast either the time or the basis of such settlement. So soon, however, as any further definite information is obtained, they will have pleasure in communicating it to you. . . . As the company is incorporated under Turkish law, no registration of transfers in London can be effected until the restrictions resulting from the war conditions are removed.

Melbourne Electric Supply Co., Ltd.

Gross profit during year ended August, 1918, from the Melbourne and Geelong undertakings £161,887, against £151,304, an increase of 7 per cent. After paying expenses, debenture interest, &c., £3,408 has been written off capital expenditure, and £14,000 off cost of gold bond issue; £20,000 is reserved for income-tax and excess profits duty, and £15,000 is put to general reserve, raising it to £115,000. The 7 per cent. pref. dividend is paid, and a total of 10 per cent., free of British tax, on the consolidated ordinary stock, leaving £2,033, plus £72,817 brought in. The uncertainty due to war conditions having in a great measure disappeared, the carrying forward of a large credit balance is no longer required.

> In view, however, of the necessity for making provision for the redemption of the 6 per cent. five-year gold bonds, 1922, issued in the United States in March, 1917, for the purpose of financing the company over the war period, the directors have created a gold bonds redemption account, and have allocated thereto £50,000, made up of £10,000 hitherto standing to the credit of dividend equalisation account which the directors consider is not now required, and £40,000 transferred from the available credit balance of £74,849. This leaves a net credit balance of £34,849 to be carried forward.
>
> With a view to making timely provision for future requirements, the

directors have applied to H.M. Treasury for permission to issue a further 20,000 7 per cent. cumulative preference shares of £5 each, and also the small outstanding balance of £11,319 consolidated ordinary stock.

The following tables show the progress of the company's business:—

	Year ended August, 1917.	Year ended August, 1918.
Melbourne—		
Number of consumers	32,142	36,870
Lighting, &c., in KW.	27,583	31,740
Motors in H.P.	23,718	27,640
Total connections in KW	51,309	59,380
Total units sold	28,395,000	32,839,227
Geelong (including tramways)—		
Number of consumers	2,845	3,148
Lighting, &c., in KW.	2,643	2,843
Motors in H.P.	2,294	2,392
Total connections in KW	4,937	5,235
Total units sold	1,505,941	1,677,770

The increase in new consumers in Melbourne was 15 per cent.; in power supply 16 per cent.; in total connections 15 per cent.; total units sold 15 per cent.; gross revenue 17 per cent.

Adelaide Electric Supply Co., Ltd.—Gross revenue for year ended August, 1918, £174,254, against £154,451, an increase of 13 per cent. After paying expenses, paying debenture interest, &c., reserving £7,500 for income tax and excess profits duty, paying the 6 per cent. preference dividend, and a total dividend of 12 per cent. for the year, free of British income-tax on the ordinary shares, £16,942 is to be carried forward, including £10,800 brought in. Out of the balance of premium account £1,746 is put to writing down cost of investments, and £20,000 is put to general reserve, raising it to £80,000. The progress of the last year appears in the following figures:—

Year ended	Consumers.	Lighting, in KW.	Motors, in H.P.	Total connections, KW.	Units sold.
August, 1917 ...	19,590	14,420	10,221	24,641	9,330,495
August, 1918 ...	21,917	15,856	11,351	27,207	10,775,931

The number of consumers increased by 12 per cent.; power supply by 11 per cent.; total connections by 10 per cent.; total units sold by 15 per cent.; gross revenue by 13 per cent. The £50,000 consolidated debenture stock, 6 per cent., free of British tax, was offered in Australia last July; the whole was applied for and has been paid up in full.

French Companies.

The report of the *Société d'Electricité de Paris* states that the supply of coal proceeded in a fairly regular manner in 1917-18, both in regard to British coal and that from the Pas de Calais, although prices remained extremely high, and Government measures prevented the company from exercising initiative and experience in effecting purchases. This system would probably continue for a certain time after the end of the war. Owing to excessive wear and tear of the plant and machinery it had been necessary to make arrangements for substitutes, notwithstanding the present prices, and orders had therefore been given for some new sets. The sales amounted to 150,000,000 KW.-hours, as against 154,000,000 KW.-hours in 1916-17, the reduction being due to a decrease in sales to the underground electric railways during the period when a portion of the population left Paris owing to aerial raids and the activity of long-range guns. As net profits the accounts show the sum of £102,000, which has permitted of the payment of a dividend at the rate of 8 per cent.

The Compagnie d'Electricité de l'Est Parisien, reporting on the year ended on June 30th, 1918, states that the directors had been successful in obtaining from manufacturing consumers modifications of the supply contracts, so as to compensate to some extent for the growth in the cost of production owing to the dearness of coal and other raw materials. At the same time, it had been possible to secure similar alterations in the contracts with the municipal authorities, as a result of the approval given by the Prefect of the Seine in November, 1918, and the directors pay a tribute to the spirit of conciliation manifested by the municipal councils in this direction. The latter changes would have retroactive effect to April, 1915. The working receipts in 1917-18 amounted to £631,000, as compared with £430,000 in the previous year, but as the working expenses greatly increased, and reached £641,000, there was a loss of £10,000, which, with interest charges, interest on loans, &c., rose to £59,000. The compensation to be received under the concessions made by the local authorities, however, would permit of the extinction of this debit balance, and of the deficit of £15,000 which took place in 1916-17. It is added that the average price of coal advanced from £3 18s. 4d. per ton in 1916-17 to £5 7s. 2d. last year. The generating station at Alfortville was on the point of starting a new turbine of 6,000 KW., and new boilers were to be installed in addition to two boilers which had just been erected.

The report of the *Société Industrielle des Téléphones*, whose accounts for 1917-18 were referred to in our issue of January 3rd, states that the turnover experienced a further increase, notwithstanding the difficulties in obtaining coal and other raw materials and the necessary labour, the company having in this way contributed towards the national defence by supplying cables, apparatus, &c., for the Army and Navy. The financial results were satisfactory, despite a reduction in the net profits as compared with the previous year, owing to the tax on war profits having been raised from 70 to 80 per cent., and the directors were able to propose a dividend of £1 12s. per share, as in 1916-17. After providing for this distribution the sum of £52,000 has been placed to the contingency reserve fund, which would be all the more necessary, as the price of money after the war would certainly continue high, and as considerable funds would be required for repairs and for the development of the works. During the past year a new building was erected at the company's telephone works in the Rue des Entrepreneurs, which was the first step in the execution of the scheme for the expansion of manufacturing. The other portions of the programme, which had to be deferred having regard to the wishes of the Government, were ready, and would be carried out as soon as circumstances would permit. Numerous aerial bombardments of the works at Calais had taken place, but the personnel remained immune, and the material damages were not of much importance. The directors had facilitated the formation of a co-operative food supply company in connection with the Bezons works, and the satisfactory results obtained were now leading to the constitution of a similar company for the personnel at the Paris works. The sum of £14,000 was applied to the relief of mobilised workmen and their families, being the same amount as was allotted to this purpose in the preceding year.

Puebla Tramway, Light & Power Co.—Net profits for the year ended December 31st, 1917, £52,604, against £10,672. The power plants have been efficiently maintained, and regular services have been afforded to Puebla and to the Vera Cruz Electric Light, Power & Traction Co. Progress has been made with the reconstruction of the San Raphael transmission line, but local conditions will postpone the completion of the work for some time. The tramway service to Huejotzingo has been suspended temporarily for a few months, owing to disturbances in outlying districts.

East London Railway Co.—The report states that the passengers carried during 1918 were 10,564,306 (plus 1,222,000 season ticket journeys), against 9,189,476. Net income, £35,669, plus £991 brought forward. After making debenture interest appropriations £9,586 is carried forward.

British Trade Corporation.—The profits for 1918 were £71,589, plus £9,671 brought forward. Dividend of 5s. per share, less tax; preliminary expenses written off, £10,204; depreciation on furniture, &c., written off, £4,385; carried forward, £14,252.

London United Tramways, Ltd.—A meeting of the holders of the mortgage debenture stock approved last week the scheme of arrangement between the company, the holders of preference shares, mortgage debenture stock, and second and third debentures of the company.

Westminster Electric Supply Corporation, Ltd.—Dividend on ordinary shares for the December half-year at the rate of 9 per cent. per annum, making 8 per cent. for the year, against 9 per cent. for 1917.

STOCKS AND SHARES.

Tuesday Evening.

The labour situation dominates everything in the industrial market, besides having a pronounced effect upon Home Railway stocks. In spite of this, however, there is a good deal of business doing in the Stock Exchange. Prices keep up well, considering the various influences adverse to employment of capital. The weather conditions have also played their part in the way of interrupted communication with the provincial centres, where so much of the money lies, and from which so much of the speculative enterprise emanates. The exasperation produced by the Government offer of National War Bonds is passing away, and there is brisk demand for all securities of the best order.

The various strike developments of the early part of the week were held at first to be indications that the epidemic was dying out, but it soon became clear that this was not the case, and in consequence a slight revival in Home Railway stocks was followed by further reaction. This has affected Undergrounds with the rest. Districts shed 1½, Metropolitans ½, Underground Income Bonds a point, and the £10 shares 10s. The 1s. shares of the last-named company keep steady at 11s., although this, of course, is not anything like the top recently reached. What interest there was in dividend announcements has been damped by the first declarations from the leading steam companies. Apparently, railway directors prefer to act cautiously in the face of labour difficulties. The East London report appeared a few days ago, but furnishes slender information. It shows that traffic has increased considerably, both from season ticket and ordinary travellers. Meanwhile, the price of the company's stocks show little variation, the "A" and "B" debentures being about 68½ and 40 respectively, while the two junior stocks stand at 19 and 12. The "B" debenture stock has changed hands several times this week on the basis of the price just quoted The dividend for 1918 was, of course, 10s. per cent., as against the full 4 per cent. to which it is entitled.

Home electricity shares have not moved one way or the other. There is not much business doing in them, and pending the declarations of the next dividends, interest can hardly be expected to revive. The companies are touched nearly by coal considerations, and, having regard to the various threats of strikes, it is natural enough that prospective buyers should hold their hands until the outlook becomes clearer. Interest is being diverted from home industrials generally to those of colonial and foreign companies, which are at present less under the influence of strike threats, but although many shares in the various groups concerned have appreciated during the past week, this factor has not helped the Argentine and Brazilian traction descriptions. Anglo-Argentine Tramways preference are both decidedly lower. Prices recovered after the revolution in Buenos Aires had been composed, though they failed to regain fully their previous losses, and the market again shows a dwindling tendency. Brazilian Tractions are down ½, and the dulness in the British Columbia Electric Railway group is still apparent, the 5 per cent. preference stock shedding a point. Mexicans are also out of favour, and a dollar fall in Mexican Light & Power common shares reduced the price to 37. Meanwhile the Colonial companies are doing well, and the report of the Adelaide Electric Supply Co. shows the gross revenue increased by 13 per cent., and the final dividend, making 12 per cent., free of tax, for the year, was paid in December.

Telegraphs and Telephones are very quiet. Marconis have rallied ⅛. Manufacturing shares show some irregularity. British Aluminiums and Electric Constructions went back a trifle. A Stock Exchange rumour says that the General Electric Co., Ltd., or Fraser & Chalmers, is taking an interest in one of the well-known Colombian mining companies British Westinghouse preference are a harder market at 2 9/16. In the engineering list, Babcocks lost the 2s. 6d. they gained last week. We have added Siemens to our list of prices; there is a good deal of business doing in the shares. The rubber market has quieted down somewhat after its buoyancy and excitement. Base-metal issues are attracting no particular attention.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Jan. 28, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	9	10	7⅜	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3½	—	6 8 7
Chelsea	3	5	4	—	6 5 4
City of London	8	8	13¼	—	6 0 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	3	4	8	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	8	9	7¼	—	6 4 2
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	7⅜	—	6 2 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98½	—	6 1 10
do. Def.	1½	1½	22	—	7 12 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10½	—	*6 13 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	157½	+ ½	*5 1 7
Globe Tel. and T. Ord.	7	7	14¼	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	82	— ½	6 17 6
Indo-European	13	13	58½	—	5 11 0
Marconi	15	20	4⅝	+ ⅛	4 6 7
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7½	—	*5 1 7
West India and Panama	6d.	1/3	1⅝	— 1/16	*3 17 6
Western Telegraph	8	8	16⅝	—	*4 16 3
HOME RAILS.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan		1	30½	— ½	8 5 6
do. District	Nil	Nil	27¼	—1½	Nil
Underground Electric Ordinary	Nil	Nil	3½	— ⅛	Nil
do. do. "A"	Nil	Nil	11/-	—	Nil
do. do. Income	6	4	92½	—1	*4 6 6
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3 3/16	— 1/16	—
do. do. 2nd Pref.	5½	—	3⅝	— ¼	—
do. do. 5 Deb.	5	6	71½	—1	6 19 10
Brazil Tractions	—	—	55½	— ½	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	66½	—1	7 8 2
do. do. Preferred	Nil	Nil	48	—	Nil
do. do. Deferred	Nil	Nil	45	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	66	—	Nil
do. 6 per cent. Bonds	Nil	Nil	52	—	Nil
Mexican Light Common	Nil	Nil	37	—1	Nil
do. Pref.	Nil	Nil	48	—	Nil
do. 1st Bonds	Nil	Nil	69½	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3⅞	— ⅛	3 17 5
British Aluminium Ord.	10	10	1 7/32	—	5 8 5
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref.	7½	7½	2 9/16	— 1/16	6 0 0
Callenders	20	25	11	—	5 13 8
do. 6½ Pref.	5	5	5⅜	—	5 2 4
Castner-Kellner	22	20	3 7/16	—	5 16 8
Edison-Swan, "A"	—	—	20/-	—	7 10 0
do. do. 4 per cent. Deb.	4	4	74½	—	5 6 0
Electric Construction	7½	10	1 3/16	— 1/16	8 8 5
Gen. Elec. Pref.	6	6	10¼	—	6 6 10
do. Ord.	10	10	17½	—	*5 12 8
Henley	25	25	2¼	—	5 11 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17½	—	*5 16 0
Siemens Ord.	10	—	6 9/16	—	*7 12 1
Telegraph Con.	20	20	48	—	*5 0 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, January 29th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/5	..
a	Ammoniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	"	£78	£1 inc.
a	Bisulphide of Carbon	"	..	..
a	Borax	"	£48	..
a	Copper Sulphate	"	£60	..
a	Potash, Chlorate	per lb.	2/-	1d. dec.
a	" Perchlorate	"	1/9	..
a	Shellac	per cwt.	£14	..
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers	"	£33	..
a	" Lump	"	£25	..
a	Soda, Chlorate	per lb.	10½d.	..
a	" Crystals	per ton	170/-	..
a	Sodium Bichromate, casks	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	1/1⅜	..
c	" Tubes (solid drawn)	"	1/3¾ to 1/4	..
c	" Wire, basis	"	1/2	..
c	Copper Tubes (solid drawn)	"	1/6¼	..
g	" Bars (best selected)	per ton	£132	£3 dec.
g	" Sheet	"	£152	£3 dec.
g	" Rod	"	£132	£3 dec.
d	" (Electrolytic) Bars	"	£105	..
d	" " Sheets	"	£161	..
d	" " Wire Rods	"	£115	..
d	" " H.C. Wire	per lb.	1/1⅞	..
f	Ebonite Rod	"	3/-	..
f	" Sheet	"	2/6	..
n	German Silver Wire	"	2/6	..
h	Gutta-percha, fine	"	11/-	..
h	India-rubber, Para fine	"	2/6	..
i	Iron Pig (Cleveland warrants)	per ton	Nom.	..
l	" Wire, galv. No. 8, P.O. qual.	"	£40	..
g	Lead, English Pig	"	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small	per lb.	9d. to 1/6	..
e	" " " medium	"	5/- to 10/-	..
e	" " " large	"	12/6 to 25/- & up.	..
				..
d	Silicium Bronze Wire	per lb.	1/7	..
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	"	£243	£7 dec.
n	" Wire, Nos. 1 to 16	per lb.	4/-	3d. dec.

Quotations supplied by—

a G. Boor & Co.	g James & Shakespeare,
c Thos. Bolton & Sons, Ltd.	h Edward Till & Co.
d Frederick Smith & Co.	i Bolling & Lowe.
e F. Wiggins & Sons.	l Richard Johnson & Nephew, Ltd
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n P. Ormiston & Sons.
	r W. F. Dennis & Co.

High C.P. Searchlights.—The *E.T.Z.* states that a German experimenter has experimented in order to increase the specific surface luminosity of the searchlight arc lamp, and has been able to attain a searchlight efficiency of five times that hitherto obtained, with the same power consumption and optical arrangements. Instead of using the ordinary 38 mm. diameter pure carbons, he employed high-efficiency carbons of 11 and 16 mm. Opposite the horizontal positive carbon is arranged obliquely upwards the negative, which is 11 mm. dia. The carbon ends are played upon by a flat spirit flame, which cools the incandescent ends of the carbons, and the passage of the current is no longer limited to the ends, but reaches the inner parts of the carbons. This causes considerable increase in temperature of the carbon crater, and the latter burns very deeply into the thin carbon rod, giving a small, round, and intensely bright crater opening which, when projected, appears as a circular luminous disk, and has a much higher specific luminous intensity than the usual large, but flat, crater in the ordinary type of projector. The energy is much better used, as the voltage with a current of 150 amps. reaches 75 to 80 volts. In practice the carbons are kept constantly in rotation by a small electric motor in order to ensure even burning. To ensure the crater of the positive carbon keeping in the focus of the parabolic mirror, the carbon is adjusted by an electromagnetic device with the aid of a selenium cell. Experiments made by Prof. Wedding show the candle-power of such searchlights to attain 500 million C.P.

A New D.C. 3-wire Meter.—The Sangamo Electric Co., Springfield, has just produced a D.C., three-wire meter consisting of two standard two-wire elements placed side by side on a common base and recording on a common recording train, so that the sum of the revolutions of the two elements is indicated on the dial of the meter. This is effected by a differential gearing; and the arrangement is such that the total revolutions of the two movements are correctly recorded, no matter how the load is divided between the two sides of the three-wire system. It is claimed that this meter is the first one to read correctly even if one side of the system is dead, and if the neutral wire is opened. Illustrations and diagrams are given in *Electrical Review and Western Electrician*, November 9th, 1918.

ELECTRICITY ON BOARD SHIP.

Until recent years the application of electricity to the operation of the various devices on board ship has been slow. This has been true of marine work generally. The most conspicuous exception to this rule has been in the American Navy, which is not only a larger user of electrically-driven machinery than the merchant service, but also leads the navies of the world in the application of electricity to the almost countless devices used on board a modern battleship. The employment of electricity on shipboard was at first limited to illuminating purposes and searchlights. Since about 1898 the use of electricity has been extended, until to-day some of the largest and most powerful super-dreadnoughts and battle cruisers in the U.S. Navy are electrically driven. As illustrations of this the cases may be cited of the super-dreadnoughts U.S.S. *Tennessee* and *New Mexico*, which have displacements of 32,600 tons, and are designed for speeds of 21 knots (see Elec. Rev., September 14th, 1917, and May 10th, 1918). The first ship of any importance, excepting submarine boats, in the American Navy, to be electrically driven was the U.S. collier *Jupiter*, which was built at the Mare Island Navy Yard and placed in commission in 1913 (see Elec. Rev., November 27th, 1914, September 10th, 1915, January 14th, May 5th, 1916, and March 9th, 1917.)

The electrical installation on board a modern battleship may be divided into three general systems—power, lighting, and signalling. Outside the main drive, which usually consists of standard A.C. steam turbo-alternators similar to those in use in large power houses, the power plant generally comprises a number of 300-KW. turbine-driven, 125 or 250-volt, direct-current generators to furnish current for exciting the alternators and for light, power, signals, and the several hundred motors used about the ship. The generators of the earlier equipment were direct connected to the turbines, ran at a speed of 1,500 R.P.M., and were of the compound-wound type with commutating poles. In the more modern equipment geared turbines are used, and the generators operate at from 700 to 1,000 R.P.M. On account of the comparatively heavy current and small diameter of commutator, the 125-volt units generally have two commutators, one at each end of the armature.

It is general practice to provide not less than four of these sets, and to locate them in two separate dynamo rooms, so that in case of the disablement of one dynamo room the entire electrical equipment will not be put out of action. The method of operating the alternators varies somewhat with different nations. In America it is general practice to operate them in parallel, while in Europe in many cases the generators are arranged so that the distributing circuits can be transferred from one generator to another, but the generators cannot be operated in parallel. The switchboards used for the control of the D.C. power plant on a modern battleship are arranged as follows:—On the centre panels are mounted the switches, circuit-breakers, instruments, &c., for the control of two generator sets, either or both of which may be connected to the bus-bars. The end panels are for the control of the distributing circuits. Circuit-breakers are used to protect the large-capacity circuits, while fuses are used on the smaller circuits. Where the power plant is divided and located in separate rooms, two lines are provided between the different switchboards. In addition to the main switchboard, other distributing panels are located in various parts of the ship for the control of motors and to distribute to the various equipments.

In America the earlier practice was to construct the switchboard panels of slate mounted on angle-iron supports, and sometimes cushioned with rubber to prevent breakage. The more modern practice is to construct the panels of non-fragile insulating material, such as asbestos or timber. In Europe the panels are frequently made of steel, with the instruments insulated therefrom.

One of the most important applications of electricity on board ship is to the steering gear. Although electrical steering gears have been given attention for some 20 or 25 years past, it is only within recent years that they have been adopted in general. At first they were applied in conjunction with steam engines, the electrical drive acting as an auxiliary. One of the first systems to be successfully employed utilised a motor-generator set to supply power to a shunt motor for operating the rudder. Control with this system was effected on the Wheatstone bridge principle, and is known as the "Pfatischer" system, one arm of the rheostat being located at, and operated from, the steering stand, and the other located at, and operated by, the rudder. This system followed along the idea of the old follow-up system of the steam engine; that is, the helmsman set the steering wheel at the angle it was desired to have the rudder moved to, and when the latter arrived at that position it automatically cut out the source of driving power.

Quite a number of United States battleships and cruisers are equipped with a rheostatic system of control on the steering gear. The motor is fed directly from the ship's mains, thus obviating the use of a motor-generator set. In this system the motor is controlled by a contactor panel, which is equipped with contactors for reversing the motor, cutting out the armature resistance, for operating at low speeds, and for dynamic braking. The controller and starting resistance are usually placed near the motor, and operated from a steering stand at the steering stations in different parts of the ship. The helmsman can always tell the position of the rudder by a helm-angle indicator placed near the steering stand. To prevent the rudder from jamming on the hard-over positions, limit switches are provided.

The system which is now receiving favourable consideration makes use of a hydraulic mechanism to operate the rudder. A variable-speed hydraulic pump delivers oil to large rams connected to the rudder cross-head, and this pump is driven by a constant-speed motor, which is started up and allowed to run continuously. A small pilot motor operates the valve of the hydraulic pump, and the control of this pilot motor, from various stations in the ship, is the same as the rheostatic system previously described. This hydraulic-electric steering gear is being installed quite generally on large U.S. naval vessels. Its principal point of advantage is that it substitutes the hydraulic variable-stroke pump and hydraulic ram for the very inefficient screw gear arrangement previously used on the older vessels, and therefore permits the installation of a relatively small motor for driving the rudder. The requirement on nearly all naval vessels is that the motor must operate the rudder from hard-over to hard-over in 20 seconds; on the most recent vessels it has been modified in some cases to 30 seconds. With the rheostatic control on the larger battleships, compound-wound interpole motors of 300-H.P. capacity are required to operate the steering gear, while with the hydraulic-electric system the horse-power is reduced to about 150, or one-half. The motors are fitted with disk brakes on the armature shaft, which, assisted by dynamic braking, bring the rudder to rest.

Another service that requires large motors is the anchor windlass; on some of the recent equipment installed on U.S. battleships, two motors are used, each having a one hour rating of from 125 to

150 H.P. The motors are compound-wound and equipped with commutating poles and a disk brake, and are coupled direct to the worm gears through which the windlass is operated. The motors can be operated independently, as well as two simultaneously in series or parallel. The equipment is capable of raising two 20,000-lb. anchors simultaneously, and 360 ft. of chain on each, each chain weighing about 36,000 lb., at the rate of 36 ft. per minute.

The cranes for handling the lifeboats are operated by compound-wound motors, usually of 50 H.P. capacity. The requirements are that this equipment shall raise a load of 40,000 lb. at 20 ft. per minute, and the empty hooks at 60 ft. per minute. An electric brake is fitted to the motor, so that it will hold the load should the power fail. A motor is also used for rotating the crane, so as to place the boats in position on deck; this motor is frequently of 50-H.P. capacity. Winch motors for both coal and cargo are 35 to 45 H.P. in size, compound wound, and fitted with inter-poles. The winches for coal-handling can generally handle a 5,000-lb. load at 200 ft. per minute, and a 20,000-lb. load at 50 ft. per minute.

Forced ventilation is an important feature on modern battleships; on large ships the ventilation system may consist of over 100 electrically-driven fans, handling 500,000 cu. ft. of air per minute. The motors vary in size from 1 to 15 H.P., and in addition there may be as many as 200 small disk or bracket fans in use. In the latest practice on battleships steam turbines are used extensively for driving the ventilating fans. Electrically-driven pumps are used for various purposes, such as fire, and fresh-water supply, bilge, drainage tanks, sanitary purposes, refrigeration, &c. These motors vary from 1 to 75 H.P. in size. Some 15 to 20 pumps are supplied to handle the bilge water, which require vertical and horizontal motors from 25 to 75 H.P. in size. Motors are used for turning the turrets, elevating the large guns, and hoisting the ammunition. These services require motors ranging in size from 3 to 35 H.P. Variable as well as constant-speed motors are used on the ammunition hoists.

Electricity is used for almost every imaginable purpose on board the modern ship; the completeness of the equipment is evident from such items as moving-picture machines, cake mixers, ice-cream freezers, &c., which would indicate that almost all the luxuries that may be had on land are also provided on board ship.

The illuminating equipment of a battleship consists of from 3,000 to 4,000 lights; incandescent lamps are almost exclusively used, and the fixtures are of special design to make them water-tight, and also on account of the vibration of the ship. The cables must also be of a special design to resist moisture; on American ships they are insulated with a high-grade rubber and suitable braid, and then protected with a lead sheath and metal armoured, while in the British Navy ordinary commercial standard, stranded, paper-insulated and armoured cable is used throughout on the ring-main system. Rubber insulation was abandoned some years ago. The electrical installation on a battleship requires from 75 to 100 miles of cable.

The signalling apparatus is a very extensive part of the electrical equipment, consisting of some 40 different systems, including ammunition-hoist indicators, turret telephones, gun-firing, fire-control, and engine-room telegraphs, fire alarms, torpedo-firing, wireless telegraph, &c. A number of these equipments are installed in duplicate, and are supplied with power from two sources. The systems operate on pressures ranging from the voltage of the power circuits down to 15 volts, used for call bells. Both A.C. and D.C. are used, the former and low-voltage D.C. being obtained from motor-generator sets.

One of the most interesting pieces of electrical apparatus on a ship is the Sperry gyroscopic compass (see Elec. Rev., June 6th, 1913). This has completely displaced the magnetic compass on the larger vessels and submarines of practically every navy in the world. Another interesting and important device is the high-intensity searchlight (see Elec. Rev., September 8th and December 15th, 1916). The size used on ships is 36-in. diameter, and throws a beam 40 miles, its candle-power is 320,000 per sq. in., and it has a beam intensity of 250,000,000 C.P. It has been reported that signals flashed with such a searchlight of 60-in. diameter were seen 150 miles away.

The arm of the Navy that is attracting more attention than any other at the present time is the submarine (see Elec. Rev., July, 1915). Each propeller shaft of a modern submarine is operated by an oil engine or motor, according to the conditions of operation, the oil engines driving the motors as generators while on the surface, and charging storage batteries, which in the submerged condition supply energy to the motors to drive the propellers. The main motors are of large size, varying from 500 to 800 H.P., and even larger, according to the size of the boats, and they are remotely controlled by automatic-contactor controllers from a central station. Each motor may consist of two units or a single unit, according to conditions. In addition, each submarine is provided with a large number of auxiliary motor equipments for operating pumps, air compressors, steering gears, diving gears, periscope-lifting gears, &c.; the horse-power of these auxiliary motors varies from 0.5 to 50 or 60 H.P., and the majority of them are operated by contactor push-button controllers. Submarines are also equipped with electric lighting, cooking, and heating devices, and complete sets of wireless and other signalling apparatus.

In addition to what has already been done, the American General Electric Co. has contracts for machinery for three battle cruisers of 32,000 tons displacement and 180,000 shaft H.P., and it is building electric propelling machinery for two cargo vessels, each of which equipments will deliver 3,000 shaft H.P. Some of the ship equipments are by far the largest ever made; each of the eight motors on one of the battle cruisers has four times the capacity of the largest motor previously built.

IRON AND STEEL ELECTRIC FURNACES.

By J. BIBBY.

(Abstract of paper read before the Manchester Association of Engineers.)

The subject of the reduction of iron ore is not without interest to this Association, as recent improvements in the reduction of iron ore electrically have come from this country, and the furnaces themselves, together with the electrical equipments, are mainly manufactured in the Manchester district.

On the average a blast furnace consumes one ton of coke per ton of pig iron produced. The electric furnace consumes one-third of a ton of coke, and requires one-third H.P.-year per ton of pig produced. For the cost of the two systems to balance, 1 H.P.-year must be supplied at the cost of two tons of coke. In many countries the balance is in favour of the electric system; there are already 17 electric reduction furnaces working, and 18 others are now being installed in Italy and Japan.

Electric pig-iron is a superior product to that from a blast furnace, chiefly because only one-third of the impurities are introduced by the fuel, and it is possible to maintain a basic highly fluid slag in the melting chamber, which facilitates the extraction of the sulphur; also electric pig-iron does not contain the oxides produced by the blast in an ordinary furnace. Fig. 1 shows the general arrangement of an electric reduction furnace, which to a large extent resembles an ordinary blast furnace.

There is a shaft and charging gear on identical lines with the blast furnace. In the electric furnace we have a hearth which is three or four times the diameter of the bottom of the shaft, which constitutes the melting and crude refining chamber. In the electric furnace the whole of the heat necessary for the process is generated electrically. The ore is fed through the usual bell and hopper arrangement at the top of the furnace, together with lime for slagging the gangue and coke solely for reduction. The whole of the reduction takes place through the affinity of oxygen for carbon being greater than its affinity for iron at certain temperatures.

Between temperatures of, say, 250 deg. C. and 500 deg. C. reduction of iron ore takes place as follows:—

$$Fe_3O_4 + CO = 3FeO + CO_2.$$

At temperatures between 500 deg. C. and 800 deg. C. the ferrous oxide is reduced by solid carbon as follows:—

$$FeO + C = CO + Fe.$$

The CO produced lower down the shaft is used for the reduction of the higher oxides further up.

The iron produced is in sponge form, and gravitates down to the crucible together with the lime and gangue; the crucible is not completely filled, but there is a space between the angle of repose of the material and the annular crucible roof. Into the material a number of electrodes are embedded, and these pass through holes in the crucible roof. On small furnaces of 2,000 H.P. there are four electrodes, on medium size furnace of 4,000 to 6,000 H.P. six electrodes, and on larger furnaces of 8,000 to 10,000 H.P. eight electrodes.

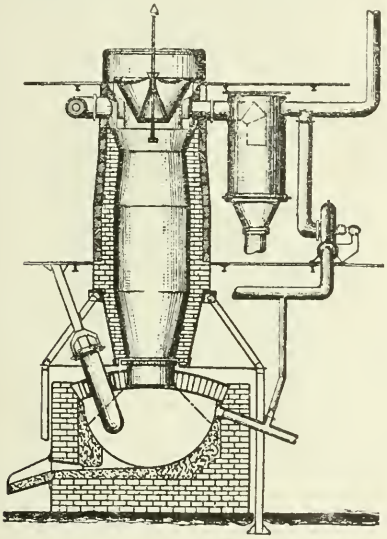

Fig. 1.—Electric Reduction Furnace.

The furnace comes under the class of solid resistance furnaces. For metallurgical reasons it is important that the heat should be generated throughout the circular zone as uniformly as possible, for unless this is accomplished we shall have undue destruction of the lining where there is an excess of heat, and where there is too little heat a deficiency in slag melting. This is a matter of the greatest importance.

Considering first the case of four electrodes, we naturally employ the Scott connection, in which the terminals of each transformer are connected to diagonal electrodes. In this case, whilst we get equal voltages between the two pairs of diagonal electrodes, it does not follow that the voltages between adjacent electrodes are equal; in fact, there is no reason why there should be any voltage drop between electrodes 1 and 4, and in that case no current, and therefore no heat would be generated there. The voltages between electrodes 1 and 4 and 4 and 3 will be equal, and equal quantities of heat will be generated between these two points, but the voltage between electrodes 2 and 3 will be 1.4 times the voltage between electrodes 1 and 2, and since the distances, and therefore the resistances, are the same, the currents, and therefore the heats generated, will be above the normal.

As the later furnaces became larger it was necessary to employ more electrodes, because, for one reason, up to the present the largest electrodes will only take about 1,000 KW. each, so we had to devise a system where eight phases could be secured in such a manner that the phases were at 45 deg. to each other. This was accomplished by a simple static transformer system which produces the heating effects shown in fig. 2.

The resistance in the crucible varies within wide limits, and it was therefore necessary to have tappings on the transformer which gave voltages varying from 20 to 50 between the electrodes and the neutral. No attempt is made to regulate the current, but all regulation is done on the voltage. The electrodes are not regulatable in the ordinary sense, but are simply dropped a few inches further into the material every few days. The electrode consumption is only about 6 lb. per ton of pig iron produced. Amorphous carbon electrodes have up to the present been used exclusively.

Practically the whole of the gas in the electric furnace is produced from the oxygen of the ore and the carbon in the fuel. There is no external gas supply as in the blast furnace, consequently the total amount of gas passing away is only about one-eighth of that from a blast furnace, but it has a calorific value from two to three times that of blast-furnace gas. This richness of the gas is valuable for heating purposes, and also for power, since engines of the same cylindrical dimensions will develop about 25 per cent. more power with electric-furnace gas than with blast-furnace gas. Another feature of the electric furnace is that about two-thirds of the gas issuing from the top of the shaft is re-introduced into the crucible between the charge and the roof. This gas passes through a dust extractor, washer, and dryer, and the circulation is produced by a regulatable fan. Every particle of gas generated, therefore, passes three times through the furnace. The object of the circulation is to cool the roof of the crucible and to convey the heat into the shaft, so that the material may be raised to a reducing atmosphere at about two-thirds the height from the bottom of the shaft.

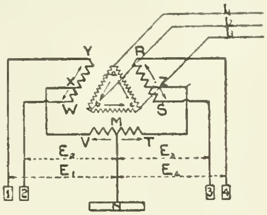

Fig. 2.—Method of Arranging Four-arc Furnace with Neutral Current.

The temperature of the hearth in a blast furnace is limited to the temperature at which the slag melts close to the tuyeres. The maximum temperature is about 1,800 deg. C., and this limits the melting point of the slag, and, in turn, the temperature of the hearth. In the electric furnace we have a temperature well above 2,000 deg. C., so that slagging materials, having a high temperature, can be employed, that is, we can have a more basic slag. The value of having a more basic fluid slag is that the sulphur is more readily extracted from the iron, and, in fact, with the electric furnace it is possible to produce pig iron which has only a trace of sulphur present. The pig iron from the electric furnace is most suitable for steel making, and consequently has a higher value than that from the blast furnace.

(To be continued.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

New Electric Cooking Apparatus.

We have received specifications of various new electric cooking apparatus manufactured by the British Electric Transformer Co., Ltd., Hayes, Middlesex, comprising the following:—A 12-gal. boiler, 26 in. × 15 in. × 12 in. in size, made of best tin-plate with double wall, air lagged; the loading being 3 KW., and fitted with three-heat control. The unit is complete with a control panel consisting of a cast-iron box, "Zed" fuse, and "Hart" switch giving three-heat regulation. The single tier steamer is similar to the boiler in construction, its size also being 26 in. × 15 in. × 12 in., and its capacity 56 lb. (potatoes). The illustration (fig. 1) shows a new boiling plate with ground top. The loading is 2½ KW., and its size 24 in. × 24 in. × 4¾ in. The fitting is complete, the control panel consisting of two three-heat switches and two "Zed" fuses.

Grill No. 586 is 36 in. × 12 in., and is made of sheet steel with cast-iron top. Each of the sections, of which there are two, is controlled separately, having a complete control panel fitted with two three-heat switches and two "Zed" fuses. The total loading is 4 KW., that is, 2 KW. per compartment. The frying pan is of cast-iron and loaded to 1 KW., while the fish fryer, 15 in. × 10 in. × 6 in., consists of a cast-iron oval pan and base loaded to 2 KW. It is nickel plated inside, and the control panel, consisting of a cast-iron box, is fitted with a "Zed" fuse and "Hart" switch, giving three-heat regulation. This fryer is also made in the size 18 in. × 10 in. × 5 in. All these articles are fitted with self-contained elements.

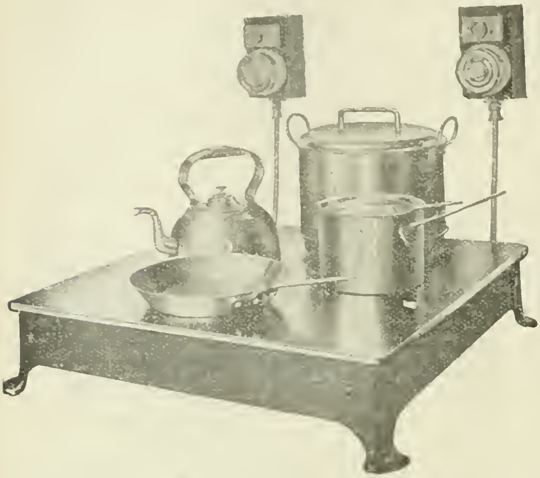

Fig. 1.—New Electric Boiling Plate.

A Spring Cable Drum.

The small spring cable drum illustrated below (fig. 2) is for automatically winding up slack flexible cable. Slip-ring and brush connections are provided, and any number of terminals may be fitted. The drum may be made up for winding by hand, with or without gearing, in any size and for any purposes. The London Electric Firm, of Croydon, makes all types of cable winches and drums of both wood and steel, for use with current-carrying cables, for colliery sinking pumps, mine pumping, inspection of shafts, tunnel boring, &c., and fitted with worm, spur, or their patented gearing, which is self-sustaining in all positions without ratchets or pawls.

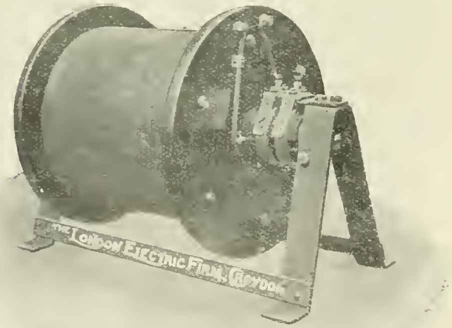

Fig. 2.—A Spring Cable Drum.

Arora Fires.

We have received from the Arora Co., of Loughborough, a new pamphlet dealing with heating apparatus. Now that restrictions are removed on materials, the company hopes rapidly to develop more cooking apparatus, and according to experimental work carried out during the last three years it is hoped that the ovens will be equally successful, and show as great progress as the firm's fires have done. Referring to our illustrations, fig. 3 shows a three-bar workshop fire, the consumption of which is 2¼ units per hour. These fires are built up by using the fire boxes from standard 2- and 3-bar Arora fires, heavy wire guards being substituted for the ordinary fronts. The W.I. brackets space the fires 1½ in. from the supporting wall. A small cast-iron cover protects the terminals. No flexibles or switches are supplied with these fires.

Fig. 4 shows a modified No. 1 two-bar fire, designed especially to withstand the rough handling in hotel use. It has a front casing of extra strength, back feet of wrought iron, and a wire handle which always remains cool. In summer these fires can be removed and stored in small space.

The dimensions of these fires are 11¼ in. high, 12¼ in. wide, and 7 in. deep. Their consumption is 1½ or ¾ units per hour. They are supplied complete with 2 yd. of heavy flex, 2 switches, and a wire handle.

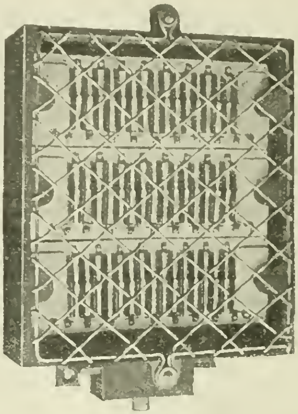

Fig. 3.—Three-bar Workshop Fire.

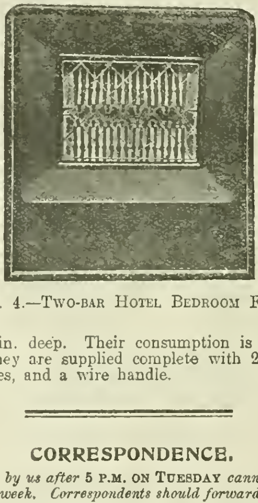

Fig. 4.—Two-bar Hotel Bedroom Fire.

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Early Wireless Telegraphy.

In the interest of historical accuracy, may I protest against the suggestion contained in your article on "Wireless and the War," that Mr. Marconi when he first arrived in this country failed to meet with sympathy in official circles?

This is very unfair to the late Sir William Preece, then Chief Engineer to the Post Office, who received Mr. Marconi with open arms, and gave him much technical assistance, including the use of a considerable sum of public money, which was expended in developing wireless telegraphy by numerous experiments carried out with the help of Post Office officials, including Mr. (now Sir) John Gavey.

Official sympathy with inventors is perhaps not very common, but there was certainly no cause for complaint in this particular instance.

A. A. Campbell Swinton.

Westminster, *January 25th*, 1919.

National Electricity Supply.

The letter of the Committee of the I.E.E. to the Rt. Hon. Sir Albert Stanley will, I believe, be read with astonishment and regret by the majority of electrical engineers who have at heart the reputation of "The Institution."

The Board of Trade reports are, it is generally agreed, full of imperfections. These the committee and its confederate interests are wisely prepared to overlook if they can thereby knock away the props of the whole structure through the carrying into effect of the recommendations contained in clause 7, sections (*e*) and (*g*) of the letter. Unless (1) general legislation be introduced, and (2) wide initiative be allowed to the Commissioners, it hardly seems worth while to summon five gentlemen "of the highest ability, knowledge and independence" from the presumably useful work upon which they are now engaged, in order to delimit their activities to the duties of the Railway and Canal Commission.

Ex pede Herculem, and in the reference to that body the cloven hoof is at once apparent to anyone who knows anything of the Commission's constitution and functions.

One gathers that the really progressive undertakings, whether municipal or company, would be subjected to an interference only to be tolerated if employed for the purpose of co-ordinating their arrangements in the interests of a national scheme, and that the "stand-patters" would be free (subject to the cumbrous and dilatory procedure referred to in clause 7, section (1)), to waste coal and hinder industrial efficiency to the worst of their ability.

It is to be hoped that the "Centres" will evince their customary independence of thought on this occasion, and that they will be stimulated further to demand from the Council a more democratic consideration of the opinion of the younger men of the profession, especially now that the Institution has, it would appear, abandoned its former aloofness from material matters.

Associate Member.

January 27th, 1919.

A Protective Association for Non-Technical Officials.

I was pleased to see "Non-Technical's" letter in this week's Review. I would like to point out, however, that the statement "we have no organisation to protect our interests" is not correct. The National Union of Clerks has many members who are non-technical assistants on the staffs of the following undertakings: Bristol, Brighton, Bermondsey, Bury, Battersea, Finchley, Fulham, Grimsby, Lincoln, Manchester, Poplar, Sheffield, Stepney, Southampton, and Swansea Corporations; St. Marylebone Electric Supply Co., Potteries Electric Co., Llanelly Electric Light Co., South Wales Electrical Power Co., &c., &c., and I venture to suggest that your correspondent should join this union, and thus have his interests protected. It would be absurd to start a sectional organisation for clerks in the electric power supply industry when the National Union of Clerks, with its increasing membership—at present 40,000—has all the machinery ready. Further, a guild system is now being formed within this union by which sections are formed for clerks in each industry, viz., colliery, Government, engineering, co-operative, Local Government clerks, &c. N.U.C. members in these industries can, therefore, discuss their own special problems when necessary. I think it is quite obvious that it would prove much more advantageous to clerks engaged in the electric power supply industry to become members of the N.U.C. and form a guild, than to start a sectional organisation, which could never be strong enough to have the numerical backing that appeals to employers. Further, by joining the N.U.C., if a clerk ceased to be employed in the electric power supply industry, and became engaged in a manufacturer's office, he or she would still retain their membership.

The N.U.C. is a progressive trade union affiliated to the Trade Union Congress, and only last week secured salary scales commencing at £45 for juniors, rising to £360 per annum for clerks engaged in the Swansea Corporation offices (including the electrical department). I suggest that all those interested write for full particulars to the head offices. 1, Brunswick Square, London, W.C., or to the following district offices:—

3, New Road, Woolwich, London, S.E., 18.
72, Market Street, Manchester.
63, Blonk Street, Sheffield.
95, Bath Street, Glasgow.
53, Queen Street, Cardiff.

There are branches of the union throughout the United Kingdom.

Power Company Clerk.

January 25th, 1919.

I have read with interest "Non-Technical's" letter in the Electrical Review of January 24th, and agree as to the necessity of co-operation. There is an association in being, *i.e.*, the Clerical Assistants' Association (electricity supply undertakings); if this could be strongly backed up and affiliated to the E.P.E.A. it would make for the good of all concerned.

Another Non-Technical.

I was very pleased to see in your last issue the letter from "Non-Technical" pointing out the necessity of forming an association to protect the interests of the men on the non-technical side of the electrical industry, *i.e.*, chief clerks, accountants, sales, and development staff, &c.

In the light of recent events, it is perfectly obvious that those men who are not in an association or union of some kind in the future will be working under a certain handicap, and, furthermore, I would mention that at the present time the whole of the staff and men employed by electric supply companies, corporations, and tramways are all eligible, and for the most part belong to unions excepting the non-technical side of the business as mentioned by your correspondent.

Any proposal to form an association on the lines indicated would have my sympathy and support, and I hope that my fellow clerks on electric supply companies will take the matter up as far as lies in their power, in order to further our common interests and future welfare.

Electric Supply Clerk.

January 24th, 1919.

Electricity Supply Progress.

I am much indebted for the space and attention accorded me in dealing with the above subject. It is also gratifying to find that, after making due allowance for your "prejudice," we are really in agreement in regard to many of the issues involved.

Electrical science has been one continuous process of evolution, and methods modern enough at the time of their adoption have long since become obsolete.

To be admonished at this stage that we "Have done those things we ought not to have done, and left undone those things which we ought to have done" is, I am afraid, but cold comfort to those concerned. The one and only point in your comments which strikes one as distinctly odd is your assertion that many municipal engineers "share your prejudice in favour of company control." This statement is all the more difficult to understand, inasmuch as many of our most prominent municipal engineers have been recruited from service with the companies. "No man can serve two masters." How, then, can these gentlemen work enthusiastically in the interests of employers whose methods are repugnant to them? The only obvious and honourable course is for any such men to go "back to the place from whence they came, there to——" serve (more loyally, let us hope) under congenial environment. Judging from your advertisement columns there are plenty of openings (cutting out, of course, those to which our friend, Mr. Abraham, has already drawn attention), and the "advantage" would be all on the side of the companies.

You may possibly be relieved to know that I do not propose to carry "my pig any further." He is a sturdy animal, and being quite an "unprejudiced" little porker, I am content to leave him to toddle the remainder of the distance unaided.

J. C. Williams,
Engineer and Manager.

Electricity Supply and Tramways Department,
Erith, *January 27th*, 1919.

[We thought that the point which strikes our correspondent as "odd" was a matter of common knowledge. Naturally, engineers in municipal employment do not advertise their private views on the subject, unless they happen to be in favour of municipal methods, but we have listened to many harrowing tales in private conversation, and it would be easy to draw up a list of one-time municipal engineers of standing who have changed over.—Eds. Elec. Rev.]

Engineer Surveyors' Salaries.

I have been greatly interested with the several letters in the Electrical Review concerning the above matter. For several years I was employed by a very prominent engineering insurance company as an inspector, and therefore know something about this question. During this period I had several small increases, sometimes £6 and sometimes £12 per year. As I was not satisfied with these small increases, I applied to another insurance company for an improved position, and was informed that I was not eligible, as the several companies had an agreement not to engage each other's officials. In fact, the poor inspector must continue to work for one particular company or leave this class of employment. This fact settled the matter as far as I was concerned, and, being fortunate at the time, I obtained a position as engineer to a private firm, where I have been treated in a much better manner. I have never regretted the step I took, and am now receiving no doubt nearly double the salary I should have been getting if I had stayed with the insurance company. I should very much like to know if the surveyors have received increases in their salaries in proportion to other branches of engineering. Perhaps someone can enlighten me on this point. I advise budding surveyors to keep clear, as I am certain they can do much better in other spheres, with the work less trying, and more consideration shown. I have sympathy with the writer of the letter signed "Electric," and advise him to change his job as soon as he can. It is a great shame that a man should spend the best part of his life, and not be appreciated. The engineer surveyors have the matter in their hands, and if they will form a strong association their salaries will soon increase by half, which I am certain they should do. The several insurance companies concerned will alter the conditions perhaps when they have lost the confidence of their clients through employing incompetent men at a low salary. I always found that the older surveyors were very competent and practical men, with the younger surveyors less competent. Perhaps the E.P.E.A. or E.T.U. will form a branch for the inspectors.

Old Inspector.

January 25th, 1919.

I fully endorse Mr. A. J. Abraham's letter. The salary offered—£150, plus £25 war bonus, with increases according to merit—is at present more than equalled by ordinary wiremen in certain districts, some of whom I wouldn't pay with iron washers, let alone money. These men get employment in all parts of the country, and install electric light and power circuits, under supposed contractors' supervision, in buildings that are afterwards fully insured. I can confidently state that it takes a good practical man, who has had years of experience in installation work, to know where to look for the likely bad work. It takes more than a testing set with a technical, trained man using it, to find it. Of course, it is essential that he be fully trained technically, otherwise he is useless.

All I hope is that they get the inspectors at the salary offered.

J. Cookson.

Blackpool, *January 24th*, 1919.

The Shorter Working Week.

I have read with much interest the letter in the current issue of your paper by Mr. H. H. Morton, referring to the shifts worked by the City of Manchester power station employés on the 47-hour basis. I note that an effort has been made to overcome the 12-hour change-over evil during week-ends, which I should like to see stamped out in London; but it puts another obstacle in the way in doing so. According to the tables set out in Mr. Morton's letter a shift hand may have a Saturday afternoon, a Monday night, and a Thursday morning off once in three weeks, but *never* does he appear to be able to get a *Sunday*. This, I will admit, will change the query of the kiddies as to "who the man is that is at home *sometimes* on Sundays?" but will replace it with, "Mother, who is daddy?" Surely some scheme can be adopted so that a shift hand has a Sunday off, say, once in six weeks at least. Another hardship lies with the relief man, who has to work the time the shift hand is off. What sort of week can he have when he had to dodge about on three different shifts each week? He gets in according to the tables 27 hours shift work as relief man spread over Saturday afternoon, Monday night, and Thursday morning (eight hours each), and Wednesday afternoon (three hours). How does he get in his other twenty hours during Wednesday and Friday unless he does ten hours each day in addition to the time he has worked on Wednesday afternoon, or, perhaps, he doubles back on Tuesday?

If he has to do this, I think he deserves his Sundays off. But how many men are willing to do it? Very few, I'm afraid. Another thing to watch is when men will be required to work reliefs for two jobs, as will no doubt be necessary in small power stations. Then it will be a practical impossibility for him to work on these lines. Some other method will have to be adopted, which no doubt can be done if only employers will take their staffs into their confidence in the matter, for what may suit the conditions in one station may be absolutely unworkable in another. To get over the whole difficulty, it is necessary to have six working days of eight hours in each week, with an occasional Sunday off, which should be at least once every six weeks. If this is not done, I can definitely state that much discontent will be caused in the London area, which, I think, everyone is trying to avoid.

William H. Streeter.

(*Financial Secretary*, Marylebone Branch, National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers.)

London, *January 25th*, 1919.

Electrical Contracting.

Apparently Mr. Fowler is of the opinion that only large firms such as the one he represents should be enabled to carry out electrical contracting; may I be allowed to put in a plea for the small contractor? in many cases a workman who has started in business for himself, and who therefore thoroughly understands his work. The supply companies have rules and tests, and if these are complied with, why worry?

G. Wallace.

London, W.C., *January 25th*, 1919.

Moisture in Low-Grade Fuel.

Mr. Morinan's letter of the 13th inst. refers to possible methods for removing the moisture from small fuel.

It would doubtless be interesting to many of your readers to know what proved methods there are already on the market for effecting this.

Perhaps those having information on the subject would be willing to communicate it through the medium of the "Correspondence" column of your journal.

F. G. Fryer.

York, *January 23rd*, 1919.

[Several letters have been unavoidably held over.—Eds. Elec. Rev.]

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

864 "Electric sparking plugs for internal-combustion engines." A. R. Kahl (A. A. Radke & O. M. Leich). January 13th.

888. "Generation of electricity in connection with internal-combustion engines or steam generating plants." C. W. Brock. January 13th.

889. "Cooling dynamos, electric motors, &c." C. H. Lauth. January 13th.

903. "Electrical apparatus for prevention of corrosion in steam boilers, &c." A. S. Gush. January 13th.

910. "Electric light sockets." H. H. Melaun. January 13th.

913. "Spark plugs." W. W. Bugh. January 13th.

919. "Telephone systems." H. G Shriveil. January 13th.

928. "Sparking or ignition plugs." E. Leymarie. January 13th. (France, April 15th, 1918.)

929. "Electrical measuring instruments." British Westinghouse Electric & Manufacturing Co. & G. A. Cheetham. January 13th.

955. "Electrical apparatus." J. C. Todman. January 14th.

965. "Variable condensers for wireless telegraphy and telephony." E. E. G. Boite & W. H. Edridge. January 14th.

967. "Magnetos for ignition purposes." E. A. Smith. January 14th.

989. "Sparking plugs." D. Douet. January 14th.

993. "Telephonic systems." E. A. Graham. January 14th.

1,009. "Electrically-driven vehicles." A. R. Angus. January 14th. (Sweden, January 14th, 1918.)

1,012. "Signalling and otherwise utilising radiant impulses." R. A. Fessenden. January 14th. (U.S.A., January 14th, 1918.)

1,044. "Trolley wheel mechanism of overhead electric tramway systems." W. R. Jenkinson. January 15th.

1,071. "Electric batteries." E. H. Naylon & S. F. Tyler. January 15th.

1,081. "Telephone systems." G. E. Tukner. January 15th.

1,115. "Sparking plugs for internal-combustion engines." V. Joly. January 15th.

1,123. "Resisters for electric furnaces." W. Travis & T. H. Watson and Co. January 16th.

1,129. "Electrified vibrator." J. A. Rawlinson. January 16th.

1,133. "Sparking plugs for electrical ignition systems." A. Ogden. January 16th.

1,155. "Series-wound electric motors." E. Stirk, G. Stirk, J. G. Stirk and R. Stirk. January 16th.

1,251. "Magnetos for ignition purposes." E. A. Smith. January 17th.

1,255. "Electric switches." R. B. Benjamin & A. N. Nilson. January 17th. (U.S.A., May 4th, 1918.)

1,259. "Translating a number of small reciprocating or vibratory movements into substantial unidirectional movement" Automatic Telephone Manufacturing Co. & S. R. Smith. January 17th.

1,266. "Combined electric switches and plug connectors." J. H. Farthing, J. B. Levee & M. J. Railing. January 17th.

1,271. "Electroplating." C. A. Bolton. January 17th.

1,273 "Wireless transmission systems." C. S. Franklin. January 17th.

1,283. "Means for securing electric lamp bulbs to holders." J. Condie and J. S. Jepson. January 17th.

1,293. "Electric nightlight battery with detachable lamps." S. W. Kent. January 18th.

1,343. "Protective gear for alternating electric current generators." British Thomson-Houston Co. & R. M Wilson. January 18th.

1,341. "Sparking plugs." J. A. Moreau. January 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

9,305. Ignition dynamos. C. T. Mason. June 28th, 1917. (121,812.)

14,481. Electric ignition apparatus for internal-combustion engines. J. Courtier & P. Courtier. October 7th, 1916. (110,549.)

17,296. Test sheath joint for electric cables. C. J. Beaver, A. F. W. Richards & E. A. Ciaremont. November 23rd, 1917. (Addition to 15,821/17.) (121,623.)

17,300. Carbon brushes for dynamo-electric machines. Morgan Crucible Co., C. Y. Knight & W. N. Wilson. November 23rd, 1917. (121,624.)

17,301. Carbon brushes for dynamo-electric machines. Morgan Crucible Co., C. Y. Knight & W. N. Wilson. November 23rd, 1917. (121,625.)

17,529. Vacuum electric discharge devices. British Thomson-Houston Co. (General Electric Co., U.S.A.) November 27th, 1917. (121,627.)

1918.

662. Electrical replaceable fuses. M. H. Goldstone. January 11th, 1918. (121,651.)

1,948. Sparking plugs for internal-combustion engines. F. A. L. Johnson. February 2nd, 1918. (121,663.)

2,081. Electrical fuse boxes. W. T Henley's Telegraph Works Co. and E. E. Judge. February 5th, 1918. (121,664.)

3,420. Process of making iron and steel in electric furnaces. E. Humbert. February 26th, 1918. (121,674.)

4,336. Electrical contact-making and breaking apparatus. British Thomson-Houston Co. & A. P. Young. March 12th, 1918. (121,680.)

5,319. Process for removing rivets and cutting metal by means of the electric arc. Soc. Anon. l'Acetylene Dissous du Sud-Est. May 30th, 1917. (116,890.)

13,459. Electric burglar alarm systems. H. J. Tibbles & T. Gunn, Ltd. August 19th, 1918. (121,713.)

14,242. Safety device for the oil tank of electric transformers and other electric apparatus. Akt.-Ges. Brown, Boveri et Cie. September 1st, 1917. (119,230.)

17,277. Method of and apparatus for electrical treatment of gases. L. Bradley. June 21st, 1918. (Divided application on 8,926/17.) (120,573.)

"A.E.G.": Anathema Expected Generally. — At a meeting in Brussels, last week, of the Société A.E.G. Union Electrique, it was decided to drop the three letters A.E.G., which denoted a connection with the Berlin A.E.G. concern, from the title of the undertaking.

THE
ELECTRICAL REVIEW.

Vol. LXXXIV. FEBRUARY 7, 1919. No. 2,150.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
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ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch 132, Bay Street
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving his copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICALS REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE EXPORT VISION.

It seems to us that the time is at hand when somebody should begin a powerful "drive" to bring home to the millions of workers of these islands how immensely important the development of export trade is to the entire nation. We have devoted a great deal of attention to the need for organisation among manufacturers and traders; have urged the most complete study of the markets and the peoples to which and to whom we want to sell; have seen the need for impressing upon the purchasing world how extensive and how efficient is the manufacturing capacity of British factories. We have appointed His Majesty's new Trade Commissioners, whose activities will, no doubt, produce results—in course of time; we are supposed to be developing plans for putting the British Consular Service into such a state of usefulness as has been seen as a far-off vision by many of us for decades, though until we have direct evidence to the contrary we shall be unable to shake off our fears that the effort is half-hearted; we see co-operation developing between Government Departments and manufacturing organisations for the furnishing of information which being partly Government-collected ought to be common knowledge for all firms. Yes! we are doing a great many things—some of them excellent, some of them unproven in regard to effectiveness—and we hope that the fullest measure of success will attend them all. But remembering all that is enterprising and all that is good in our record of achievement or of promise during these last few years, have we done all that we ought? Have we made a strong effort to remove the ignorance of the masses in regard to the vast opportunity that is open to us as a great exporting nation in supplying the requirements of a world whose needs, after nearly five years of unparalleled shortage, are more clamant than they have ever been before?

Is it too much to say that we are allowing ourselves, as a people, to foster the industrial-unrest spirit by failing to advance popular constructive propositions? Everybody is asking for more money, for less work, for better conditions, and unless we inaccurately gauge the position only a very small percentage care one rap whether or not industry will receive from them in return a greater efficiency or a larger output from which to pay the cost of these improved earnings and conditions. Can we not immediately correct this frame of mind by appealing to the imagination of the workers in such a way that they will see the export fields white unto harvest with orders for their employers' books and for their own hands? It is sometimes said that the employés have in few instances any interest in anything beyond the particular piece of handiwork that they contribute to the production work of the business; they are prepared to do that for so many hours, take their meals, draw their pay—and there's an end on't. We are disinclined to take that view. We do not think we misunderstand human nature to-day when we say that it ought to be easy to secure their active interest in a business through bringing to their minds visions of the scope that there is for that business and the benefit that it can bring to them. There is a widespread demand for what is termed a measure of "control" to be accorded to the workers: up to a point, and within their capacity, it is legitimate enough. Call it co-partnership, profit-sharing, a widened interest, or whatever we may—there is the demand, and it is stronger than it ever was before, and the altered times have given it a stronger backing of reasonableness. But this sort of thing inevitably implies increased responsibility and duty, and requires hearty co-operation, so that greater success may be secured with benefit for all. Too many of the present demands of labour are advanced irrespective of whether industry can meet them and survive. That is the curse of the present movement from the employment point of view, and if it cripples industry for years where shall we all find ourselves? Cannot we strike a new note by inducing the employés of all our undertakings to cultivate a world vision? How fascinating is the story that could be placed before them had they but ears wherewith to hear! how fine the vision had they the mind wherewith to see! They worked like fury in some cases during the war because there was the fear of defeat by a group of enemies whose teeth were set, and whose hands were soiled with vice and dripping with innocent blood. Can they not be induced to work with a will to-day if we put before them, as we have never really properly done, the vision of industry made prosperous and labour well paid and contented, the vision of economic disaster defeated, by a common determination and effort to make and sell the hundreds of millions sterling value of goods and articles that the world is looking to the manufacturing nations to produce for it? In many a factory there are times when the workers are called together to listen to "talks" from those under whom they serve. How many such occasions there have been here and in the States when employés have been called together and interested in War Loan, works welfare, and other such matters! Where is the manager or director who will call the employés together and tell them, with popular and happy phrase, the story of the world as it is to-day in relation to the class of goods that they are daily making?—the emptiness of the shelves of the stores of all great cities abroad; the arrears of work waiting to be done; the overloading of existing facilities as they creak and groan, overborne and unrepaired, because they are waiting for others like themselves to come from the British factory to render assistance; the vast territories throughout the world waiting for development; the openings for railways, for hydro-electric utilisation, and so forth. Nobody who has had any long connection with, or travel in, a foreign market, loses the broader-mindedness that such experiences and operations give him. They are interests that remain and linger long, especially if they have struck the imagination in its earlier impressionable years. They are worth having, and the incidents surrounding them are worth the telling. Surely we have plenty of men who could put the intimate touch and humour into such a "chat" that would give all in a business a new interest therein.

From our own position we have studied the export possibilities during the war, as we have received innumerable appeals from different parts of the world, and we say, with conviction, that the situation is such that only good can result from letting our people, one and all who will listen, know how ripe the harvest is if they will only throw themselves heartily, and in the right spirit, into the work that awaits them, instead of nursing "grievances" and spreading the deplorable spirit of unrest and discontent. Attention needs to be diverted to more useful channels in the interest of the people themselves; the scales of self-interest are over too many eyes, and important things are lost to view in consequence. Of course, there are questions respecting national policy for safeguarding our Home Trade, and in that way assisting us for more efficient export enterprise; but those are being dealt with pretty well all the time to-day. We are concerned here and now especially with the education of the worker respecting the possibilities that the world presents. Let us add to them the arrears of work that must occupy us at Home, too. We have tried it ourselves and observed the effect; the information given by authorities on such matters is not resented. One more word: let us encourage the export interest and spirit in the ranks of clerical and other juniors who are in the warehouses and offices of our electrical trading and manufacturing concerns in London and in all the big cities of the United Kingdom. Let us give *them* the vision so that they will learn the languages, the weights and measures systems, the tariffs, and other parts which go to make up the exporters' compendium of information. They and the nation will gain thereby. Bread cast upon the waters may return in some cases *before* many days—as well as *after*.

Strikes and the Supply of Electricity.

The fact that workmen responsible for the supply of electricity have joined the ranks of the strikers in Belfast portends a serious menace to industrial peace. The public who are served by electrical undertakings may well ask: "How comes it that workmen, to enforce a claim for higher wages or shorter hours, can deprive us of light and heat?" A complete answer to this question would be a long business, which might involve us in a perfect maze of political controversy; but a partial answer may be found in the Statute Book. It seems as if the worker at the generating station has discovered that he is in a more favourable position than the man employed at the gas or waterworks. By the Conspiracy and Protection of Property Act, 1875, Sec. 4, if a man at a gas or waterworks "wilfully and maliciously breaks a contract of service . . . knowing, or having reasonable cause to believe, that the probable consequences of his so doing, either alone or in combination with others, will be to deprive the inhabitants of a city, borough, and . . . . wholly, or to a great extent, of their supply of gas or water," he may be convicted and have to pay a fine not exceeding £20, or go to prison for three months. That Act was passed in 1875—before public electricity supply was born or thought of; but there it was "on the book," and ready to be copied into the Electric Lighting Act, 1882. Yet it never was! We are not aware that the powers conferred by it have often been invoked. At any rate, "Stone's Justice's Manual" records no case where the terms of the Act have been discussed in any Court of law. On the other hand, it is a matter of common knowledge that a strike at a gas works is a very rare occurrence; and it may well be that until the spirit of unrest which has now over-run these islands made its appearance, the deterring power of this Act of Parliament, although mild, was sufficient to prevent strikes. One may be permitted to wonder whether the Government will have sufficient courage to put it in force—and to wonder, further, whether we may expect it to be extended to the supply of electricity. Electricity used to be looked upon in the very early days as the bitter rival of gas; but the progress of time and science has shown that they are not only not rivals, but interdependent and equally important to the community. If the man whose task it is to fill the retort throws down his shovel and goes home, his offence is no more serious than that of the switchboard operator whose breach of contract leaves a whole town, with its hospitals full of wounded men, in cold and darkness. It may be a constitutional defect, but it is quite impossible for the editorial mind of this journal to imagine any dispute between employers and workmen being of such consequence as to justify methods of this kind. It constitutes, in our view, an attempt on the part of the workmen to apply the doctrine that "Might is right"—a doctrine which we should have thought had been sufficiently flouted on the battle fields of Europe during the last four years. Should the Government take the necessary steps to stop this particular form of industrial warfare, we are confident that it would have the support of the great majority of the community.

Strikes in London.

Since the foregoing was written the London electric railways have been compelled to cease running, owing not to the official action of the executives of the trade unions concerned, but to the unauthorised and disorderly caprice of a small minority, in defiance of a decision arrived at by the trade unionists in conference to await the result of the meeting with the Railway Executive Council next week. Moreover, the London Branch of the Electrical Trades Union has declared its intention to cut off the supply of electricity to London on Thursday evening, February 6th, for the avowed purpose of forcing the Government to intervene "in the Labour disputes of the Clyde, Belfast, London, and other places, with a view to instituting legislation making operative a national 40-hours' week, *with the object of absorbing all the unemployment in the country*." The words which we have italicised are pure hypocrisy: unemployment has nothing at all to do with this or any other strike which is at present in progress in the country. The Executive Committee of the Amalgamated Society of Engineers has appealed to all its members in the London area to ignore the decision of the E.T.U. to strike, and the London Branch of the E.T.U. is in no way concerned with the movements at Glasgow and Belfast.

In fact, this threatened strike and that of the drivers of electric trains are strikes against organised Trade Unionism just as much as they are strikes against the public in general; they are part of the Anarchy offensive which is being promoted by the enemies of the State; they lead nowhere, and will produce no result of advantage to any party. It is the duty of the public to defeat them by maintaining a calm demeanour and steadfastly enduring the inconvenience inevitably arising out of this attack upon it. On no account must any concession be made—if the threatened electrical strike takes place, let it be fought out *now*. Otherwise London will be for ever at the mercy of the Bolshevists who control the Electrical Trades Union in London.

We note with pleasure that the Electrical Power Engineers' Association has declared its intention of keeping the London generating stations running, and that the Government has announced that it will take over the stations and run them with voluntary aid. We are certain that many of our readers resident in the Metropolitan area would gladly take part in this work for the public benefit, and we invite them to communicate with us; giving the addresses at which they can be most quickly located, by day or night (with their telephone numbers, if possible), in order that we may be able to put them in touch with the authorities. We would particularly emphasise the extreme urgency of the matter—a reply to us AT ONCE is necessary, in order to be of service. We refer to the matter also in our "Notes."

When Shall we Have Them?

BEFORE the war, when they were not so necessary, reports from British Consuls came in with frequency—weary with the weight of years sometimes, it is true, though bearing signs of resting on the way between Government departments, but they came—and in these pages we made such use of them as we thought well in the interests of the electrical and engineering trade. To-day a British Consular report is a rare thing, yet in preparing for future trading operations we need them more than ever before. Occasionally we see extracts from brief Consular advices in the *Board of Trade Journal*, such as we reproduce to-day regarding Brazil; but, seeing that the Armistice was signed as long ago as last November, we think it high time that the British trader had at his disposal some larger evidence that His Majesty's representatives are at work. We believe that there is a series of special reports preparing, and the sooner they are available the better. Our four original Trade Commissioners have served us well, but the others should not let the grass grow, even though the cables are subject to delay.

Telephone Efficiency.

COMMENTING on the new Ministerial appointments, the *Times* remarked recently that, in the opinion of City men, the "weak spot" was regarded as the Post Office, "where Mr. Illingworth, who has hitherto given no sign of directive capacity, will, it is hoped, now make an effort to give the country a more efficient telephone service." We hope, indeed, that he *will* do so, for a change is badly needed—though we must confess to certain doubts as to whether it makes a bit of difference whether the Postmaster-General is a genius or a juggins—the Department is run by the permanent staff, headed by the Secretary, and the Postmaster-General is a more or less ornamental figure-head. Unfortunately, the technical staff of the Department is in much the same position as the nominal chief—under the thumb of the administrative staff—a fact which makes us disinclined to severity of criticism. Moreover, the difficult conditions under which the engineering work has been carried on during the war, imposing heavy burdens on the personnel, disarm the hostile critic. But still, facts cannot be ignored: and while our attitude towards the telegraph and telephone branches of the Post Office must be, for the reasons above stated, a benevolent one, we are bound to recognise that these services have deteriorated to a very serious degree, and that they are now in a condition very far from efficient or satisfactory.

The public, doubtless making allowance for the circumstances, has been very patient; but lately numerous complaints have appeared in the lay Press with regard to every branch of communication—inland and foreign telegraphs, trunk and local telephones—alleging, with the support of unquestionable evidence, that the extraordinary delays which occur and the bad quality of the telephone service have reached an unbearable pitch. Our own experience, we regret to say, bears out these allegations: the service, all round, is slow, the telephone circuits are extremely noisy and often crossed, and the speaking is sometimes unintelligible, while the number of failures to "get through" is altogether too high a proportion.

As we have said, we make these remarks in no unfriendly spirit; we know what grave difficulties the staff has had to fight against, and we confine ourselves to stating the bare facts. From time to time excuses are emitted by "an official of a Government Department"; but the public does not want excuses, but service. There is a tremendous task awaiting the Department—to raise the service, not merely to its former state, but to the highest level of efficiency attainable, and quickly.

Engineering Training.

THE Engineering Training Organisation, which was founded in October, 1917, has not hitherto been much in evidence; but we understand that a good deal of preparatory work has been accomplished, the ground to be covered has been surveyed in readiness for the assumption of active functions, and the time has now arrived when the voluntary services of the honorary organisers—Mr. A. E. Berriman and Mr. A. P. M. Fleming—can no longer cope with the requirements of the Organisation. Hence the Executive Committee is advertising in our columns for an Engineer Secretary, who is to be a first-class man, and therefore is offered an adequate salary.

We cordially welcome this first step as a happy augury for the future of the Organisation; the secretary will be the motive force of the new institution, and on his ability and energy hang its prospects of fulfilling the functions for which it was established—functions of the first importance to the future of the engineering industry. At the same time, the Committee is assuming a heavy financial responsibility, and the inevitable question arises—whence shall the necessary income be derived to meet the cost of staff and office accommodation?

Naturally, the answer is that those who stand to benefit most materially by the work of the Organisation ought to foot the bill—namely, the members of the industry itself. The movement was heartily welcomed by engineering firms, and has already received generous support from the Engineering Institutions, by means of which the initial expenses have been defrayed; but the total amount subscribed was little more than £1,000, and over £150 has been expended. Obviously, what is needed to ensure the success and permanence of the Organisation is a regular income, the amount of which, when distributed over the whole industry, is insignificant in comparison with the resources at the disposal of the engineering community. We are confident, therefore, that engineering firms, recognising the value of the work that will be done by the Engineering Training Organisation, will consider it incumbent upon them to place its finances upon a sure footing by undertaking to contribute annually the small quota required for this purpose.

ELECTRICITY AND PHOTOGRAPHY IN WARFARE.

By HARRY MOSS, late R.E.

Having recently returned from France, where I have been attached to a photographic section of H.M. Armies, it may be of general interest if I place on record a few particulars of the work of these sections, and the part played by electricity and engineering in carrying out their functions.

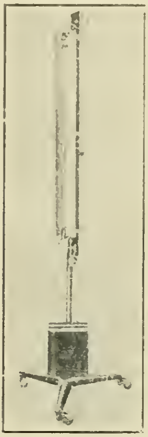

Fig. 1.—Cooper Hewitt Photographic Lamp.

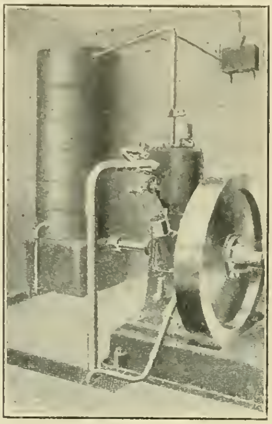

Fig. 2.—Gardner Petrol Engine.

It must be clearly understood that these sections are not responsible for the actual taking of the photographs, as this duty falls on the Royal Air Force. The photographs cover quite a large range of subjects—such as front line and support trenches, panoramas of large tracts of country, large mosaics or photographic maps of certain parts of the country, "aerials" of particular spots, enemy gun emplacements, bridges and railways before and after bombardment, roads, &c.

The duty our little party had to perform was to turn out copies of these photographs in large numbers and very quick time, working, when necessary, night and day, to get the work turned out in time to be of service for the particular military operations they were required for—whether it was for operations on a large scale or for local raids or artillery work. To give some idea of the magnitude of the operations these small isolated and almost unknown "sections" of the Army carried out, I may say that work equal to 23,000 full-plate photographs was turned out in 36 hours for one of the big blows dealt at the enemy last August.

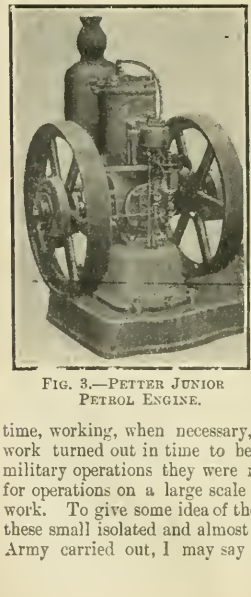

Fig. 3.—Petter Junior Petrol Engine.

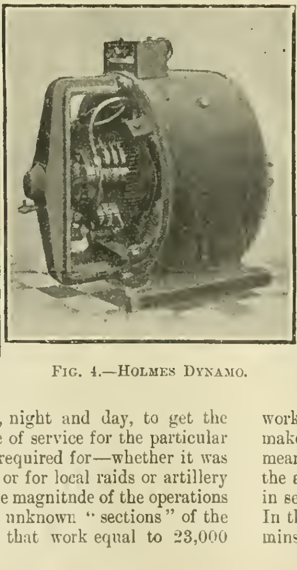

Fig. 4.—Holmes Dynamo.

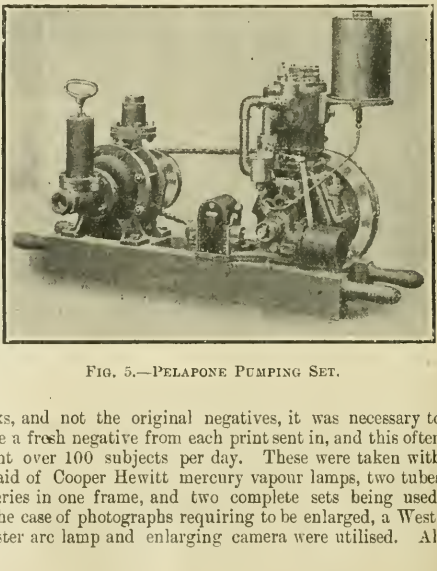

Fig. 5.—Pelapone Pumping Set.

Having gone so far to show the extent of the work, we now come to the means of carrying it out, and this is where electricity and engineering played their part "in the game."

As these photographic sections have to move with the Armies, the apparatus is often being dismantled, moved, and re-erected, and as the conditions vary with every move, retreating or advancing, the plant is put to work under a variety of conditions; sometimes the generating plant is resting on a few piles driven in the ground, and at other times on a good solid concrete foundation.

The plant I was in touch with consisted of one Gardner 5-h.p. petrol engine, direct-coupled to a 3-kw. Holmes generator running at 500 r.p.m. These machines were, of course, mounted on one bedplate. A second set consisted of a Petter Junior petrol engine, direct-coupled to a 3-kw. Holmes dynamo running at 725 r.p.m., on a common bed-plate.

The working voltage in the depôt was 110, and as a steady light was very essential for the photographic work on account of the time for exposure, for printing, equalising, &c., the supply to the depôt was always taken from accumulators, of which we had two complete batteries, which were used alternately, one being charged whilst the other set was being discharged.

These batteries were generally accommodated in a room or hut near the engine room, and complete control of the whole installation was obtained by a switchboard in the engine room, fitted with the usual meters, charge and discharge switches, change-over switches for switching in or out either generator on to either battery, and also for switching either battery on to the works.

All outgoing circuits were controlled by switches and fuses on the main switchboard, and mercury vapour lamps, general lighting and night-light circuits, &c., were all separate.

The batteries were put up in teak boxes, lead-lined, and fitted with lids, and each set had a capacity of 190 ampere-hours. These had a fair amount of rough usage during the various hurried removals, but kept up to their work very well.

As photographic prints of each subject were sent to our works, and not the original negatives, it was necessary to make a fresh negative from each print sent in, and this often meant over 100 subjects per day. These were taken with the aid of Cooper Hewitt mercury vapour lamps, two tubes in series in one frame, and two complete sets being used. In the case of photographs requiring to be enlarged, a Westminster arc lamp and enlarging camera were utilised. All printing from negatives was done in special printing boxes, lighted either by half-watt or ordinary M.F. lamps, and the same remark applies to the equalising boxes.

After being printed, developed, fixed, and washed, all prints were hung up in a drying-room heated by slow-combustion stoves and spirit flares, and the air was kept moving with two 12-in. electric fans. As the temperature in this room was generally about 120°, the prints were dry and ready for the cutters in a very few minutes.

The water supply was generally obtained from a stream near which the works were always situated, and the water pumped up to a supply tank with a Pelapone pumping set consisting of a petrol engine driving a turbine pump by means of a V-shaped belt, the set being mounted on a wooden frame, and so arranged that when the pipes were disconnected, it could be picked up bodily and carried. The water supply tank was generally fixed on a wooden structure near the main shed or building, and the water supply to all the washing sinks was run in screwed iron pipes, although a quantity of hose pipe was used for connecting up to the pump and tank at various times. The quantity of water used would be about 2,000 gallons per day.

Floats and indicators were used in and connected to the supply tank, and arranged with electrical contacts either to ring a bell or switch on a coloured light when the tank was either full or empty.

The general lighting of the depot, which consisted of dark rooms, cutting room, stores, office, engine, battery and pump rooms, dining room, billets, &c., was carried out with ordinary M.F. lamps, and the general wiring was carried out on the cleat system, this enabling dismantling and re-erecting to be carried out in a very short time; I have known the plant to be dismantled and taken across country 30 or 40 miles, photographic work being resumed in something like 48 hours. This, of course, was with a good deal of very temporary work, but the "military machine" had to be kept going, and the work of making a fairly decent job of the general installation had to be done whilst the place was kept working; very often as soon as it was a bit straight another move would be ordered. However, as the production of these photographs in an efficient and quick manner very often meant the saving of thousands of valuable British lives and the destruction of those of the enemy, everybody worked with a will for a definite purpose.

The engineering staff consisted of another R.E. and myself, and the total works staff only amounted to 25, including officer, N.C.O.'s, engineers, dispatch rider, cook, storekeeper, and photographers.

The illustrations show some of the plant as used and described, and I might also add that the switch used for the firing of the mines at Messines Ridge eventually found its way on to our switchboard.

Such is a short account of one of the many cases where engineering and electricity, in particular, have come to the aid of our Armies, and have been used to advantage in helping to beat the Hun and save civilisation from a fate that was too horrible to contemplate.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Below we give a further list of contributions received in response to the appeal made by Mr. Hunter (the chairman):—

	£	s.	d.
J. Rawlinson, Jun. ..	1	1	0
J. H. Golding ..	2	2	0
J. Owing	1	1	0
Electric Control Co. .	1	1	0
Geo. Cooke & Co.		10	6
J. Smith & Sons	1	1	0
W. J. H. Wood	1	1	0
R. T. F. Hearn	1	1	0
A. B. Cousins	1	1	0
H. J. Cuates		10	6
S. E. Hunt		10	0
J. Bernerd		10	0
Thames Paper Co.	10	0	0
Sterling Boiler Co. ...	10	10	0
Bexter & Impy	1	1	0
Sec.-Lieut. R. O. Kapp, R.E.	1	0	0
C. V. Hill	1	1	0
A. R. Mundy	1	1	0
J. Evans	1	1	0
J. Evans	1	1	0
M. Curran	1	1	0
D. H. Bonnella & Sons	1	1	0
Lt. W. Burton, R.E. (T.)		10	0
J. M. Crowdy		10	6

ELECTRICAL DEVELOPMENTS IN NEW ZEALAND.

By WILSON ORMROD, A.M.I.E.E.

There is probably no part of the British Empire overseas that offers a more promising field for electrical development than does New Zealand. It is equally safe to assert that no part of the British Empire has greater spending power per capita, or is more anxious to get its natural resources opened up. New Zealand possesses latent water power in so many different places, and in such quantities, that its full utilisation is not likely to be achieved for many generations; the call for its development is general from the extreme north to the extreme south, and it is both urgent and insistent.

The success that has attended the first hydro-electric venture of the Government—the Lake Coleridge to Christchurch scheme—has only whetted the public appetite. The people looked askance at it for a time, and doubted if it could be relied upon; it took six months to overcome prejudice, and then the output rose from under 5,000,000 units the first year, 1916, to over 14,000,000 units in 1917, and the load since has been fixed not by the demand, but by the capacity of the plant, and the impossibility of augmenting it under war conditions.

The Government controls the right of utilising the water power, and is definitely committed to developing it as soon as conditions allow, and it has already laid its plans for certain schemes, so that they may even be moving forward by the time this is in print—facilities for procuring the material are all that are required. Certain public bodies and private syndicates are also seeking to acquire the rights to develop power where the Government cannot yet undertake it. The tunnel on the Midland Railway to the West Coast of the South Island is pierced, and should be completed and ready for the electrical equipment in 12 months' time.

From the foregoing it may be gathered that, in a general sense, the electrical development of New Zealand will be on hydro-electric lines, and there is not likely to be any great demand for steam generating plant, boilers, and auxiliaries. Coal is dear, and the best of it is not found near the cities; labour and transport are proportionately dear, as well as uncertain, and all the factors require that the natural resources involving the minimum of labour should be utilised. Above all, the general public are alive to it. Natural development has been restrained for the past four years, and there is plenty of leeway to make up.

The first object of this article is to convince the British manufacturer, if he needs convincing, that New Zealand offers a field for his product, and one well worth cultivating—the majority appears to be content to supply markets nearer home. Possibly the more enterprising will come further afield, for the demand is steady, the sentiment British, and a country that depends upon its primary products is not liable to extreme fluctuations, such as a manufacturing country experiences, at intervals.

From time to time there have been published in the Electrical Review statistics of New Zealand imports, articles on schemes contemplated or in operation, and sections of the excellent annual reports of Mr. R. W. Dalton, H.M. Trades Commissioner, and I have, therefore, more particularly to indicate the types of material most in demand and the competition to be met.

Bearing in mind always that the principal sources of energy will be hydro-electric stations, not supplying one point a long distance away, but feeding a number of points over comparatively large areas, there will be the power equipments, turbines, pipe lines and control gear, generators, transformers, switchgear, transmission lines and protective apparatus, insulators and pole equipment, sub-station plant, underground feeders, converters, and so on, these forming the principal portion of the material that will be required for supply in bulk as distinct from that necessary for the reticulation and utilisation by the consumers. Many of the sub-stations will be of the outdoor type, consisting of transformers and protective apparatus, with section and isolating switches all mounted on a pole structure: in many cases the sub-station building, as generally constructed in Great Britain, is not justified by the demand, and is quite unnecessary, and the English type of cast-iron, totally-enclosed switchgear, originally developed for mining work, is far too expensive, both in works cost and importing charges on account of its weight and bulk. Up to the present British manufacturers do not appear to have studied the pole-type sub-stations, and have not laid themselves out to equip it, with the consequence that the American manufacturers have got a good hold.

The consumers' apparatus, especially for domestic supply, follows much on the lines of that used in Great Britain, except possibly that, owing to the difficulty of getting domestic help, there is a greater demand for labour-saving appliances, and there are few houses with an electric supply where an electric iron, at least, is not to be found.

Manufacturing is not carried on to a great extent as yet, and the farmer is the backbone of the country; nevertheless, manufacturing will undoubtedly follow quickly on the supply of cheap electric power; the largest existing works to be adapted to the new supply are those owned by the freezing companies, where sheep by the thousand and cattle by the hundred are dressed and prepared daily for export for about nine months in the year. The refuse from these works is the basis for the manufacture of manures, for which there is a good demand, and alongside these will spring up works for the fixation of atmospheric nitrogen and various chemical processes such as the production of caustic soda, common salt, &c., the present supplies of which are brought from Europe. The combination of the tallow from the freezing works and the caustic soda suggests the manufacture of soap on a large scale; the nitrogen products, other classes of manures possibly in combination with those now made, calcium carbide, explosives, and so on.

Dairy factories, flax mills, timber mills are the next largest consumers that are more or less common to all parts of the Dominion, whilst in particular districts there are woollen mills, tanneries, flour mills, with an occasional special industry. The farmers are much more ready to adopt electric driving and lighting than is the case in Great Britain, and they will themselves form a market for small motors, up to about 5 H.P., for shearing, milking, separating, churning, pumping, &c., as well as lighting and heating appliances. In the cities and boroughs, most of which already have electric supply of some kind, conversion of the existing system is the first step, and development will follow; ultimately the railways will be electrically operated for suburban traffic at least, with probably some of the more difficult sections of the main lines, and this in itself is a promising field, if for no other reason than the high cost of coal.

Electric vehicles, both for delivery of goods in the towns and to some extent as private vehicles, are making good headway, and as all benzine for motor vehicles has to be imported, the cost of it is such as to make the electric quite a good proposition. Practically all the electric vehicles are of American make, fitted with Edison batteries, and they have been so uniformly successful that their more extended use is certain.

The city electrical engineer of Christchurch has set something of a standard in charging rates for tradespeople using electric vehicles for delivery purposes, with the result that other centres are following his lead; the tradesman provides the truck the City Council garages it, charges it, and maintains the electrical equipment at the following charges—½-ton truck £40, 1-ton £45, 2-ton £55.

These figures are based upon 300 working days per annum and an average of 40 miles per day, and they work out to 6.66d., 7.4d., and 10d. per mile respectively, allowing for man's wages at local rates, insurances, depreciation, and interest on outlay.

Compared with the motor truck using benzine at 3s. 6d. per gallon, the electric has decided advantages.

Incidentally, it should be observed that even in these high-priced articles (the 1-ton truck costs over £1,000 to the user) the American manufacturer lays himself out to give quick delivery, often from stock or shipments already at sea.

Before leaving this phase of the subject, the country's requirements, it may be noted as a matter of interest to the electrical trade, that the telephone systems throughout are being gradually converted to automatic working, and, although the work has been hampered by the events of the past four years, yet progress has been made even in that time, and plant is installed in the four main centres, as well as in a number of the smaller towns, and will shortly be in operation.

During the past four years supplies have been limited here, as elsewhere, and as the stocks of British material have been worked out recourse has had to be had to American and Japanese material. Let it be said at once for the American manufacturer that the bulk of his product is good, and that his motors especially are excellent, both in quality and finish; he has, further, had the foresight to stock his agent well, and has obtained a large share of the trade simply because he could give immediate delivery, whereas the English agent could only promise indefinite delivery, and only in rare cases from stock.

This is a strong point; it is even stronger than the question of price, because it should be noted that the American motor is not a cheap article. The Americans have also put out some very excellent small motors for special work, as for instance, sewing machines, pumping, portable motors for general farm work, &c., and the bulk of the irons and heating appliances is either American or Canadian make, and is of good grade. The use of American material has also, to some extent, encouraged the adoption of standards not common in England, so that lamps and lampholders, wall sockets, &c., with Edison screw threads have become by no means uncommon, and once they have been used, in contrast with the standard English bayonet-cap connection, one is compelled to admit the good points of the screw.

The Americans have also put into the New Zealand market some really excellent types of self-contained lighting sets, generally about ¾ KW., and with 32-volt battery, and they are imported in large quantities; it will be seen that by the use of 32-volt apparatus they retain the supplies of lamps and accessories, the English agents not having standard stuff for this pressure.

Service meters of American make have been readily sold in the Dominion, and at prices lower than were asked for English meters, whilst their accuracy and finish meet all requirements. The Americans pack their goods well, and, as a rule, their shipping documents and packing lists are very complete, and give the importer little or no trouble.

As illustrating the extent of American competition, the relative imports of generators, motors, and transformers for the year 1916 were:—

United Kingdom £40,723. ...... U.S.A. £36,781.

The returns for 1917 and 1918 will probably show the Americans imports under these headings very much in excess of those from Great Britain.

Just a word now as to Japanese competition; when the Japanese first began to supply electrical material the quality was often very poor, but, either on account of experience gained or fear of losing their hold, the class of material now arriving is a considerable improvement, although still sometimes behind what is desirable. The greater portion of it, in so far as it concerns this article, comprises wiring accessories, lampholders, ceiling roses, cut-outs, opal and glass shades, switches, flexibles and small V.I.R. wires, bare copper, both hard and soft-drawn, aerial cables, small insulators as used for telephone work, primary batteries, both wet and dry cells, &c. A good proportion of this trade should revert to British makers as soon as supplies can be got through, and the majority of buyers would be glad to have the better article even at a somewhat higher price; nevertheless, the improvement in the Japanese article since it first came into this market shows that they may yet produce a grade equal to the British.

Further, the price now charged for Japanese stuff appears to be fixed not by the cost of manufacture, but by the price of the competing article, and in many instances the price could be appreciably reduced and still show a fair margin of profit to the importer—this will probably enable the Japanese still to export good quantities of such things as bare copper and aerial cables, and there is always the type of user who will buy the cheapest article, irrespective of quality.

In 1916 the imports of insulated cables and wire were:—

United Kingdom £84,893 ...... Japan £8,758

and the Japanese imports of these items have risen enormously since then.

The bare copper returns for the same year were:—

United Kingdom £5,793 ...... Japan £2,275
U.S.A. £1,635.

The Japanese trade increased from £562,974 in 1916 to £628,822 in 1917.

National sentiment and the preferential Customs tariff will, however, favour the British manufacturer, and, when shipping conditions are normal again, provided he seriously lays himself out to secure a fair share of the business, there appears to be no valid reason why he should not succeed.

The main object of these notes, however, after the production of evidence as to the value of the market, is to indicate to the British manufacturer how best to proceed to secure a fair share of the trade. A number of representatives have been sent out by individual firms to open up business connections and study local conditions, but it is doubtful whether in a month or two spent travelling in the Dominion they are able to gain anything much more than a superficial idea of things. Mr. Dalton in his reports has warmly advocated direct representation by a responsible agent or firm, and undoubtedly the best method is for a group of manufacturers to combine for this purpose so as to give their agents a strong backing both in quality of material and finance, and more especially to share the cost of carrying local stocks of the lines in everyday demand. The possession of local stocks for immediate delivery is half the battle.

In the past, English firms have clung too rigidly to the demand for payment against documents f.o.b. or c.i.f., and as payment by the actual user is sometimes not made for weeks or even months after the material is landed, the importer has been handicapped to this extent. It is to be hoped that the banks will come to the assistance of manufacturers, and only by some such means can the competition of other countries be met. In most cases, too, a knowledge of local conditions is more valuable than a highly specialised knowledge of the material itself, and it does not necessarily follow that a highly trained man from the works will get the business until such time as he has become familiar with the country and its men and methods. On the other hand, the New Zealand representation of some good class manufacturers is in the hands of firms who possess very little technical knowledge of the material they are handling, and this obviously is not as it ought to be. The Americans overcome this either by sending out a better type of man or getting their local agent to the works to familiarise himself with their product, or by publishing very much more complete catalogues profusely illustrated.

Conditions brought about by the strife in Europe have enabled competitors to come into this market whilst Britain has been otherwise occupied, and it remains now for the home manufacturers to take up their former position of principal suppliers; it will not come automatically, but it can be regained by organised effort properly directed. We are led to believe that the war period has shown the advantages of concentrating on standard lines, each works making its own specialities, and by amalgamation with other works enabling each member of a group to handle the products of the other. So far as the manufacture is concerned, this is good news, but to keep these works fully occupied and enable them to bring down the works' costs to the minimum, better organisation of sales is urgently needed, especially for export trade. It is not sufficient to be content to sell through buying agents in London—it may be easier—but the works should be in direct touch with the salesmen, and the salesmen should hold regular conferences to discuss the requirements of the various markets, and the works manager should take his cue from them. The old policy of sending out the material that the works produced with an implied intimation that the buyer could either take it or go elsewhere is no use for present-day conditions; the sales department should lead the works and not follow. Salesmanship is mainly a matter of personality, and the men handling foreign trade should be selected with as much care in Great Britain as is done in the States; once chosen they should be given to feel that the whole organisation is behind them.

Just a final word to those engineers, electricians, and others, who may be minded to emigrate to New Zealand in the hopes of finding good positions going begging—the developments indicated in the first portion of this article will necessarily take time, and little or no advance can be made till the schemes are definitely launched and the material comes to hand, and this will not be yet. The cost of living is higher than in the old country, even under normal conditions, setting aside the increased cost due to the war. Rents, clothing, and, in most cases, food are higher than in Great Britain, travelling is much more expensive, and to live to the same standard a man requires a salary about double what he would expect at home, otherwise he will save little or nothing. In applying for a post in New Zealand he should keep this in mind.

The Nomenclature of Electrical Vehicles.—The Electrical Vehicle Committee of Great Britain has recently been considering the question of standardising the nomenclature of electric vehicles, and has drawn up the following terms and definitions: "Electric lorry," to cover all forms of electrical vehicles (of the industrial type) suitable for use on ordinary roads. "Electric trucks," to cover all forms of electrical vehicle specially constructed for running about factories, workshops, railway platforms, warehouses, &c. "Electric tractors," a truck similar to the above, but arranged only for hauling trailer trucks, and not for carrying anything on its own chassis. The Motor Trade Association, to which the suggestions have been submitted for criticism, has agreed with the recommendations except that it recommends the word "trolly" instead of "truck" in the second definition.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Spring Terminal for Accumulators.

The Fuller Accumulator Co., Ltd., of Chadwell Heath, Essex, in conjunction with Mr. Archibald Parker Welch, has recently secured a patent in respect of an improved form of spring terminal for accumulators, the object being to provide a terminal which will ensure a good contact between the active elements of the cell and the external circuit, and which is at the same time so arranged as to prevent its corrosion by the electrolyte. Referring to the accompanying illustration (fig. 1), it will be seen that a tubular chamber A of celluloid or other suitable material is inserted in the cell lid B, the top of the tubular chamber projecting above the surface of the lid to prevent any acid spilt on the lid from running into the interior of the chamber. The lug C from the active element in the cell is carried through the base of the tubular chamber, and an acid-tight joint is made between the lug and the chamber by means of an india-rubber bush E, covered with hard wax, run in whilst warm. A celluloid washer F is then pushed over the lug C and pressed down on the hard wax, to act as a protector to the bush. A tapered hole is drilled or cast in the lug C, over which a contact H of brass, closed at one end, is made to slide freely.

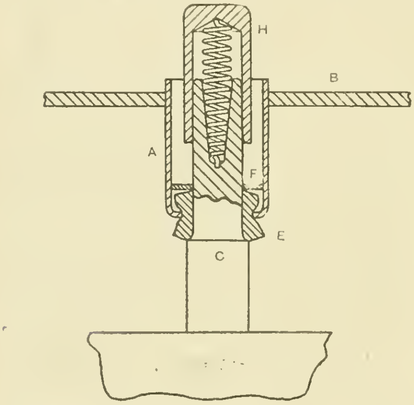

Fig. 1.—Fuller Spring Terminal for Accumulators.

A spring is placed in the tapered hole of the lug C, and in the interior of the contact H. When no pressure is exerted on the spring, its normal free position maintains the contact in the position shown in fig. 1. When pressure is applied to the top of the contact, the spring is compressed and the tapered portion of the spring is pressed down into good electrical contact with the internal face of the tapered hole in the lug. The ends of the spring are bent over so as to be forced into intimate electrical connection with the contact and lug respectively. The interior of both the contact and the tubular chamber is filled with vaseline to prevent corrosion, and to keep all sliding surfaces clean and lubricated. It will be seen that the contact H and the spring can be readily removed; in cases where this detachability is not desirable an alternative form of spring is used. The upper portion of this is wound to such a diameter as to spring tightly into the contact H, the top end being bent so as to tend to spring outwards, and, scraping against the inside of the contact, it prevents the spring from being easily withdrawn; this also applies to the lower end of the spring when inserted in the lug C, with the result that the contact and spring can only be removed from the lug by applying considerable force.

A New High-Voltage Transformer.

An article in *E.T.Z.* describes a new method, suggested by F. Dessauer, of constructing transformers for very high voltages in such a manner that the dielectric stresses are in part transferred from the high-tension windings to portions of the transformer that can better withstand them. To effect this the transformer is divided into two portions, one carrying out the transformation and the other taking up the dielectric stress. Tests show that the brush discharges that are so destructive to transformers of the usual construction are absent in transformers of the new description. The new transformers are particularly suited for X-ray work, and afford means of reaching regions in the Röntgen spectrum in which effects analogous to those given by radium are obtainable.

The principle of the device will be understood by reference to fig. 2, showing a transformer for 210 kilovolts. The high-tension winding is divided into sections, as shown at the top of the diagram. The primary circuit is composed of a series of transformers with ratios approximately 1 : 1. The mid-point *c* of the high-tension winding being at earth potential, the potentials in kilovolts of the various parts of the combination are shown in the figures on the diagram. It will be noted that for a total voltage of 210 KV. no part of the assemblage is exposed to a stress exceeding 35 KV. The cost of a transformer of this type is only slightly greater than that of the types hitherto in use, as the extra cost of the additional secondary transformers is nearly balanced by the cheapening in the construction of the high-tension winding. The diagram should be taken as typical, but a variety of other combinations on the same principle is possible. The arrangement has the further advantages of enabling the parts to be manufactured in series, and of permitting the easy replacement, or cutting out of circuit, of defective parts.

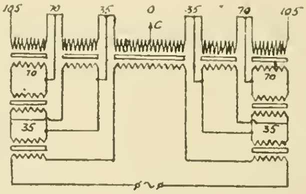

Fig. 2.—Diagram of High-voltage Transformer.

Ross Anti-Vibration and Shock-proof Device.

Our illustration (fig. 3) shows a device which enables metallic-filament lamps to be used where previously it has been found inexpedient to use the more efficient one-watt or half-watt lamps. The fitting in question has been tested, we understand, under the most severe conditions on board ship and under gun-fire, also by vibration set up by a pneumatic hammer, and in no instance has a metallic-filament lamp been broken when fitted to the anti-vibration disk, although carbon-filament lamps in the vicinity of this test, and fitted in ordinary lampholders, have been destroped.

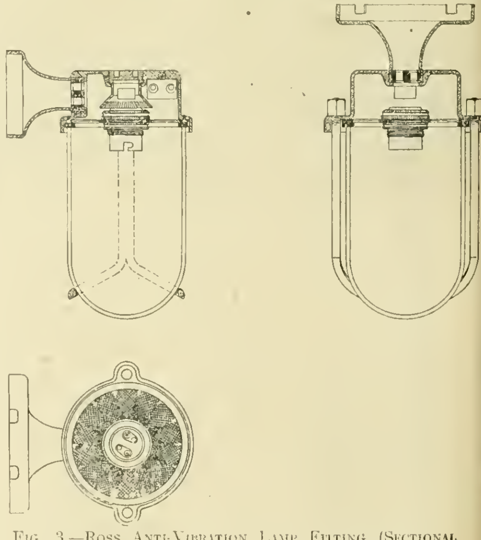

Fig. 3.—Ross Anti-Vibration Lamp Fitting (Sectional Elevations, and Disk with Glass Removed).

All forms of spring devices have been previously tried without success owing to the sensitive nature of the lamp filaments and the fact that the springs themselves, having to be made of a stouter material than the lamp filaments, conveyed the vibration to the lamp, thus making the filament sag, short-circuit, and ultimately break. Further, when subject to shock or wind pressure the springs did not prevent the lamp from side swinging and being broken against the inside glass or reflector shade.

In the device shown there is no connection between the outer fitting and lampholder through which vibration can be conveyed, whilst at the same time the lamp is held rigidly in position, all vibration being damped out or dissipated before it reaches the lampholder. The device is mechanically strong and unaffected by heat or atmospheric conditions, and will readily dissipate heat set up when half-watt lamps are used. It can be adapted for use on board ship, train, or tramcar, factories, &c., wherever vibration or shock exists. The fitting can readily be made into a pendant, bracket, back plate, or pipe-pendant fitting by simply exchanging the position of the plug and the supporting arm. The fitting is also made watertight by means of a rubber washer through which the wires pass; no wood blocks being required in order to finish off the armouring or lead covering of the cables.

The device would also seem to be suitable for the protection of delicate instruments, clocks, watches, &c., for aeroplanes and such like. The sole rights of manufacture have, we understand, been assigned to the Engineering Supplies Co., Ltd., of Lyndhurst Street, Thornaby-on-Tees, and Station Works, Allison Street, Stockton-on-Tees.

A Portable Generating Set.

The "42 C.M." portable generating set which we illustrate below (fig. 4), built by the Aster Engineering Co. (1913), Ltd., Wembley, Middlesex, was designed and supplied during the war in fair quantities to one of the Allied Powers, and was largely used as a power unit for field searchlights, as well as for fortress use. It was fitted with a specially light portable projector mounted on a pedestal, and a considerable length of cable was provided with the set, which was wound on a drum with slip-rings, so that the projector could be situated some distance from the power unit when desired. As regards the set itself, the engine has four cylinders 65 mm. in diameter, with a piston stroke of 100 mm., and is direct coupled to the dynamo. The engine, dynamo, and radiator are mounted on light longitudinal channels, which are supported upon short bent-iron feet, four in number. The coupling between the engine and dynamo is of the flexible-leather disk type. The radiator, which is of automobile pattern, is of aluminium, in order to reduce the weight of the equipment as much as possible. The circulation is partly thermostatic, and is assisted by a small gear driven pump at the front end of the cam shaft. The fuel tank is mounted over the dynamo, and close to it is placed a light iron-framed switchboard. Hand rails are attached to the longitudinal channels, by means of which four men are enabled to move the set about from place to place when required. The output of the set is about 4 kw. It should be noted that a fan, driven by a belt from the engine, is fitted behind the radiator, and this, in conjunction with the pump before-mentioned, carries out the cooling of the engine in a satisfactory manner.

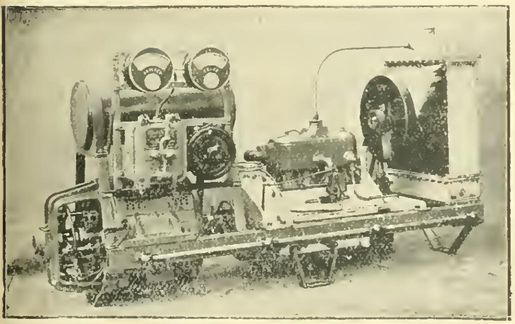

Fig. 4.—Aster "42 C.M." Portable Generating Set.

Photographic Meter Readings.—The Detroit Edison Co. is using a special camera for taking "load-test" meter readings to establish customers' demand charges. A regular meter-reading camera was rebuilt, so that now photographs are taken showing in the picture not only the meter reading but a watch dial with the time of reading and also the name and address of the customer. The photographic readings have shown their value in a number of instances where differences of opinion have come up with regard to the correctness of load curves. For example, in a case where a customer raised an objection to his bill on the ground that readings were not taken exactly one hour apart, the production of an actual photograph of his meter, with the time of taking shown on the same film, satisfied him as to the correctness of the load test.

THE ELECTRICAL CONTRACTING INDUSTRY.

We have received from Mr. Leonard G. Tate, General Secretary to the National Federated Electrical Association, a copy of the following letter, embodying an agreement which has increased the hourly rates for electrical wiremen and their assistants by an average of 2d. per hour all over the country. The exact details of the wages have to be agreed in each locality, and Mr. Tate is now receiving reports from the Branches of the agreements that are being arrived at:—

Ministry of Labour,
Montagu House, Whitehall, London, S.W.
January 29th, 1919.

Sir,—I am directed by the Minister of Labour to refer to your letter of January 29th, enclosing copy of an agreement arrived at on January 23rd, 1919, by the National Joint Industrial Council for the electrical contracting industry, as set out below, and to say that the Minister approves the agreement on the understanding that the local agreements come to in pursuance of this general agreement are submitted for his consideration.

The National Joint Industrial Council for the Electrical Contracting Industry.

Agreement arrived at re 47-hour week (January 23rd, 1919.)

1. That the standard hours of work be 47 per week. The rate of pay per hour shall be:—Pre-war rate of district multiplied by 53, add 28s. 6d.; divide the sum by 47 to obtain the hourly rate. Plus 12½ per cent. bonus where applicable.

The exact rate for any district under the above arrangement shall be settled locally, and in the case of disagreement shall be settled by the Chairman, Vice-Chairman, and Joint Secretaries of the N.J.I.C.

2. That in districts where levelling up has occurred during the war, an adjustment shall be made as required to give effect to such levelling up. In such cases the exact hourly rate shall be settled in the district, and in the event of difference, shall be settled by the Chairman and Vice-Chairman of the N.J.I.C.

3. That this alteration shall apply to the first full working week following Monday, January 27th.

4. It is provided that after this agreement comes into effect there shall be one break only of not less than 45 minutes duration in the ordinary full working day.

5. Starting and stopping time to be settled locally.

6. This Council is agreed that overtime is to be deprecated, and is contrary to the spirit of the application for a shorter working week. It is agreed that systematic overtime should be abolished, and that any overtime should only be worked when absolutely necessary.

I am, Sir, Your obedient servant,
(Signed) H. J. Wilson.

Leonard G. Tate, Esq.,
The National Federated Electrical Assn.,
11, Southampton Row, W.C. 1.

THE RELAY AUTOMATIC TELEPHONE SYSTEM.

Just before the outbreak of war—in our issue of July 3rd, 1914—we announced the development of the new Betulander relay automatic telephone system, in which the whole of the operations are carried out by simple relays, and we stated that in our opinion it constituted an epoch making advance in automatic telephony. The war has naturally hindered progress in this, as in other affairs, but we have never wavered in our conviction as to the inherent excellence of the relay system. By the courtesy of the Relay Automatic Telephone Co., Ltd., the owners of the British patents, we have now been favoured with a copy of a report received from Stockholm on the working of the semi-automatic exchange there on the relay system, in connection with the State telephone system. The report applies to a system which is doing public service, a 1,000-line installation, of which 450 lines are working. It shows a marvellous record of reliability, only 24 faults in all having occurred in 19 months. The following is an abstract of the report:—

The automatic plant has a capacity of 1,000 subscribers and 10 per cent. talking possibilities; 450 subscribers are at present connected, with three operators at work. The plant is working together with local-battery stations, as well as with central-battery stations of several different systems. An accumulator-battery for 36 volts and 150 ampere-hours supplies the necessary energy, and during the charging the voltage amounts to 40, but the plant works just as well at 35 as at 40 volts. Every connection takes an average of about 1-1¼ amp. The greatest current-strength for a connection amounts to about 2.5 amps., during scarcely one-fifth of a second. For a talking period 0.325 amp. is used during some 121 seconds, *i.e.*, the average length of a connection. The whole of the connecting-time for a three-figured number, including searching, selecting, and connecting is 1.2 seconds. The searching for an idle trunk and connecting to a free operator takes something between one-tenth and one-fifth of a second, and certain tests have given the result that a trained operator can effect up to 1,500 connections hourly. Five-figured numbers will, including selecting, searching, and connecting, take about 2 seconds. Owing to the quickness of the connections, only a single key-set is needed for each operator.

The automatic plant has been at work during 19 months, and the total of the completed connections during that time amounts to 1,226,104. To these are to be added about 15 per cent. non-completed connections, *i.e.*, calls for engaged subscribers. All the faults during that time have only amounted to 24, or one fault on 51,087 completed connections. There were 15 relay-faults, making only one in 81,740 completed connections. There has been only one soot-fault in the relay-contacts on 175,157 completed connections, and this is very remarkable, in view of the fact that the officials at the start were of opinion that faults of this kind would be so numerous that they would prevent the practical use of the relay system. The result is all the more remarkable as the number of relay operations for these connections amounts to 26,273,550, with a total of contacts of about 105,094,200. No parts whatever have been exchanged, with the exception of two condensers and two lamps. No number not wanted has ever been received through the plant. The only contacts which have been cleaned are seyen sooted contacts.

The foregoing relates to public service; but even a better record is shown by a small private installation which the company has had at work for 2½ years, and on which no faults at all have developed.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Shorter Working Week.

With this arrangement it is necessary to have four men for each position, three on shift and one spare man every week, all taking their turn around shifts :—

(1)

	1st Week.	2nd Week.	3rd Week, Wed. night.	4th Week.
Thurs.	7 a.m—3 p.m.	3 p.m.—11 p.m.	11 p.m.—7 a.m.	(Spare man) 7 a.m.—3 p.m., or 3—11 p.m., or 8 a.m.—5 p.m. (1 hr. din.)
Fri. ..	7 a.m.—3 p.m.	3 p.m.—11 p.m.	11 p.m.—7 a.m.	ditto.
Sat. ..	7 a.m.—3 p.m.	3 p.m.—11 p.m.	11 p.m.—7 a.m.	ditto.
Sun...	7 a.m.—3 p.m.	3 p.m.—11 p.m.	11 p.m.—7 a.m.	Off.
Mon.	Off	3 p.m.—11 p.m.	11 p.m.—7 a.m.	7 a.m.—3 p.m.
Tues.	3 p.m.—11 p.m.	Off	11 p.m.—7 a.m.	7 a.m.—3 p.m.
Wed.	3 p.m.—11 p.m.	Tues. night. 11 p.m.—7 a.m.	Off	7 am.—3 p.m.
Total hrs...	48	48	48	48

(2)

	1st Week.	2nd Week.	3rd Week. Wed. night.	4th Week.
Thurs.	7 a.m.—3 p.m.	3 p.m.—11 p.m.	11 p.m—7 a.m.	Off
Fri. ..	Off	3 p.m.—11 p.m.	11 p.m.—7 a.m.	7 a.m.—3 p.m.
Sat. ..	3 p.m.—11 p.m.	Off	11 p.m.—7 a.m.	7 a.m.—3 p.m.
Sun...	3 p.m.—11 p.m.	Sat. night. 11 p.m.—7 a.m.	Off	7 a.m.—3 p.m.
Mon.	3 p.m.—11 p.m.	Sun. night. 11 p.m.—7 a.m.	(Spare man) 7 a.m.—3 p.m., or 3 p.m. 11 p.m., or 8 a.m.—5 p.m. (1 hr. din.)	7 a.m.—3 p.m.
Tues.	3 p.m.—11 p.m.	11 p.m.—7 a.m.	ditto	7 a.m.—3 p.m.
Wed.	3 p.m.—11 p.m.	11 p.m.—7 a.m.	ditto	7 a.m.—3 p.m.
Total hrs...	48	48	48	48

If 47 hours is required, then knock four hours off spare man's time. Note, with above arrangements, the spare men would be divided into two sets. One set working Monday, Tuesday, and Wednesday, the other Thursday, Friday, and Saturday every week; also, every man has one Sunday in four a clear day off, which is what everyone wants, also a fourth man is a great advantage to have in case of illness, as, with only three, it means the others have to do 12 hours continuously until the sick man returns.

P. Balfre.

London, S.E., *February 1st*, 1919.

The apportionment of the hours between the three shifts aggregates 141 hours in the three weeks, but the hours from noon in one week to the corresponding noon in the next week vary in three consecutive weeks for the same set of workers according to the day of the week chosen for the start from a maximum of 59-32-50 to a minimum of 42-51-48. There is also no explanation of how the station is run during the 27 hours of each week which is unallotted to these three shifts, whether by a shift working extra time, and, if so, which shift, or what other staff may be available. The hours at which the changes of shift are made are no doubt the most convenient.

Inquirer.

January 30th, 1919.

The Need of Co-operation Among the Smaller Manufacturers.

The discussion which has been taking place in your paper under the above heading would, I take it, lack of purpose were it not intended to explain the electrical manufacturers' inability to compete successfully in the foreign markets. One of the reasons may or may not be the lack of co-operation referred to by Mr. Siddeley; but, to my mind, this factor, even if it has a bearing on the matter, is certainly of a secondary order. I believe there is in England a great scope for intelligent co-operation, but this is not so vitally needed among small firms as it is within the organism of larger concerns.

I entirely agree with the views so clearly set forth by Mr. Bray with regard to the superiority of small concerns as compared with larger ones, but is the capital invested in small concerns sufficient for commercial ventures abroad? It seems to me that the fights in the international arena should be borne by the large concerns. The inability of such concerns to do so is, to my mind, to be ascribed to the present system of directorship.

Directors of large firms have seldom large financial interests at stake, as the leading men of small firms have. Directors, if not only financially interested in the firm they direct, ought to be capable of intelligent contribution to its success. They ought to be animated and inspired by engineering knowledge or by large commercial vision, and be the central energising forces, rather than a damping body, retarding progress and high achievements. The fabric of success in the commercial world competition is very hard to build, and its pillars are knowledge, constant care, enthusiasm, and faith.

N. Pensabene-Perez.

London, N.W. 4, *January 28th*, 1919.

Electricity on Board Ship.

I read the most interesting articles in your issue of January 31st with a real feeling that at long last marine electrical engineering is coming into its own. I was struck with the statement that the rheostatic-controlled, compound-wound D.C. motor acting direct on the mechanical steering gear required no less than 300 H.P., whilst the so-called "hydraulic-electric system" required only 150 H.P.

What is meant, I think, by the statement is that it took a 300-H.P. frame motor at some given speed to produce the torque necessary to do the duty in 20 seconds, but only a 150-H.P. motor at a higher, and possibly standard, speed to drive the hydraulic pumps to enable the "hydraulic" motor to produce the torque necessary to put the rudder over in 30 seconds, which is probably nearer the truth.

With properly designed "direct electric" driving, much less electrical energy is required; in one case which I have recently worked out for a very large firm of Diesel-engined shipbuilders at Copenhagen, the saving in fuel energy, as compared with "hydraulic-electric" steering is as much as 40 per cent., whilst the deadweight and first cost is considerably less.

Experience has proved that the ordinary D.C. motor with contactor, resistance armature control, should not be used; it wastes very considerable energy during the short-period operations of rudder driving, and is costly and heavy, and liable to breakdown.

Dynamic braking is a feature which should be demanded by all shipowners. The "Paragon" polyphase steering gear is pure direct-acting, synchronous, and has all the efficient follow-up features of up-to-date steering plant; frequency controls speed, and not temperature.

The features embodied in this modern electrical power system are also highly suitable for anchor-winch operation, ammunition-hoist operation, and also for the operation of guns and turrets and searchlight remote control.

William P. Durtnall,
M.I.Mar.E., M.I.Loco.E.

London, S.W., *February 2nd*, 1919.

The I.E.E. and National Electricity Supply.

Your comments on the views of the Committee set up by the Council of the Institution of Electrical Engineers to deal with the Board of Trade Power Supply Report are well justified, and with your leave I would like to carry the criticism a little further.

The Committee's letter opens with an impressive statement as to the importance of a cheap and abundant supply of electricity to the industries of the country, but its recommendations are entirely unprogressive and reactionary.

It is difficult to see how, if the Board of Commissioners is not to be given administrative powers or authority to set up District Boards, to both of which the Committee offers strenuous objection, we are going to be any nearer to a reconciliation of the conflicting interests which at present retard the development of power supply. Without the granting of such powers, and without the general legislation which the Committee deprecates, how are the present legislative restrictions to be removed, and how can the Government give financial assistance?

In general, the effect of the Committee's proposals would be to deprive the Board of Trade Report of its constructive features, and to leave matters pretty much where they are at present. The reference to the Railway and Canal Commission, which is held up as a model for the new Board of Commissioners, is most unfortunate in view of the little good which that body has ever been able to do for the railways (an expression of opinion on the working of this Commission may be found in the leading article of the *Iron and Coal Trades Review* of December 27th, 1918).

It is deplorable that the Institution should not only fail to take advantage of the public opinion which has been aroused in favour of the development of electrical power supply, but representing, as it does, the interests which Government assistance would benefit, should take up an attitude so prejudicial to its own welfare.

As some explanation of the action of the Council of the Institution in the matter, it should be known that the terms of reference to the Committee set up by the Council were to consider the Electrical Trades and Power Supply Reports, and to report thereon to the Council. The Committee, however, acted irregularly by sending its conclusions in the form of the letter in question direct to the Board of Trade without reference to the Council, and by so doing committed the Institution to an expression of opinion which, I submit, is more that of the other parties to the Committee than of the Institution.

My fear is that the views of the Committee, coming as they do from a body which purports to represent the whole electrical industry, and more particularly its technical side, may be taken to depreciate the well-considered opinions of the eminent authorities who have examined the question in all its bearings during the last two or three years, and may be used in opposition to the legislation which the Government has in hand. I am, therefore, of opinion that steps should be taken by members of the I.E.E. to secure the repudiation of the views of the Committee, as I cannot think that from a professional standpoint those views are likely to meet with favour.

C. H. Marshall,

Member of Council, Institution of Electrical Engineers.

Middlesbrough, *February 1st*, 1919.

We are interested to see your comment on the letter sent by the Institution of Electrical Engineers to Sir Albert H. Stanley, P.C., M.P., President of the Board of Trade. It seems unfortunate that the Institution did not bring the matter before the people interested with a view to discussion before issuing the report purporting to convey the views of the majority.

The views of this company, expressed at a directors' meeting held on October 9th last, are as follows:—That to eliminate all executive powers of the proposed Electricity Commissioners would not be in the best interests of the rapid and economical development of electricity in this country.

The constructive criticism of our company would be that no provision has been made for the Commissioners to acquire the gas interests of this country. We consider the Commissioners should have power to acquire the gas undertakings as well as electricity supply undertakings in any district where the national scheme of power supply is inaugurated. We arrive at this conclusion for the following reasons, viz:—

1. In equity the State power supply should not be in competition with the private and municipally-owned gas undertakings.

2. Under the proposed national scheme, gas engineers and chemists will be required for the proper utilisation of coal, as outlined by the Coal Conservation Sub-Committee.

The Suffolk Electricity Supply Co., Ltd.
Napier Prentice, *Secretary*.

Felixstowe, *February 3rd*, 1919.

The Mains Department.

Your recent article on the extensions at Sheffield, illustrating the sub-stations, was very interesting, and quite an exception, as generally in such cases the mains department is entirely left out. One wonders why. Is it because there is nothing new to learn about mains? or is it a case of "out of sight, out of mind"? Surely "mains" are of equal importance as any other part of the station, and have to be as frequently extended or replaced with larger. Yet the fact remains they seem to pass unnoticed, almost uncared for, except by those in direct charge of them.

So I am requesting you, Mr. Editor, to whom we look to a certain extent, to keep us well informed of up-to-date practice, with regard to sub-stations, mains, switchgear, &c., to include the same in the descriptions of such installations which you publish from time to time. I am quite sure these will be appreciated by all mainsmen. There must be a good many towns where the mains have been overloaded to a terrific extent, owing to the growth of power, heating and cooking loads. Will "G.W.S.," or some other able man, give us the benefit of his experience under such conditions?

Sub-Station.

[The distributing system often represents half the total expenditure of an undertaking; but it seldom offers much material for a descriptive article. One yard of paper-insulated L.S. cable is very like another, and sub-stations are almost manufactured to stock; the former cannot be photographed *in situ*, the latter can, but with difficulty. Where the work is thus repetition work, one cannot make a long story of it. Moreover, the mains engineer is usually an enthusiast, and, like most enthusiasts, is immensely interested in details, so that he finds it difficult to view his subject broadly and to convey an intelligible account of the whole scheme to a visitor. Hence it is not easy to describe the mains.—Eds. Elec. Rev.]

A Protective Association for Non-Technical Officials.

With reference to a letter appearing in last week's Review, suggesting the formation of an association on the lines of the E.P.E.A. for the non-technical staff, *i.e.*, chief clerks, accountants, &c., of electrical supply undertakings, I beg to say that I am heartily in agreement with the cause. This is, no doubt, a most opportune time, and I thank you for your courtesy in allowing us an opportunity of an interchange of views on this matter. Without entering into minute details as to why such an association should be formed, I think that if one were formed exclusively of chief clerks, accountants, &c., it would, in my opinion, be unsuccessful, and most certainly not effective, unless it included in its membership all the clerical staff from the secretary or chief clerk downwards; of course, a qualifying period should be made operative.

Why not make a united application to the E.P.E.A. for admission to membership? Although I know we are not qualified engineers possessing technical skill, we all of us must have a technical knowledge appertaining to our duties, and if the E.P.E.A. include draughtsmen, I do not see why they should not make their Association stronger still by admitting us to membership. We are all, I assume, on the salaried staff of our undertakings, and practically on a level status with the assistant engineers, yet, in view of the recent award granted to members of the E.P.E.A., I am afraid our status will be considerably lowered in comparison; if equal treatment is not meted out to all the staff, whether members of the E.P.E.A., technical or non-technical, it is grossly unfair.

No time ought to be lost in considering this question, and I should like to be put in communication with other gentlemen interested in this subject.

Accountant and Chief Clerk.

January 28th, 1919.

Your correspondent "Non-Technical" advocates another means of absorbing valuable power needlessly. In the opinion of many there is no need for a *separate* association for chief clerks, accountants, costs clerks, &c., in electrical undertakings any more than in other businesses, and we have found all our needs amply catered for by an ingenious guild system, embracing the non-technical men in this and other industries, such as engineering, iron and steel, and colliery trades.

The National Union of Clerks, having been compelled to perfect this system of sectionalising its national membership, has evolved a co-ordinated policy for each of the sections, and if your correspondent and others in the electrical industry will only come along and join the 40,000 members already enrolled, it will save the energy necessary for the formation of a comparatively weak association.

We want these problems solved quickly, but not experimentally, and as the Union has about a dozen organisers and branches all over the British Isles, the organisation is there for use as and when we realise the need. Too many associations and all too few members has been the rock on which we split. "In unity alone lies strength," therefore unite and conquer.

Electrical.

January 28th, 1919.

I have read with interest the letters which have appeared in the Electrical Review of the 31st ult., and also the letter from "Non-Technical" in the previous week's issue, and I should like to take this opportunity of drawing your correspondents' attention to this Association. Formed in April, 1918, by members of the clerical staff of many undertakings in London, at a time when it was necessary for some adequate representation to be made in respect of the war bonus question, the Association has progressed to a wonderful extent, and now includes in its membership practically all the members of the clerical staff of electricity supply undertakings in Greater London, and has a large representation in the provinces. The success attained on behalf of its members in many undertakings, in obtaining for them the full war bonuses applied to workmen and the technical staff, has undoubtedly influenced many clerks in the industry to join. At a recent meeting it was unanimously resolved to register the Association as a Trade Union, which should remove any doubt in the minds of those who still hesitate.

Your correspondent, "Power Company Clerk," suggests the absurdity of forming a sectional organisation composed of the clerical staff, yet later on in his letter he contradicts this statement, and makes mention of a "guild" system, by which sectional problems can be discussed. Surely the action of the E.P.E.A., which is a sectional organisation, is sufficient answer to the query as to whether sectional organisations can obtain adequate representation before employers. The advantage of the Clerical Assistants' Association is that the members are discussing problems of their own *all the time*.

Apropos of the guild system, it may be of interest to your correspondents to learn that the Chief Commercial Officers' Association and this Association are affiliated for one common purpose, and such relationship is, in my opinion, to be preferred to the guild system, as by this means there is no interference with internal management.

The Association is composed of members of the clerical staffs of electricity supply undertakings, democratically governed by men who have spent practically all their lives in this occupation, and who are, therefore, in the best position to understand the particular requirements of its members.

Your correspondent also states that the N.U.C. has members on the staffs of the undertakings at Bermondsey, Battersea, Fulham and Stepney. If by this he means electricity supply undertakings, I would point out that the whole of the clerical staffs of these undertakings are members of this Association, and have raised a protest against the statement. It would be well if your correspondent would verify such statements before submitting them for publication in such an important organ as the Electrical Review.

All these letters, however, prove that at last members of the clerical profession are waking up to the fact that they must join suitable organisations if they wish to receive adequate representation and protection in the future.

We also have all the machinery not only ready, but in operation, to absorb all the clerical assistants in electricity supply undertakings in the country, and branches are being established for this purpose.

The surest way to prove sympathy is to become a member at once, and strengthen the association of your own class to obtain adequate representation before our employers, whether municipal, company, or national.

Full particulars will be sent willingly on application, stating name of company or municipality.

G. R. Smith,
Hon. Secretary,
Clerical Assistants' Association, Electricity Supply Undertakings.

39, Leghorn Road. London, S.E. 18,
February 3rd, 1919.

[Correspondents at Fulham, Battersea, and Stepney write denying that any of their staffs belong to the N.U.C.; they are members of the Clerical Assistants' Association.—Eds. Elec. Rev.]

Electrical Contracting.

Mr. H. J. Fowler's letter in your issue of January 24th will be widely read, and will produce a very false impression of the work of the electrical contractors in this country.

Having been an officer of the Electrical Contractors' Association since its foundation, I have had much opportunity for knowing the class of work done by electrical contractors in different parts of the country, and although there has been much shoddy work executed by the smaller class of tradesmen in the past, this abomination has been very little in evidence during recent years. The Electrical Contractors' Association was formed expressly to overcome the tendency to install cheap work to meet competition, and it has been successful. The Association embraces some 400 of the best firms in the country, and there are very few firms of standing outside its ranks. Speaking for the members, I say that Mr. Fowler's suggestions are absolutely unfounded, and I challenge him to produce detailed evidence of his assertions. Further, I would like to ask why, if difficulty is being experienced in obtaining sound installation work, complaint is not made direct to the Electrical Contractors' Association.

There is a large and active branch in Liverpool, and investigation of any case of alleged bad work would be conducted promptly if made known to the executive.

H. Marryat.

Chiswick, *February 1st*, 1919.

The Re-settlement of Officers.

With reference to your leading article on "The Re-settlement of Officers," in your issue of January 24th, it is very interesting to read of the many schemes put forward to help towards the re-settlement of officers in civil life, but apparently no one seems to have given a thought to the case of the warrant officers and senior N.C.O.'s of technical corps, such as the Corps of Royal Engineers, many of whom, through no fault of their own, but through the very fact of their technical abilities, *could not be spared* to take up commissions.

Again, with reference to your article on "Electrical Engineering in the Army," I think it only fair that it should be known that the majority of the big jobs in France (not only oil sets have been laid down, but modern three-phase turbo-alternators up to 1,000 kw., and even of the latest type—the Ljungström—have also been laid down and run by R.E.) have been carried out, under the direction of a *very few* able engineer officers, by W.O.'s and senior N.C.O.'s of the Establishment for Engineer Services—the technical staff branch of the R.E.—which is, undoubtedly, very seldom heard of. Many officers posted for electrical engineering work were, however good they were at their own branch of engineering, practically "lost" when it came to three-phase working, consequently the work of erection and running devolved on the W.O.'s and N.C.O.'s mentioned.

As an instance of the class of man I refer to, one of the writer's colleagues in France was a B.Sc. (Eng.) of London University; another the senior shift engineer in a large generating station in the Midlands, who patriotically enlisted as a sapper in the ordinary way, although he was a "starred" man.

Perhaps this will catch the eye of one of the gentlemen mentioned, who will perhaps use his influence to start a scheme to help the W.O.'s and N.C.O.'s mentioned to resettle in civil life. They are all fully qualified engineers, therefore require no grants for training, simply appointments in keeping with their technical abilities.

In conclusion, I may say that the writer has no axe to grind, having already secured an appointment with a well-known supply company.

Warrant Officer, R.E.

B.E.F., *January 29th*, 1919.

Electrified Seed.

There can be no question as to the great ability of Dr. Charles Mercier, who has just been awarded the Swiney Prize, for the second time, by the Royal Society of Arts, for his work "Crime and Criminals"; but isn't there just a possibility that he is pulling our leg?

Dorset is a great county for "cackle," and I haven't forgotten the "electrified chickens" which caused such a sensation a few years ago. I saw them myself. They were wonderful! Farmers are not, as a rule, competent to carry out scientific experiments; and, reading between the lines of Dr. Mercier's remarks, I expect that he is as nearly converted to electrical treatment of seeds as he was to Sir Oliver Lodge's statements.

Wide Awake.

February 2nd, 1919.

Engineer Surveyors' Salaries.

Your correspondents on this subject by no means overstate the grievances of insurance companies' surveyors. These men worked long hours for small pay before the war, and their position has become consistently worse during the last four and a half years, as the cost of living has steadily advanced. The companies have continued to pay 30 per cent. to 35 per cent. per annum on their paid-up capital, have continued to place vast sums to reserve each year, and have not been liable to excess profits tax; yet they have only made niggardly allowances of war bonus from time to time—these never adequate to meet the increases in the prices of necessities at the times they were granted. "Old Inspector" says he found his advances of £6 to £12 per annum insufficient; I can assure him that his old colleagues are to-day ten years behind with their advances, taking into consideration the purchasing power of a sovereign as compared with a "Bradbury."

"Old Inspector" suggests the formation of an association. There already exists the Engineer Surveyors' Association, Onward Buildings, Deansgate, Manchester, which has a large membership, but is not at present recognised by the various companies. This is the old story. Employers will never recognise a trade union or an association until it can organise a successful strike. Witness the railway clerks.

As an alternative I suggest that as the inspection and certification of boilers, engines, and electrical plant was recognised as a work of national importance during the war, it ought now to be taken in hand by the Board of Trade, who would perhaps be as successful in obtaining efficiency as the companies are to-day in securing profits.

X. Y. Z.

Engineers and Demobilisation.

At the present time, a very large number of engineers who formerly held good appointments are looking forward with some anxiety to the time when they will leave the Army, Navy, or Royal Air Force, and have to find positions in civil life. Similarly, in view of the great work of reconstruction, employers must know that sooner or later they will be needing competent men, and may have some difficulty in finding them.

I should esteem it a very great favour if you would publish this letter, the object of which is to call together old students of the Crystal Palace Engineering School for co-operation in dealing with the problems of demobilisation as affecting engineers. Over 2,000 engineers have passed through this school, the addresses of many being unknown to me; they include many men holding the highest positions in the profession. The Council of the Crystal Palace Old Students'

Society feel that they can do good work in this respect not only among their own members, but for many others.

May I, therefore, ask you to insert this letter as an appeal to all old students of the Crystal Palace Engineering School or others interested in the subject to communicate with me by letter?

I would add that this is not an ordinary employment bureau, and that no fees of any kind are to be charged.

H. C. H. Shenton,
Hon. Secretary.
Crystal Palace Old Students' Society.

28, Victoria Street, S.W.,
January 28th, 1919.

Repayment of Loans.

In the paragraph relating to the result of the working of the Rotherham undertaking for the year ending March 31st, 1918, published in this week's Review, I notice it is stated that "of the gross profit of £19,702 debt redemption absorbed £6,426 and interest £7,714, leaving a balance of £5,562." If "debt redemption" is synonymous with "repayment of loans," this figure seems extremely low. Taking the average loan period as 20 years, which I think is a fair one, the annual repayments would amount to £19,425 on £388,511. My small undertaking, with a capital of £34,800, has to pay £1,569 per annum, and yet Rotherham has only to pay four times this amount with a capital expenditure of eleven times my own. I should be interested to hear how Rotherham is able to manage these extremely easy terms, and I am sure many of my colleagues would be able to show much larger net profits if such favourable loans could be obtained.

Interested.

February 3rd, 1919.

The Circular Letter of Inquiry.

At present if an engineer at an electricity works wishes to know what they are doing at other works he sends out circular letters to a number of towns and tabulates their replies. Three months afterwards, probably, another engineer wants the same information. He sends out a circular letter to a number of towns asking for replies. A great deal of unnecessary clerical work is entailed in this manner. Why cannot some central authority, such as the I.M.E.A., receive an inquiry from an engineer regarding a certain matter, get the necessary information from a number of towns and be in a position to forward this same information to any other engineer that is requiring the same at any time? Electricity offices are kept very busy at present supplying tabulated information to other supply authorities, to the Board of Trade electric power supply department, to the Ministry of Munitions of War power supply department, and fuel overseers, and if something could be done to prevent overlapping of the information, it would certainly be a great benefit.

W. A. Toppin.

Chesterfield, *February 1st*, 1919.

BUSINESS NOTES.

Oversea Trade Commissioners to be Appointed by the F.B.I.--In the *Bulletin* of the Federation of British Industries for January 30th, it is stated that the Federation by resolution of December 12th decided that Commissioners or Representatives of the Federation be appointed in each of such oversea markets as may be determined. The suggested functions of these representatives, which are fully set forth in the *Bulletin*, include the collection and classification of information, the provision of periodical reports, the holding of lists of men suitable for appointment as agents by members, the co-operative placing of advertisements in the local Press, and so forth. It is mentioned in the *Bulletin* that the Federation is negotiating with Sir Charles Mandleberg's organisation (the British Manufacturers' Corporation) with a view to amalgamation between the two bodies in the appointment of the above Commissioners.

Effect of High Wages and Shorter Hours in Germany.—The Julius Pintsch Co., Berlin, states that in consequence of the promise made to give compensation for loss of wages incurred by the adoption of the 8-hour day, the work of production is being remunerated at a level of 14 per cent. above the former one. Further curtailment of the working day, as a result of the coal shortage, is responsible for another 12.5 per cent. increase. Surplus expenditure amounting to Mk.5,000 a week, is necessitated by the re-engagement of returning soldiers, for whom there is no work. On the other hand, navy and army contracts are withdrawn, and less work is done. Each month Mk.600,000 extra is paid in wages. As the average net profits during the last three years of peace—and those for 1918 can hardly be larger—were Mk.1,600,000, three and a half months would use them up—*i.e.*, after the end of February the company will work at a loss. (*Kölnische Zeitung*, December 31st.)

Plant for Sale.—West Hartlepool Corporation Electricity Department is offering for sale one 100-kw. Belliss-Crompton d.c. generating set. Full particulars are given in our advertisement pages to-day.

Non-Ferrous Metal Industry Act.—Further lists of licences granted under this Act are published in the *London Gazette* of January 31st and February 4th.

Advice to Intending Exporters to Brazil.—According to an article in the *Board of Trade Journal* by H.M. Consul-General at Rio de Janeiro, the details furnished by British exporters anxious to be placed in touch with new connections in the Brazilian market are sometimes inadequate. He desires that firms writing to his office should give the fullest possible particulars of their requirements in order to facilitate the by no means easy task of inducing local merchants to interest themselves in their proposition.

He states that the export trade to Brazil is a matter requiring considerable experience, both of the tariff and of local methods, and he suggests that inquirers should furnish the following minimum information:—

1. Exact nature of their business, *e.g.*, manufacturers, merchants, merchant shippers, &c., and fullest details of goods offered. Some indication of the volume of business that can be handled would be useful.

2. Exact nature of new connections desired, *e.g.*, commission agent, buying agent, or list of possible customers. It should be noted that as regards the district of Rio de Janeiro there is really little prospect of business being done direct with the local Brazilian wholesaler, and in most cases it is preferable to appoint an agent.

3. As Brazil is three weeks from England it would save time to state the terms proposed, instead of inviting an offer. Exporters should indicate whether they expect the agent to take the whole or part of credit risks. The normal terms of business here are 90 days' sight draft with merchants.

Brazil, again, is an expensive country, and the cost of upkeep of a small office runs from £1,000 per annum upwards. An offer of 2½ per cent. commission is therefore not particularly attractive except in certain easily handled lines, as £40,000 business must be done to cover expenses. Without going into detail, it is suggested that there should be some arrangement for profit sharing for over-prices.

4. If exporters are already represented in the market and wish to make a change, they can inform H.M. Consul-General in confidence in order to obviate any difficulties with the house holding their agency.

Any other information of interest would be appreciated, such as normal time of delivery, whether the exporter is prepared to advertise or share the cost of publicity, extent of territory offered, whether samples will be supplied free of Brazilian Customs duty, &c.

Germany's Industrial Future.—In the *Kölnische Zeitung* for December 31st there was published the text of a resolution passed at a joint meeting of the Rhenish-Westphalian and South Westphalian Chambers of Commerce of the North-Western Group of German Iron and Steel Manufacturers, the Union for the Protection of Economic Interests in Rhineland and Westphalia, Düsseldorf, and the Union for Mining Interests in the Chief Mining District of Dortmund relating to the economic situation that threatens Germany. We quote the following extracts from the resolution:—

"Unless stringent measures are taken at once to establish peace and order, and to ensure the development of the economic life, our present situation will lead to a collapse even more terrible than the political catastrophes of our Fatherland. . . . Within Germany's own boundaries economic burdens are being prepared, which make the structure quiver in every joint. The exigencies of the moment have forced employers and employés to form a Labour Alliance, which will lead the working world into more peaceful paths of development, but any achievement of such ends will be quite impossible so long as wilful and unreasonable conduct and weakness make our economic system a chaos. Some weeks ago, both masters and men in the Ruhr district spoke of the terrible dangers of the situation. It is an absolute untruth that is being taught to the nation by other parties, who represent that, despite the loss of the war, a period of economic progress is about to commence, as a result of the revolution. More work, less income, and less favourable conditions of life—such is the fate which awaits all in proportion to the stupidity with which the present time is used. The present economic ruin of the middle classes does not mean advancement of the working classes; but rather the undermining of their basis of existence. Nationalisation of industry and the abolition of private property is nothing more or less than handing over the nation's wealth to the enemy Powers. The strikes in the mines, the inadequacy of the transport system and the output of coal, and the general insecurity smother all enterprise. No contracts are placed. The few more or less productive urgent works and State contracts cannot make up for this state of affairs. The largest industrial and commercial undertakings feel that their very existence is threatened, and are preparing for the worst. Taken in conjunction with our international situation, all these disturbances must inevitably result in unemployment for millions of people with its attendant evils. A speedy and radical change in the State's economic policy is the only means of averting complete disaster."

Staff Dinner.—On Saturday, January 25th, Messrs. Falconar, Cross & Co., electrical contractors, of 7-9, Ridley Place, Newcastle-on-Tyne, entertained their staff to dinner at the Savoy Restaurant. Mr. and Mrs. Falconar and Mr. and Mrs. Cross welcomed their guests, about 100 in number, including seven employés who had been with the firm for periods varying from 10 to 20 years, and a few of their former men who had left them to take up responsible positions in the district. During the evening the employés presented valuable gifts to the partners in celebration of the twenty-first anniversary of the commencement of the business. Toasts were given or replied to by Messrs. O. L. Falconar, A.M.I.E.E., W. Cross, M.I.E.E., R. Robson, A.M.I.E.E. (of Robson & Coleman), R. Young, C. Brown, J. Gibson, E. F. Turpin and W. R. Harley, in the course of which it was pointed out that the relations between the firm and its employés had always been of a cordial character, and that it had been decided to further this co-operation by forming a Works Committee under the Government scheme of Joint Industrial Councils. During the war the firm has been very fully engaged on work of National importance, largely in the electrical equipment of ships for the Navy and Mercantile Marine, but it is now undertaking again normal work which could not be carried out during the past four years.

Patent Applications. — The British Lighting and Ignition Co., Ltd., has applied for licences under various patents granted to the Bosch Co., in connection with magnetos, electric lamps, starting devices, and switches. The applications will be heard to-day.

Engineering Exhibition at Olympia.—At the time when war was declared, arrangements were completed for holding within six weeks the Shipping, Engineering, and Machinery Exhibition at Olympia, and it has now been decided to resume immediately the organisation of the exhibition, and, if possible, to arrange for it to be held in the autumn of the present year.—*Birmingham Post.*

Liquidations. — Fraser & Chalmers, Ltd. — This company is winding-up voluntarily. Liquidator, Mr. W. McDermott. Meeting of creditors, February 10th, at Moorgate Hall, Finsbury Pavement, London, E.C.

Armorduct Manufacturing Co., Ltd.—Application for release of the Controller, Mr. J. Patterson, was to be heard by the B. of T. on February 5th.

Metal and Machinery Syndicate, Ltd.—Application for release of the controller, Mr. P. H. Green, to be heard by the B. of T. on February 8th.

Trade with Bolivia.—At the meeting of the I.E.E., at Manchester, last week, Mr. M. Angus asked engineers to pay a little more attention to new fields in the export trade. In Bolivia, during the war, they had been swamped with Americans in person. The Japanese also came, the Germans were always with them, but they never had a single Englishman who had been about business in Bolivia, Chile, or Peru. Designers seemed to think that the only voltage rules they had to fulfil were the voltage rules of this country, but the Germans did well because their machinery was designed not for their home trade, but for the export trade. Machines designed for British mines could not be sold where the conditions were quite different.

Steel Exports.—The Minister of Munitions gives notice that, following the withdrawal on January 31st of certain subsidies on steel, the drawbacks payable to the Government in respect of exports of steel have been reduced as from February 1st. Particulars of the reduced rates of drawbacks may be obtained on application to the Ministry of Munitions, Steel Department (Room 104), Hotel Victoria, W.C. 2.

Chloride War Record.—The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester, has lost 33 men fallen in the war, and eight have been taken prisoners. Military honours won by employés of the company include five Military Medals, a Military Cross, and the Croix de Guerre.

Shell Factory Plant for Sale.—The engineering equipment of the National shell factory, Midland Works, Birmingham, which is to be sold by auction, includes 70 electric motors, ¼ to 110 h.p., nine Edison electric trolleys, &c.

Social.—A Fancy Dress Cinderella, arranged by the Sterling Athletic and Social Club, was held in the Recreation Hall at Dagenham of the Sterling Telephone and Electric Club on Saturday evening last. The event was supported by Mr. Guy Burney, Mr. C. E. Sherwood, and the directors. The Men's Football Team is doing well in the East and South-East London Munitions League; it has suffered only one defeat, and has gained 19 points out of a possible 22, and is well in the running for the championship. The Ladies are still undefeated, and have scored 94 goals to 4 this season.

Iron and Steel Exchange.—On Tuesday next, Sir Albert Stanley, M.P., President of the Board of Trade, will open a new Iron and Steel Exchange for London at Cannon Street Hotel, E.C. The use of the Great Hall has been secured for every Tuesday from 1.30 to 4 p.m.

Eight-Hour Day in France.—MM. Renaudel, Bauche and Voilin, French Socialist Deputies, are submitting a Bill in the Chamber proposing the establishment of an eight-hour day and an English working week (*i.e.*, one half-day holiday in the week) for all workers.—*Times.*

Export Restrictions Relaxed.—The *London Gazette* for January 31st contains a list of further relaxations of export restrictions.

No German Automobiles for Chicago.—The *Times* states that the Chicago Automobile Club has passed a resolution not to purchase for seven years any automobile accessory or automobile product manufactured in Germany.

Iron and Steel Prices.—The Minister of Munitions gives notice of alterations and additions to Maximum and Fixed Prices to take effect on February 1st.

Trade Announcements.—Messrs. H. Maguire & Co., electrical contractors, are resuming business at 6, Witham, Hull, and invite manufacturers to send catalogues and trade terms.

The business of Messrs. Wm. Suckling & Sons, of Kingsway House, Albion Street, Birmingham, has been converted into a private limited company, under the name Suckling, Ltd. Messrs. W. and J. Suckling will act as joint managing directors.

The London Electrical Co., electrical engineers and contractors, have opened premises at 29, Mackenzie Street, Slough.

Mr. J. R. Tesseyman, electrician, having been released from the R.A.F., has resumed business at 24, Silver Street, Whitby.

Mr. W. G. Bedford, for 15 years mains superintendent and electrician to the Slough and Datchet Electrical Supply Co., has commenced business as an electrical engineer at 43, William Street, Slough.

Mr. George Gregory, whose business was closed about two years ago owing to war conditions, is recommencing operations, on February 10th, at 90, High Street, Camden Town, London, where he has up-to-date equipment for the manufacture and repair of all types of accumulators, and for the repair and rewinding of electrical machinery and apparatus.

We are informed that the old-established firm of Taylor & Co., mica and micanite merchants, of 40, Hatton Garden, E.C., 1, has been converted into a company under the name of Taylor & Petters, Ltd. The directors are Messrs. J. Taylor, S. Blofeld, R. H. Lindley (of C. Lindley & Co., Ltd.), and J. McFarquhar Petters, M.Inst.C.E., who has been appointed managing director of the new and enlarged business.

New Switchgear Construction Co., Ltd. — Mr. D. R. Llewellyn and Mr. H. Seymour Berry have joined the board of this company.

Messrs. William C. Jeary & Horace F. Marchant (late directors of Magic Appliances, Ltd.) are carrying on the business of the Shore Leader Co. at Waterloo Works, Lanfranc Street, Westminster Bridge Road, S.E. 1.

An Electrochemical Scheme.—The St. Helens Coal and Firebrick Co., Workington, has been acquired on a cash basis of £12 for each £5 share of its issued capital by a syndicate, of which Mr. A. E. Barton, chairman of the Nitrogen Products and Carbide Co., is the head. The last-named company, it is stated, is to establish a works on the site of old West Cumberland Works, at Workington, for the manufacture of cyanamide; carbide will be an important product of the new industry, and the plant will provide for the working of all the by-products of coal, such as sulphate of ammonia, benzole, oils, pitch, &c. The works will need 3,000 tons of coal per day, and the turbines will generate 120,000 h.p. A capital of £5,500,000 is involved. The works will take two-and-a-half years to complete, and will ultimately employ 4,000 hands.

To Prevent Dumping.—The *Times* states in its Parliamentary notes that the Government has on the stocks—and it will be one of the first matters to be dealt with in the new Parliament—a measure intended to stop "dumping" in this country.

Book Notices.—Messrs. E. Bennis & Co.'s magazine, *Cheap Steam*, for January, contains a photograph of the late Mr. Edward Bennis, founder of the business, and a very interesting account of his career. Many tributes from the staff and friends are reproduced. The periodical has now reached its third volume. The present edition quite maintains the high reputation established by earlier issues. One of the subjects now dealt with is "Education for Genius," on which Mr. E. C. Reed delivered an address before the Association for the Scientific Development of Industry, at Manchester.

We have received copies of three numbers (July and October, 1918, and January, 1919) of *Steel Structures*, the sixpenny quarterly journal of the Steel Structural Association of the British Engineers' Association. The publication is issued from the Association offices, 32, Victoria Street, London, S.W. 1.

"Annuaire du Bureau des Longitudes." Paris: Gauthier-Villars et Cie. Price 3 fr. net.

"Ways and Means" is the title of a weekly review of industry, trade, commerce, and social progress inaugurated by Mr. E. J. P. Benn at 8, Bouverie Street, E.C. 4. Price 6d.

Calendar.—Messrs. Davis & Timmins, Ltd., of York Road, N., have sent us an extremely neat calendar, in the form of a handy mirror with a small perpetual calendar inset; the device is novel and ingenious, and will certainly give rise to pleasant reflections.

Lists.—William Firth, 200, Devonshire Street, Boston, Mass., U.S.A.—Illustrated descriptive leaflet of vacuum portable broomless floor sweepers for textile mills.

New System Private Telephone Co., Ltd., 143-5, Great Portland Street, W. 1. Leaflet relating to the "New System" automatic telephones

LIGHTING AND POWER NOTES.

Argentina.—Extensions.—The Compania Andina de Electricidad, Sociedad Anonima. has decided to increase its capital from $1,600,000 m/n to $2,500,000 m/n for the purpose of undertaking the construction of a new hydro-electric power station of 1,200 h.p., at Zonda, the extension of the supply to the neighbourhood of San Juan and the construction of a branch electric tramway.—*Review of the River Plate.*

Barrow-in-Furness.—Street Lighting.—The T.C. has decided to install 34 additional electric lamps in the Salthouse district.

Barnes.—Bulk Supply.—The L. & S.W. Railway Co. has decided not to continue for any period a bulk supply of electricity to the U.D.C.

Belfast.—Strike.—Up to Wednesday there was practically no alteration in the situation brought about by the general strike. The employés of the electricity department did not resume work, and the only electricity available was that permitted to be supplied to the hospitals. The tramways were also idle, owing to lack of energy. A great deal of looting has taken place due to the absence of street lighting. On Thursday. last week. the secretary of the Municipal Employés' Association, of which the electricity workers are members, went to Belfast to investigate matters. A picket was sent to bring him before the Strike Committee, and, after heated words, he was assaulted and his clothes were torn, but eventually there were explanations and apologies. The men at the Harbour Commission's power station also left work, and owing to six electric cranes being idle, the coal supply is being endangered.

Bolton.—Proposed Extensions.—The Electricity Committee has deferred consideration of a report of the borough electrical engineer with regard to extensions of plant at Back-o'-th'-Bank generating station until its next meeting.

Bournemouth.—E.L. Charges.—The Lighting Committee has recommended the T.C. not to consent to the proposed increased charges for electricity supplied by the Bournemouth and Poole E.S. Co. The company has asked that the price be increased from 25 per cent. to 33⅓ per cent. over pre-war charges.

Bradford-on-Avon.—The B. of T. has extended the time for the transfer, authorised by the Bradford-on-Avon E.L. Order, 1914, for one year from January 30th, 1919.

Broughton (Hants).—Proposed E.L.—A proposal is on foot to provide a supply of electricity by generating hydro-electric power from the mill stream.

Continental.—Sweden.—Constant and increasing attention has been given during the war to the possibility of utilising further Sweden's sources of hydro-electric power. and there has recently been a revival of the talk of electrifying the railways of the kingdom. For the purpose of encouraging agriculturists to participate in this movement, an association was formed, last spring, consisting of representatives of electric power companies and rural societies. The aim of the association is to furnish advice and information relative to the distribution of energy, and to render financial assistance in the purchase of electrical apparatus. Some typical examples of developments of the nature contemplated are as follows :—

In the province of Halland a group of farmers purchased a waterfall in order to obtain electric power for their farms. The amount to be expended on plant in connection with the scheme was nearly £50,000. Electric power is to be utilised for agricultural purposes on the island of Hisingen, £3,500 having been subscribed by prospective customers, the remaining cost being defrayed by the local authorities. Under somewhat similar arrangements, the entire parish of Vastra Frolunda (adjoining the city of Goteborg) is being furnished with electric power and lighting.

It is estimated that during 1917 the capacity of water-power plants operating in Sweden was increased by one-third, one-fourth of which was due to the Government and three-fourths to municipalities and private corporations, the last-named consisting mainly of large industrial enterprises. Extensive wiring in country districts is taking place.

Spain.—A concession has been granted to Don Alfredo Velasco to utilise 2,500 litres of water per second from the River Gudalfeo for the production of electricity.

A group of Bilbao capitalists has secured concessions for developing the falls on the River Duero. It is calculated that between 350,000 and 370,000 h.p. will be obtained, which is about equal to the total horse-power now utilised in all Spain. The scheme is a joint one for the benefit of both Spain and Portugal, and the Banca Portuguesa will subscribe its proportion of the share capital of 150,000,000 pesetas. The current generated will be employed for lighting and industrial purposes in both countries and the electrification of the Iberian railways.—*La Energia Electrica.*

A concession has been granted for the utilisation of the water power of the River Guaro, in the Province of Malaga, for the generation of electricity.

Dunstable.—Proposed Bulk Supply.—The Town Clerk has inquired upon what terms the Luton T.C. will supply energy in bulk.

Edinburgh.—Portobello Station.—The E.L. Committee has recommended the T.C. to proceed with the erection of the new power station at Portobello, at an estimated cost of £930,312. The scheme provides for the installation of three 10,000-kw. sets.

Fermoy (Co. Cork).—Proposed E.L.—Messrs. Cooke and Byrne, of Dublin. have communicated with the U.D.C. with regard to an E.L. scheme for the town. and the Council has decided to supply the firm with particulars as to the water power available.

Glasgow.—Strike.—The threat of the Strike Committee to shut down all the electricity works in Glasgow last week did not materialise, and although the supply was disorganised at the week end, owing to the men at the Port Dundas power station joining the strikers, the street lighting and the supply to the hospitals was never entirely suspended. On Monday a larger amount was available, and many works which had closed down for want of power were able to resume. The power stations were strongly guarded by troops.

Proposed Linking-up.—The Corporation and the Clyde Valley Electrical Power Co., after conferences with Mr. A. B. Gridley, the director of Electric Power Supply, have decided further to consider the question of linking-up the two undertakings.

Ilford.—Proposed New Plant.—The U.D.C. has approved a scheme for the installation of new plant at the electricity works. at an estimated cost of £25,000.

Kendal.—Price Increase.—The T.C has fixed the following new charges for electricity for power purposes :—Up to 183 units per annum, £2 13s. 4d. : between 183 and 1,000, 3½d. per unit ; between 1,000 and 2,000, 3d. : beyond 2,000, 2½d.

Leeds.—Wages.—The National Union of General Workers has applied for an advance of 5s. per week for Corporation employés outside the scope of district agreements. This means an advance from 25s. to 30s. per week war bonus. The demand includes double time for Sunday work. Consideration has been deferred. About 40 employés of the electricity department complained that they had not yet received the 3s. 6d. per week awarded by the Ministry of Munitions last August, and threatened to strike last week if they did not immediately receive back payment from August. The men belong to the General Workers' Union, and decided to remain at work under protest, pending an interview with the manager of the undertaking.

Liverpool.—Wages.—The following new bonus scheme has been arranged by the Corporation for its full-time employés :—From 7s. 3d. to 20s. per week on wages from 10s. to £4 per week : on wages from £260 to £500 per annum, 30 per cent. bonus, with a maximum total wage of £600 ; men over 21 receiving up to £260 per annum, 30s. per week bonus ; between £500 and £1,000 per annum, £100 per annum bonus.

London.—Electricity Charges.—In connection with applications by the Hampstead, St. Marylebone, and Southwark B.C.'s to the B. of T. for powers to increase their charges for electricity, the L.C.C. has communicated to the Board the observations of the Council on the applications, drawing special attention to the consideration that the ordinary lighting consumer should not bear an undue proportion of the burden of war-time conditions.

Poplar.—The borough electrical engineer has been instructed to obtain an estimate for the following work at the electricity works :—One boiler, feed pump, coal-weighing apparatus, and a balancer booster.

Morecambe.—Proposed E.L.—The Ministry of Munitions has informed the T.C. that, owing to the small demand for electricity by the town, it is not in a position to give a supply from the filling factory at a price favourable to the Council. Owing to the uncertain condition of the factory, the Council intends to install its own generating plant, at a cost not exceeding £4,000.

Newport (Mon.).—Strike.—The fitters at the Corporation electricity works left work on Thursday, last week, at the behest of their Union, so as to be in line with the men in the rest of the country.

North Wales.—Water Power.—In connection with the acquisition by the Aluminium Co. of certain water-power rights in North Wales. the Anglesey C.C. has passed a resolution to the effect that the attention of the Government be once more called to the necessity for immediate action to safeguard public interests in the water-power resources of North Wales, the appropriation of which by industrial concerns entirely foreign to North Wales appears to be proceeding unchecked ; also that the other County Councils of North Wales be asked to adopt a similar resolution, and that representatives of the Councils shall confer and take such action as may be thought desirable.

Oldham.—Proposed Extensions.—The Electricity Committee has decided to recommend the T.C. to apply to the L.G.B. for sanction to borrow £150,000 for additional plant, &c., to meet the need for extensions.

Peterborough.—Proposed Extensions.—The T.C. proposes to obtain expert advice as to the proposed extension of the electricity works.

Nottingham.—Extensions.—The Electricity Committee has recommended the T.C. to install a 3,000-kw. turbo-alternator and accessories at St. Ann's power station, at an estimated cost of £55,800, and to extend the mains, at a cost of £20,000.

Preston.—Proposed Extensions.—The Salford Corporation has authorised its chief electrical engineer to advise the National Electric Supply Co. as to the proposed extension of its undertaking at Preston.

Ripon.—Proposed E.L.—The T.C. has appointed a Committee to consider the provision of an E.L. scheme for its area.

Salford.—Proposed Loan.—The Electricity Committee has recommended the Council to apply to the L.G.B. for sanction to the borrowing of £14,000 for mains extensions and £6,000 for new services.

Shipley.—Wages.—At a meeting of the U.D.C., last week, it was reported that a number of employés of the electricity undertaking threatened to strike because of dissatisfaction with a decision of the War Wages Committee. The Electricity Committee recommended that the application of the general labourers should be met, and agreed that the wages of switchboard attendants and stokers would have to be brought into line with those at Bradford. The men also asked for double pay for Sunday work. The chairman of the Electricity Committee complained that the men had held a pistol at their heads three times in one week, and it was unfair to threaten to cease work on 12 hours' notice. The men agreed to await information from Bradford, but they had since demanded more.

Extensions.—The U.D.C. approved extensions of supply by overhead wires to Stoney Ridge, and also extensions to Carr Lane and Sunny Bank.

Southport.—Proposed Extensions.—The Electricity Committee proposes to borrow £132,000 for the installation of new turbine plant.

Spalding.—Hospital Lighting.—The Johnson Hospital authorities have decided to install plant for lighting, power, X-ray apparatus, and electrical treatment.

Stretford.—Proposed Purchase.—The Lancs. C.C. has decided to oppose the Bill which the U.D.C. is promoting for the purchase of the undertaking of the Trafford Power and Light Supply (1902), Ltd.

Walthamstow.—Proposed Extensions.—The electrical engineer has reported on the advisability of installing a 3,000-kw. turbine, with cooling tower, and the Director of Electric Power Supply is to be approached by the Council with a view to obtaining sanction to the necessary loan.

Watford.—Proposed Bulk Supply.—The N. Metropolitan E.P.S. Co. has suggested that the Council take a supply of electricity in bulk from the company, and the matter has been referred to a Committee.

Wellington (Salop).—Proposed E.L.—The R.D.C. has decided to support any adequate scheme which may be introduced for the supply of electricity within its area.

Willesden.—Loan.—The Council has applied to the L.G.B. for sanction to a loan of £25,000 for the following work in connection with the electricity undertaking:—Mains, £10,000; transformers, £5,000; meters, £5,000; and services, £5,000.

TRAMWAY AND RAILWAY NOTES.

Accrington.—Strikers' Wages.—The Tramways Committee has refused an application for the payment of wages during the period when the employés were on strike.

Bexley.—Track Renewals.—Owing to heavy war-time traffic £13,000 is needed for the reconstruction of the tramway track, and the War Office, the Ministry of Munitions, and the Road Board have been asked for financial assistance by the U.D.C.

Canada.—The Ottawa Electric Railway Co. has offered to sell its system to the city for $6,500,000.—*Financier.*

Colne.—Proposed Loan.—The Corporation has decided to renew its application to the B. of T. for sanction to borrow £5,500 for tramway purposes.

Continental.—Belgium.—A new concern has been organised in Liége, with the title Syndicat d'Etudes de Halage Electrique, to carry out experiments in canal and river traffic by means of an electric tractor system developed by M. de Puydt.

Spain.—Plans have been prepared by the engineer, Don Luis Rebera, for an electric railway from Lugo to Ribadeo. M. Masanet, chairman of the Compagnie Minière de l'Afrique du Nord is one of the promoters of the scheme.

Cork.—Fare Revision.—The Cork Electric Tramways and Lighting Co. has decided to increase its fares from 1d. to 1½d. per mile.

Glasgow.—Strike.—Many cars have been smashed up during the strike, and the service has been seriously interrupted by the many processions and demonstrations. The power station employés assured the Corporation of their loyalty, and at the Pinkston station arrangements were made for accommodating the staff with board and lodging. On Friday, last week, more than a dozen cars were wrecked by the strikers in Saltmarket Street, and nine cars were wrecked at Glasgow Green. The power stations and depôts are now guarded by troops.

Hythe (Kent).—Proposed Light Railway.—The T.C. has decided to support a proposal for the construction of a light railway from the town to New Romney.

Ilford.—New Cars.—The tramway manager has been instructed by the U.D.C. to prepare specifications for the supply of new tramcars.

London.—Fare Revision.—Under an arrangement by which fares are increased to meet the increased cost of materials and wages, certain fares on the Underground and District Railways were increased on Saturday last. Through railway and tramway bookings between the Underground Railways and the Metropolitan Tramways, *via* Golder's Green, have been temporarily suspended.

Underground Railway Strike.—Most of the underground railway systems, and the electric portion of the L.B. & S.C. Railway, were closed down on Monday, owing to a dispute over a half-hour interval for meals, which the men wanted counted in the 47-hour week. At a conference between the railway officials and the men's Unions, on Saturday, it was decided to leave the matter over for discussion at a meeting of the Railway Executive Committee and the men's Unions on the 12th inst., and this was confirmed at two mass meetings on Sunday. The drivers, however, refused to be bound by the agreement, and did not go on duty on Monday. The Metropolitan Railway maintained its usual service, and a few trains were run on the District. The L.B. & S.C.R. eased the situation by running steam trains on the electrified portion.

On Tuesday the men at Lots Road power station came out, with the result that the District Railway had to be completely closed down, and the services on the section of the London United Tramways which was supplied from there were suspended; the service on the Middlesex side of the river, which obtains power from the Chiswick power station, was not interrupted.

Manchester.—Proposed Underground Railway.—At its next meeting the Corporation is to consider a motion that a Special Committee be appointed to consider the provision of a system of underground railways for the town.

Salford.—Charges for Power.—The Tramways Committee has agreed that the charges for electricity supplied for traction purposes be based on the actual amount of standing charges on the capital cost of the plant and cables allocated to traction supply, and the working cost, plus £5,000 per annum for the depreciation, renewals, and reserve funds, &c., of the Electricity Committee, the agreement to remain in force for two years from April 1st next.

Stainland (Yorks.).—Extension.—The Halifax Corporation has informed the U.D.C. that the tramway system will be extended to Stainland as quickly as possible, but that a definite date cannot be given.

Sunderland.—Charges for Power.—As the Electricity Committee estimates a loss of £3,793 on the present year's working, the Tramways Committee has been requested to pay an extra ¼d. per unit for electricity. The present charge is 1·5d., which is considered to be under cost price.

TELEGRAPH AND TELEPHONE NOTES.

Snowstorms.—Telegraphic connection between Hemel Hempstead and London being interrupted owing to the snowfall, telegrams were sent by train to London for dispatch.

The Telephone Service.—In the event of a general strike of electrical workers, it is stated that steps have been taken by the authorities to maintain the telegraph and telephone systems. Under the Defence of the Realm Regulations the authorities have powers which would enable them to maintain a fairly efficient service.

The Telegraph Service.—The Postmaster-General has decided to grant full civil pay, without deduction, to officers and men in the Postal and Signal Sections of the Royal Engineers, who come under the special conditions regarding pay, and to refund all deductions that have been made in the past. It will be recalled that R.E. telegraphists recently protested at the Central Telegraph Office against the withdrawal of a Post Office grant which supplemented their Army pay.—*The Times.*

Mr. Clynes is to address a meeting of postal employés to-day on the question of a Whitley Council for Postal Servants.

United States.—The House of Representatives Committee has voted to report the Bill providing for the continuance of Government control of the telephone and telegraph systems until December 31st, 1919.—*Financier.*

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices," Jan. 31st.

Melbourne.—March 4th. Deputy Postmaster-General. Cables (schedule No. 1,504).*

March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Belfast.—February 15th. Tramways Committee. Tramway stores (including several electrical items). See "Official Notices" January 31st.

February 24th. Electricity Department. Electric and hand cranes, pumps and tanks. See "Official Notices" January 17th.

Belgium.—February 14th. The municipal authorities of Herstal, near Liége, are inviting projects until February 14th, for a system of electricity distribution in the town.

Birmingham. — March 5th. Tramways Committee. Additional rolling stock. See "Official Notices" to-day.

Dundee.—February 14th. Corporation. Electric power installation at Corporation yard, East Dock Street. Specification from Mr. J. Thomson, city architect, 91, Commercial Street.

King's Lynn.—February 24th. Corporation. One 1,000-kw. turbo-alternator, one 400-kw. rotary converter or motor-generator, and one 400-kw. transformer and switchgear. See "Official Notices" to-day.

Lincoln.—March 5th. Corporation. Four water-tube boilers with stokers, &c., complete; two 3,000-kw. turbo-alternators with condensers, &c.; extension of E.H.T. switchboard, &c.; two 750-kw. rotary converters, &c.; two 2,000-k.v.a. three-phase transformers, &c. Specifications from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices" to-day.

London.—St. Marylebone.—February 12th. B.C. Two steel-cased water-tube boilers, superheaters, economisers, stokers, fans, &c. See "Official Notices" to-day.

Stepney.—February 20th. Electricity Supply Committee. Two water-tube boilers, with chimneys; economisers, flues, &c. See "Official Notices" to-day.

Manchester. — February 11th. Tramways Committee. (*a*) Tramcar motors. (*b*) Tramcar trucks. Mr. J. M. McElroy, General Manager, 55, Piccadilly, Manchester.

February 17th. Tramways Committee. Electric tramcar bodies. Specifications, &c., from Mr. J. M. McElroy, general manager.

New Ross (Co. Wexford).—February 20th. Gas and Electricity Supply Co., Ltd. Suction-gas plant and dynamos, storage battery, main switchboard, overhead lines and street lamps. See "Official Notices" January 24th.

Tuamgraney, Scariff (Co. Clare).—February 15th. Messrs. Lysaghts. One hydraulic turbine, dynamo, pipe line, electric motors and wiring. Specifications from Mr. L. J. Lawless, Rathmines, Dublin. See "Official Notices" January 31st.

CLOSED.

Preston.—T.C. Double car-wheel lathe, £900. Hulse and Co., Ltd.

Stoke-on-Trent.—Electricity Committee. One 3,000-kw. steam turbine, three-phase generator, and condensing plant, £24,910. British Westinghouse Co., Ltd.

OUR HALF-YEARLY INDEX.

The Index to Vol. 83 of the Electrical Review, which has now been printed, will be supplied for 3d., post free, to those who, through the post, specially apply for it. Applications should be addressed to the Publisher, Electrical Review, Ltd., 4, Ludgate Hill, London, E.C. 4.

FORTHCOMING EVENTS.

Manchester Association of Engineers.—Saturday, February 8th. At 6.30 p.m. At the Grand Hotel. Paper on "Principles of Jig and Tool Design," by Mr. G. H. Hey.

Birmingham and District Electric Club.—Saturday, February 8th. At 7 p.m. At the Grand Hotel. Discussion on "The Relative Merits of Alternating and Direct Current for General Use." To be opened by Mr. C. G. A. MacDonald.

North of England Institute of Mining and Mechanical Engineers.—Saturday, February 8th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. General meeting.

Salford Technical and Engineering Association.—Saturday, February 8th. At 7 p.m. At the Royal Technical Institute. Lecture on "The X-Rays: their Production and Utilisation," by Mr. J. W. Ball.

Chief Technical Assistants' Association.—Saturday, February 8th. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Problems in Connection with Linking-up." To be opened by Mr. Bowden.

Royal Society of Arts.—Monday, February 10th. At 4.30 p.m. At John St., Adelphi. Cantor Lecture, "Scientific Problems of Electric Wave Telegraphy," by Prof. J. A. Fleming, F.R.S. (Lecture I).

Wednesday, February 12th. At 4.30 p.m. Paper on "The Government and the Organisation of Scientific Research," by Sir Frank Heath, K.C.B., Secretary of the Department of Scientific and Industrial Research.

Royal Institution of Great Britain.—Tuesday, February 11th. At 3 p.m. At Albemarle Street, W. Lecture on "Study of Electric Arcs and their Applications," by Prof. J. T. MacGregor-Morris.

Industrial and Reconstruction Council.—Tuesday, February 11th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on Industry and Educational Reconstruction. To be opened by Mr. F. W. Sanderson.

Association of Engineers-in-Charge.—Wednesday, February 12th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "The Psychology of Reconstruction," by Mr. A. W. Wyatt.

Institution of Electrical Engineers.—Thursday, February 13th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "The Functions of the Engineer: his Education and Training," by Lieut.-Colonel W. A. J. O'Meara, C.M.G.

(**Students' Section**).—Friday, February 7th. At the City and Guilds Technical College, Finsbury, E.C. Lecture, with experimental demonstrations, on "Oscillatory Electric Discharges"; also an Exhibition of Ancient and Modern Illuminants, by Mr. R. P. Howgrave-Graham.

(**North-Eastern Centre**).—Friday, February 7th. At Messrs. Swan, Hunter & Wigham, Richardson's Yard, Wallsend. Demonstration of electric welding as applied in ship construction.

Monday, February 10th. At 6.45 p.m. At the Mining Institute, Newcastle. Paper on "The Supply of Single-phase Power from Three-phase Systems," by Prof. Miles Walker.

(**North Midland Centre**).—Tuesday, February 11th. At the Metropole, King Street, Leeds. At 7 p.m. Address on "The Leeds Automatic Telephone Exchange," by Mr. T. B. Johnson, and visit to the Exchange.

(**North-Western Centre.**—Tuesday, February 11th. At 7 p.m. At the Engineers' Club, Manchester. Lecture on "Planning a Works Research Organisation," by Mr. A. P. M. Fleming, O.B.E.

(**Scottish Centre**).—Tuesday, February 11th. At 7.30 p.m. At 207, Bath Street, Glasgow. Paper on "Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery," by Mr. P. Hunter-Brown.

Electro-Harmonic Society. — Friday, February 14th. At 7.30 p.m. At the Holborn Restaurant (Venetian Chamber). Ladies' night.

NOTES.

Faraday House Old Students' Association. — At a meeting of the Council of this Association, held on January 28th, it was decided to hold a Re-union of Old Students early in June. In view of the frequent changes in location, and in order to keep the records of the Association up to date, the Hon. Secretary will be obliged if members will keep him advised of any change of address.

Legal.—An Unprotected Motor.—At Paisley Sheriff's Court, Matthew Gunnis was charged, under the Coal Mines Act, 1911, with having, while acting as manager of a colliery at Giffnock, permitted, in connection with haulage down the pit, an unprotected electric motor to be used between September 11th and November 8th last. He pleaded guilty, and explained that after the Mines Inspector had complained steps were immediately taken to get a protected motor, and that the delay was due to the difficulty, owing to the war, of getting suitable motors at the time. Sheriff Blair said the case had been brought as a warning to others, and having heard the excuse and explanation of the circumstances, he found it unnecessary to impose any penalty or pronounce any sentence. Respondent was accordingly dismissed.

Weld-Blundell *v.* Stephens.—In the Court of Appeal, last week, the appeal of plaintiff in this case was heard. The case arose out of correspondence, &c., connected with the affairs of the Float Electric Co., and the hearing was briefly reported in these pages at the time. The appeal was allowed, and the cross-appeal dismissed, without costs of the appeals on either side. Judgment was entered for the appellant in the action for 20s., without costs.

Ramsay Memorial Fund.—The treasurers of the Ramsay Memorial Fund have now received over £41,000 towards the £100,000 at which the appeal aimed. As a part of the Ramsay Memorial scheme, a special effort is being made at present to raise a further sum of £25,000 towards the £50,000 required for the Ramsay Memorial Laboratory of Chemical Engineering. Further donations to the fund may be sent to the Hon. Treasurers (Lord Glenconner and Prof. J. Norman Collie), University College, London.

Copper Prices.—Messrs. F. Smith & Co., and Messrs. James & Shakespeare, report, February 5th. No change.

Power Consumption of National Industries.—An attempt is made by L. W. Schmidt, in *Power*, to evolve a scheme according to which the power requirements of the leading national industries should be measured with a view to facilitating regional distribution and to prevent waste. He says that during the year 1914 American industry was using 22,547,571 H.P. in the form of primary power, and it spent the enormous sum of $666,406,709 for fuel and rent of power. It must be suspected that much of that power might have been saved.

Power is produced by two different agencies. The first and most active of these is private generation by steam, water, or internal-combustion engines. Of the 22 million primary horse-power employed by industry during the year 1914, over 18,500,000 H.P., or 82 per cent., was produced in this way. The remainder consisted of power rented by the consumers; and 3,917,655 H.P. of rented power was electrical and was supplied presumably by central stations.

Unfortunately, our knowledge as to what should constitute the normal consumption of power in any industry is still very small. Estimates as to what constitutes a safe limit of power for certain industries have not been made yet. As a result, there are enormous differences in the power consumption of factories making identical products and working under practically similar conditions :—

H.P. Used per Wage Earner in Various American Industries During 1914.

—	Number of wage earners.	Primary power. Total H.P.	Electrical power. Total H.P.	Total power per wage earner.		H.P. per $1,000 of product.
				Primary H.P.	Electrical H.P.	
Agricultural implements	48,459	191,428	83,117	2·5	1·7	0·73
Automobiles and bodies	127,092	173,684	135,818	1·4	1·0	0·26
Brass, bronze, and copper products ..	40,306	132,700	64,868	3·0	1·6	0·75
Carriages and wagons ..	52,391	112,549	46,384	2·1	0·9	0·78
Cars and general shop construction (electric railroads)	26,384	44,989	44,670	1·7	1·7	1·16
Cars and general shop construction (steam railroads)	339,518	433,994	325,054	1·3	0·9	0·82
Cars, steam railroad, (not included above ..	54,288	126,687	115,479	2·3	2·1	0·65
Cement	27,916	490,402	336,516	17·5	12·0	4·81
Chemicals	32,311	282,385	172,510	8·7	5·3	1·52
Coke, not including gas-house coke	21,107	120,327	88,409	5·7	4·2	1·21
Copper and tinsheeting	80,029	75,263	49,473	0·9	0·6	0·79
Cotton goods	393,404	1,585,953	512,903	4·0	1·3	2·29
Cutlery and tools ..	33,427	73,255	34,680	2·2	1·0	2·86
Dyeing and finishing ..	48,467	130,172	51,021	2·7	1·0	1·19
Fertilisers..	22,815	114,281	65,266	5·0	2·8	0·74
Firearms and ammunition	18,557	18,828	17,259	1·0	0·9	0·45
Flour and grist mills ..	39,718	822,384	150,248	20·7	3·7	0·93
Food preparations ..	20,306	80,022	47,761	3·9	2·3	0·36
Foundry and machine-shop products	564,610	1,129,768	896,849	2·0	1·5	0·82
Furniture and refrigerators	133,498	251,997	88,964	1·9	0·6	0·89
Gas illumination ..	43,792	245,715	38,826	5·6	0·9	1·11
Glass	74,502	163,139	92,896	2·1	1·2	1·33
Iron and steel blast furnaces..	29,356	1,222,273	212,582	41·6	7·2	3·84
Iron and steel rolling mills	248,716	2,706,553	1,207,715	10·9	4·8	2·94
Iron and steel bolts and nuts..	10,658	28,897	18,562	2·7	1·7	1·23
Iron and steel forgings	10,689	38,215	25,076	3·5	2·3	1·31
Leather, tanned.. ..	55,456	122,712	73,424	2·2	1·3	0·47
Lime	12,429	39,134	12,851	3·1	1·0	2·12
Oil, cottonseed cake ..	21,810	249,781	80,393	11·5	1·4	1·17
Paint and varnish ..	16,083	70,611	34,917	4·4	2·2	0·48
Paper, wood pulp ..	88,457	1,621,154	325,211	18·3	3·6	4·88
Petroleum	26,366	128,468	38,614	5·1	1·5	0·32
Rubber goods	50,220	151,927	93,998	3·0	1·8	0·67
Shipbuilding	44,489	115,333	66,275	2·6	1·4	1·30
Smelting and refining copper	17,731	194,980	88,213	10·9	4·9	0·44
Sugar refining	11,253	49,666	24,016	4·4	2·1	0·17
Wire	17,600	83,940	39,458	4·8	2·2	1·02
Wire work.. .. .	12,126	21,547	14,305	1·7	1·1	0·51
Woollen goods	163,976	398,367	144,244	2·4	0·8	1·01

Appointments Vacant.—Tramway overhead linesman for the Erith U.D.C. tramway department; charge engineer (£215), junior charge engineer (£199) for the Barrow-in-Furness Corporation electricity works; secretary (£1,000) for the Engineering Training Organisation; sub-station attendant (60s. + 28s. 6d. + 12½ per cent.) for the Walthamstow U.D.C. electricity department. See our advertisement pages to-day.

Working Conditions at Woolwich Arsenal.—A deputation from the Electrical Trades Union was received at the Ministry of Labour, on February 2nd, by Sir David Shackleton, the permanent secretary, with reference to several questions concerning the conditions of labour of electricians at Woolwich Arsenal. After discussion with the permanent officials of the Ministry, the deputation agreed to the whole of the questions in dispute being referred to arbitration.—*Daily Telegraph.*

Engineering Golfing Society.—At the annual general meeting of this Society, held in February, 1915, it was decided to discontinue all operations during the continuance of the war. The Committee feels that an effort should now be made to resume activities, and has arranged that a general meeting shall be held at the Institution of Civil Engineers, on Thursday, February 27th, at noon. Owing to the disturbing influences of the war, it is probable that many members have changed their addresses during the last four years, and it would be of great assistance if they would kindly communicate with Mr. Walter L. Mansergh, 5, Victoria Street, Westminster, S.W. 1, who is acting as hon. sec. *pro tem.*

Institution and Lecture Notes.—**Electrical Power Engineers' Association.**—The following is a list of officials of the Scottish Division :—

Divisional Chairman.—W. J. Cooper, A.M.I.E.E.

Ditto, Vice-Chairman.—T. M. Lingard, Edinburgh.

Ditto, Hon. Secretary.—A. E. Kelly, 70, Bothwell Street, Glasgow (head office).

Ditto, Assistant Secretary.—J. H. Wright, A.M.I.E.E., 8, Garland Place, Dundee.

Ditto, Treasurer.—G. Brander, 11, Alpha Place, Broughty Ferry Dundee.

Section Secretaries.

Glasgow.—Harry Mackenzie, 46, Springhall Gardens, Glasgow.
Edinburgh.—A. Lingard, 41, Falcon Avenue, Edinburgh.
Dundee.—G. Fowler, 8, Molison Street, Dundee.

National Association of Supervising Electricians.—A concert has been arranged by this Association to take place at Caxton Hall, on March 8th, at 6.30 p.m. Tickets (5s. double, 3s. single) may be obtained from the Hon. Sec., 83, Deodar Road, Putney, S.W. 15. Ladies are invited.

Huddersfield Engineering Society.—Mr. F. Bland, of Sheffield, delivered a lecture, last week, on "The Evolution of Street Tramways."

SCIENCE AND THE NATION.—A special lecture on "Pure Science in Relation to the National Life" will be delivered by Prof. Arthur Schuster, F.R.S., on Saturday morning, February 15th, at 11 o'clock, at the Regent Street Polytechnic, W.

Staff Dinner.—On Thursday, January 30th, the Manchester Corporation Electricity Committee entertained the staff at dinner at the Grand Hotel, Manchester, on the occasion of Mr. A. E. McKenzie, the deputy chief engineer, relinquishing his position in order to join the staff of Messrs. C. P. Sparks, consulting engineers, London. In addition to the Committee, about 80 members of the staff were present, and during an interval in the musical programme the chairman (Councillor Dagnall), on behalf of the Electricity Committee, handed to Mr. McKenzie a handsome bronze figure, surmounted by an electric torch, and in doing so referred in flattering terms to the recipient's 17 years' connection with the undertaking. Mr. S. L. Pearce, C.B.E., chief engineer and manager, in presenting a grandfather's clock, subscribed for by the staff, paid a tribute to Mr. McKenzie's loyalty and conscientiousness during his period of service. In acknowledging the gifts, Mr. McKenzie referred to the many happy years he had spent in Manchester, and thanked the staff for the assistance and co-operation he had always received. Messrs. S. L. Pearce, H. W. Smyth, S. A. Russell, A. E. McKenzie, and Councillor Hill contributed to the musical programme.

Future of the Railways.—According to the *Financial Times*, Lord Claud Hamilton, presiding at the meeting of the East London Railway Co., on Friday last, stated that the Government considered itself absolutely pledged to maintain control of the railways for two full years subsequent to the declaration of peace. The question of the future management of the railways of the United Kingdom was still receiving the closest examination on the part of the Government, but, so far, no final decision on the subject had been reached.

A Submarine Cable Operators' Association.—In harmony with the widespread inclination of all classes of industry to identify themselves with some kind of association for the purpose of safeguarding their vital interests on equitable lines, not the least noteworthy is the prospective formation of a Submarine Cable Operators' and Employés' Association, which, if placed on a sound working basis, may be expected to bring substantial influence to bear for the adjustment of outstanding grievances. The idea is by no means new in the history of submarine telegraphy, but previous attempts have been throttled in their infancy for want of unanimous co-operation between the employés of various companies, coupled with the instinctive fear of running foul of officialdom, and consequent dismissal. The rapid change of events, however, seems to call imperatively for united action if legitimate claims are to receive full recognition. The formation of such an association is no simple matter, owing to the great distances separating the small communities which are scattered all over the world, without ready means of co-ordination. The submarine cable has done yeoman service during the war, but few outside the immediate precincts of the service can fully appreciate the unremitting pressure that was placed upon its operating staffs, many of whom, it is said, have received but meagre acknowledgment for their labours.

In the turmoil of the past four years, in most cases managers have had to contend with a tremendous influx of business, with little time at their disposal to give full consideration to staff matters. Now that the war has terminated, and with the gradual relaxation of the many inconveniences inherent thereto, no doubt adequate steps will be taken to remedy many of the alleged grievances, and to place cable operators in a position worthy of their profession. Whatever steps may be taken by the organisers of the association to assert themselves, there is no reason to suspect anything but honest and straightforward motives, and we think they can be relied upon to refrain from any attempt to propagate dissatisfaction, or to lend support to the policy of strikes. The association should stand for those ideals which are manifestly essential for the well-being of its members, and at the same time endeavour to promote a feeling of good understanding with the employers as the only possible and sure road to mutual co-operation.

Chief Commercial Officers' Association (Electricity Supply Undertakings).—The annual general meeting was held at Anderton's Hotel on Friday evening last. The Association was formed at the end of 1917, and the Clerical Assistants' Association early in 1918, the latter Association being affiliated to the C.C.O. Association.

The original intention was to confine the Association to the Greater London area, but it was deemed advisable to extend the Association to the provinces, and with this end in view the Executive Committee circularised the whole of the undertakings in the provinces early in March, 1918. Very numerous expressions favourable to organisation were received, but the general hesitation to join was due to the fact that the meetings were held in London only, and very few members from the provinces could attend. The Executive Committee has now in hand a scheme for forming local sections in various parts of the country.

It was pointed out at the general meeting that every commercial man in a position of responsibility in an electricity undertaking was invited urgently to consider his position, in view of the rapid extension of organisation amongst his technical colleagues, and also in view of the possible effects of the coming national reorganisation of the electricity supply industry. After such consideration, he could not fail to see the absolute necessity of at once becoming a member of an association formed for the express purpose of guarding his interests, and enabling him to enjoy the same sense of protection as that afforded to lawyers, doctors, engineers, and labourers by their respective organisations.

The Executive Committee contemplates taking steps to obtain representation before the Conference of Electricity Supply, through whom it is proposed to submit scales of salaries applicable to commercial officials. An immediate and substantial extension of membership, enhancing the representative character of the Association, will afford the best guarantee of success in this matter.

The Association has been successful in its efforts to obtain the awards and the 12½ per cent. for members, and, where it has found it necessary to go to arbitration, it has been successful in all cases.

The Executive Committee approached the Electrical Power Engineers' Association with a view to affiliation; that association felt unable to accede to the request, but stated that, in the event of the C.C.O.A. registering as a trade union, it would be prepared to work with it on all matters of common interest. The necessary steps for registering the Association as a trade union are in the hands of the executive committee. Any reader interested in either Association is asked to communicate with Mr. N. A. Chesterfield, Electricity Works, Fulham, S.W. 6, regarding the C.C.O.A., and Mr. G. R. Smith, 39, Leghorn Road, Plumstead, respecting the C.A.A.

Strikes in London.—On Monday morning the drivers of electric trains on some of the London tube railways and the London & Brighton Railway ceased work without warning, causing immense inconvenience to the public. The alleged grievance of the men was connected with the inauguration of the eight hour working day, which came into operation on Saturday last, the men demanding time off for meals during the eight hours.

Sir Albert Stanley, President of the Board of Trade, stated that the principle of an eight-hour day for all members of the wages staff on the railways was conceded in December last. In December the unions put forward further demands, including increased wages and improved conditions of service aside from the eight-hour day. These matters are to be considered at a meeting next week between members of the Railway Executive Committee and the men's unions. In the meanwhile existing conditions of service, apart from the eight-hour day, are to remain unaltered. Sir Albert Stanley said:—

"It is quite clear that what is now demanded by the small section of men who are on strike is contrary to what has been agreed with the unions, and it is greatly to be regretted that this sectional disturbance which so seriously interferes with the travelling public, and for which there can be no possible justification, should have occurred."

A meeting of the members of the London District of the Electrical Trades Union was held on Monday last, and adopted the following resolution:—

"That this mass meeting of the London members of the Electrical Trades Union demands that the Government at once intervene in the Labour disputes of the Clyde, Belfast, London, and other places with a view to instituting legislation making operative a national 40-hour week with the object of absorbing all the unemployment in the country. In the event of the Government deciding not to intervene, we, the London members of the E.T.U., will cease work on Thursday, February 6th, at 6 p.m."

A deputation conveyed the terms of the resolution to Sir David Shackleton, at the Ministry of Labour, on Tuesday, but gained no satisfaction. According to the *Daily Telegraph*, it is understood that if the members of the union carry out their threat, the Government is prepared with plans in the public interest to guard the power stations and run them by voluntary labour.

According to the Central News, the deputation was assured that if reasonable demands were made and they were presented in a tangible form, they would receive the most sympathetic consideration of the Government. On the other hand, if the men continued to use force, and put the civil population and business firms to serious inconvenience, pending a settlement of their grievances, the Government would take the most drastic steps to protect both the civil population and the business undertakings of the country. Any grievances which the men had regarding the eight-hour day must be presented by the men's executive.

On Tuesday the Emergency Committee of the Electrical Power Engineers' Association, Southern Division, met in London and passed the following resolution:—

"Having considered the situation arising from the threat of the electricians to shut down power stations in London, the Committee has decided unanimously to call on all its members in the stations affected to maintain the continuity of supply. The Emergency Committee bases its position on the fact that the Electrical Power Engineers' Association is a properly constituted trade union, formed for the purpose of collective bargaining.

"It contends that agreements made between duly elected representatives of trade unions and employers, and the decisions given by an arbitrator to whom both sides have agreed to refer their differences, are morally binding on both parties, and must be honoured by employers and employés alike.

"As this threatened stoppage is apparently a blow aimed at the authority of trade union leaders and the Government, the committee confidently calls upon all electrical staff engineers to do their utmost to maintain the supply. In the meantime the committee is getting into touch with all the parties concerned and will advise members as to future action."

The *Morning Post* learned from Mr. Bostel, secretary to the Division, that there was not the slightest doubt that their members who were distributed among about 40 power stations in the Metropolitan area would remain at work and keep the electricity going. "If we can get a certain amount of unskilled labour," he declared, "we can keep all the power stations of London going indefinitely. We can, and we will, keep the lighting of London going, and we shall find the necessary power for all the works which desire to keep running. All our Scottish members are working in Glasgow, and that is why the power stations are kept going there."

The Executive Committee of the Amalgamated Society of Engineers deprecated all the unofficial strikes, and urged all members to resume work immediately so that responsible trade union executives might enter into negotiations to obtain redress of grievances. The committee also appealed to all members in the London area to ignore the decision to strike on Thursday.

Whilst going to press we learn that the Government has taken firm action in connection with the electricians' strike in London; by Order in Council under the Defence of the Realm Act, a regulation similar to the provisions of Section 4 of the Conspiracy and Protection of Property Act, 1875, to which we draw attention in a leaderette, has been put in force, so that any person who acts in a way to deprive the public of the supply of electricity is now liable to six months' imprisonment and/or a fine of £100. It is also reported that measures have been taken to ensure the maintenance of the supply and the protection of loyal workers in the event of a strike taking place; the Electrical Power Engineers' Association has declared its intention of carrying on the electricity supply with the aid of voluntary unskilled labour, and in our leading columns to-day we invite those who are willing to help to send us their names and addresses at once. The executive of the Electrical Trades Union met yesterday morning to consider the situation.

The executive of the Amalgamated Society of Engineers has suspended the London, Clyde, and Belfast committees and secretaries, and contemplates still more serious action to assert its authority; it has called on all members now on strike to resume work, and the strikes in the North are collapsing.

The greatest inconvenience was caused to Londoners by the cessation of the electric railway services, the conditions being seriously aggravated by a heavy fall of snow, through which thousands had to walk to and from their business premises.

The Dynamo.—

Oh! lusty monarch of a magic race,
Enthroned in state upon a concrete base;
Who'll sing thy praises? Who shall bend the knee
To truer worth, to greater slave, than thee?

Fashioned in science to a test of man,
Gauged and corrected to a maker's plan:
Who cares thy secret? Knowing but thy ways
Wise men and earnest render thee their praise.

Out of the planet earth the primal state,
Ores that were cradled to a scheme so great;
Making thy laws, that subject man must learn;
His to obey, to make thee slave in turn.

Life runs abundant at thy strange behest,
In bounded channels which appear at rest;
Bridging the distance in a silent course,
Spending in final goal their mighty force.

We mark thy progress in the final goal,
And see a lesson taught from Nature's soul:
Thus do we gain in faith of things we may not see:
Accomplished fact, dissolved from mystery.

A. Whitmore,

Fatalities.—A flying machine, flying very low over Westcliff-on-Sea, struck an electric light standard. The pilot was killed.

Two men have died, and a third is seriously injured as the result of the collapse of a scaffold at the new North Tees power station, Haverton Hill.

An electrical engineer named Knowles, employed by the Ship Canal Portland Cement Works, Ellesmere Port, died in December as the result of inhaling gas which had leaked, through an accident, from the Government poison gas factory.

Educational.—Mr. Edward Dawson, of Cardiff, who has been elected president of the South Wales Institute of Engineers, in his inaugural address, said it was proposed to create a faculty of technology for South Wales and to raise for it an income of £50,000 a year.—*The Times*.

Volunteer Notes.—ROYAL ENGINEERS VOLUNTEERS, LONDON ARMY TROOPS COMPANIES.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 7, by Lieut.-Colonel C. B. Clay, V.D., Commanding.

Wednesday, February 12th.—Drill and Engineering Instruction for the whole Corps, 1830.

Friday, February 14th. Range, 1830.

C. HIGGINS, Captain, R.E., *Adjutant*.

A Belgian Supply Company During Enemy Occupation.—The first Belgian supply company to record its experience during the German occupation is that of the Centrales Electriques des Flandres, S.A., of Brussels, which owns generating stations at Langerbrugge, Heyst-sur-Mer, and at Overmeire, and numerous sub-stations in Eastern Flanders. The report of the directors, which was presented at the recent annual meeting, was the first issued since that of January, 1914, although balance sheets have been prepared for the intervening years.

The report states that the declaration of war surprised the company at the moment when the installations were being completed. For instance, the Langerbrugge station in Eastern Flanders had just been brought into operation; the extension of the power transmission lines, and the construction of the distributing network intended to supply the towns were being actively carried on, and the connection of industrial establishments for the supply of power under contracts was being proceeded with. On the other hand, the installations on the coast had just been reconstructed, and the favourable working results were responding to expectations. The call to arms and the uncertainties of the hour caused the company early in August to suspend the works in progress. As the suppression of the supply of power for industrial purposes rendered the working of the generating stations very onerous, it was decided in agreement with the city of Ghent to stop the Langerbrugge station periodically for a time, and to obtain from the local authorities of that city the current necessary for the company's requirements; whilst, on its part, the company undertook to supply energy in return during the subsequent periods when its own station was in operation. In practice, this arrangement was found to be all the more advantageous to both parties, as it enabled the stocks of coal to be more economically utilised, and the two works effected exchanges of energy from time to time. The installation works were resumed and carried out rapidly when it became evident that the duration of the occupation would be long, and it was consequently possible to connect numerous villages where the inhabitants had been previously without any light.

Dealing with the company's relations with the enemy, the report states that the directors succeeded in maintaining them within the limits provided for by international conventions, that is to say, the company limited itself to furnishing the communal authorities with the current necessary for the lighting of the premises serving for the accommodation of the occupation troops. Every time the Germans tried to requisition current for other purposes—whether for charging the wires closing the Dutch frontier, current for the repair workshops for submarines or aeroplanes, or for lighthouses and searchlights—the enemy met with a formal and justified refusal. The result was that the installations at Knocke and Duinbergen were withdrawn from the company's control in June, 1916, and were only restored when the evacuation of the coast took place. On the other hand, it was possible to retain possession until the end of the works and network in Eastern Flanders, only material of relatively little importance being requisitioned. On the eve of the armistice, however, the Langerbrugge station was the object of a systematic bombardment by the enemy, an operation which did not appear justified by any military necessity. The damages caused were considerable, but repairs were being actively carried out, and the station had already resumed the normal service. It was intended to demand reparation in due course. The difficulties of working in these districts were considerable owing to the scarcity of coal, oil, and materials of all kinds, the dearth of transport facilities, the suppression of all public lighting, and the restrictions on private lighting. Yet the lack of petroleum made itself so seriously felt that the number of lighting consumers in the country increased from 1,665 on September 30th, 1914, to 10,407 on the same date in 1918. In contradistinction the power consumers, upon whom the company had largely depended for its prosperity, were completely lacking, and the company thus experienced a delay of five years as compared with the anticipations of 1913.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Morecambe T.C. has increased the salary of the electrical engineer to £280 per annum.

Colne Town Council has appointed Mr. J. H. THOMPSON, of Carlisle, Corporation electrical engineer at £350 per annum, in succession to Mr. A. G. COOPER, who has secured an appointment at Sheffield. There were 146 applications for the position.

On Monday last week the staff and employés of the Norwich Electric Tramways Co. presented a solid silver tea service to Mr. F. W. KETLEY, who has resigned the position of manager of the company. The Lord Mayor (Mr. G. M. Chamberlin), a director, presided. The Lord Mayor, in making the presentation, referred to the good feeling which had always existed between every member of the tramway staff and Mr. Ketley, whose period with the company extended from 1909-1919. Mr. Ketley responded in suitable terms. On the following day he was presented by the members of the City Police Force with a silver cigarette box.

Mr. F. M. FOSTER, assistant engineer and manager of Norwich Electric Tramways Co., has been appointed engineer Ketley, whose period with the company extended from 1909 to and acting manager in succession to Mr. F. W. Ketley.

Considerable advances in salary for Manchester Corporation electricity supply officials are recommended. The Electricity Committee asks for £2,045 more. The proposals include: Mr. S. L. Pearce, chief engineer and manager, from £1,500 to £2,000; Mr. W. E. Foden, financial superintendent, from £550 to £600; Mr. L. R. Lees, mains engineer, from £500 to £600; and Mr. E. Bolton, sub-stations engineer, from £500 to £600. It is expected that the recommendations will be mentioned at the February meeting of the City Council, and will then be brought forward for full discussion at the March meeting. The subjoined appointments are recommended by the Committee:—

Mr. T. Baxendale (assistant resident engineer, Stuart Street station), resident engineer, Stuart Street station, at £600 per annum; Mr. A. L. Lu (turbine house superintendent, Stuart Street station), assistant resident engineer, Stuart Street station, at £450 per annum; Mr. J. A. Vice (engineer in charge, Stuart Street station), turbine house superintendent, Stuart Street station, at £385 per annum; Mr. W. Kidd (assistant constructional engineer, Stuart Street station), constructional engineer, Stuart Street station, at £[illegible] per annum; Mr. H. A. Ratcliff (superintendent of the meter testing and standardising department), chief electrotechnical assistant, at £600 per annum.

Mr. C. J. SPENCER, who already holds the position of manager of the Metropolitan Electric Tramways and the London United Tramways, Ltd., has been appointed manager of the South Metropolitan Electric Tramways & Lighting Co.—the third tramway controlled by the London & Suburban Traction Co. Mr. A. V. MASON, hitherto manager of the South Metropolitan Electric Tramways & Lighting Co., has been appointed engineer under Mr. Spencer to the three tramway companies. In consequence of the resignation of Mr. W. HAMMOND as traffic manager of the Metropolitan Electric Tramways, Mr. J. B. MACKINNON, traffic superintendent of the London United Tramways, has been appointed the general traffic superintendent of all three companies.

We regret to read that Mr. W. G. PICKVANCE, borough electrical engineer, Wrexham, was taken suddenly seriously ill on Tuesday of last week, but it is now stated that he is a little better.

The Belfast Corporation has resolved that owing to the increased responsibilities thrown upon the city electrical engineer, Mr. T. W. BLOXAM, by reason of the extension scheme, his salary shall be increased by £200.

General.—According to the *Times*, the Special Board for Biology and Geology at Cambridge has approved a grant from the F. M. Balfour Fund of £100 to Mr. J. GRAY, M.A., Fellow of King's, for six months in aid of his researches on the permeability of cells to electrolytes and its bearing on the problems of fertilisation.

The *London Gazette* contains the following announcement:—

"Inspector-General of Transportation.—Hon. Lieutenant Colonel (temporary Brigadier-General) H. W. THORNTON, Eng. and Rly. Staff Corps, from Dep.-Director-General of Movements and Railways at the War Office, and to be temporary Major-General whilst so employed; January 20th, 1919."

Mr. MOORE EDE having accepted (as announced here last week) a seat on the board of Messrs. Johnson, Matthey and Co., has severed his connection with the firm of Messrs. Preece, Cardew, Snell & Rider, in which he was a partner.

The Institution of Civil Engineers has elected upon its Roll of Distinguished Honorary Members, Marshal Foch, O.M., Field-Marshal Sir Douglas Haig, Kt., and Admiral Viscount Jellicoe of Scapa, G.C.B., O.M.

Roll of Honour.—Second-Lieutenant C. W. SUMNER, of the 1/8th Battalion, Lancashire Fusiliers, who has been awarded the Military Cross, was engaged at the Wigan Corporation electricity works.

Private H. TAYLOR, 37th Labour Battalion, has died from influenza in hospital at Valenciennes. He was previously employed by the St. Helens Cable & Rubber Co., Ltd., Warrington.

Driver H. Parkins, R.F.A., previously in the employ of the Birmingham Electric Tramways, has been awarded the Military Medal.

Private J. Grimley, Durham L.I., who was on the staff of Messrs. Siemens, Stafford, is reported to have died whilst a prisoner of war in Germany.

Sergeant H. Lowe, Signal Section, R.E., who was formerly with Mr. W. M. Hughes, electrical engineer, of Kidderminster, has been awarded the Meritorious Service Medal. He previously gained the Military Medal and bar.

Obituary.—Mr. E. C. Ingleby.—We regret to record the death of Mr. Edward Cecil Ingleby, A.M.Inst.C.E., which took place on January 24th, after a long illness. Mr. E. C. Ingleby was a director of the firm of Messrs. Ingleby & Co., Ltd., electrical engineers, Leeds, and also of the Electric Motor & Stove Hiring Co., Ltd., and took an active part in the formation and management of both firms.

NEW COMPANIES REGISTERED.

Franco Signs, Ltd. (152,761).—Private company. Registered January 24th. Capital, £1,000 in £1 shares. Gas, electrical, and general engineers, makers of and dealers in illuminated and other signs, &c. The subscribers (each with one share) are:—H. Bey, 25, Oxford Street, W., engineer; E. F. Harrison, 25, Oxford Street, W., company director. The first directors are: H. Bey, E. F. Harrison, and Capt. C. A. L. Irvine. Registered office: 25, Oxford Street, W. 1.

Electric Productions Co., Ltd. (152,862).—Private company. Registered January 30th. Capital, £1,000 in £1 shares. Electricians, mechanical engineers, manufacturers of electrical signs, makers of experiments in and public exhibitions of electric force, lighting, machinery and appliances, &c. The subscribers (each with one share) are:—F. Farndon, 441, Romford Road, Forest Gate, electrical engineer; A. E. Abrahams, 114, Earlham Gate, Forest Gate, advertising contractor. First directors: A. E. Abrahams, F. Farndon, W. H. Shorter, and W. F. Wilson (all permanent). Registered office: 65-6, York Terrace, Regent's Park, N.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Banbury & District Electric Supply Co., Ltd.—Satisfaction in full on December 31st, 1918, of debentures dated 1913, securing £200.

Sheerness and District Electric Power & Traction Co., Ltd.—Satisfaction in full on January 1st, 1919, of 6 per cent. debs. dated 1915, securing £200.

Aluminium Corporation, Ltd.—Mortgage on freehold land, works, &c., dated January 9th, 1919, to secure £9,000. Holder: K. M. Clark, Sudbourne Hall, Oxford, Suffolk.

CITY NOTES.

The Zurich Bank for Electrical Undertakings. An interesting financial report for 1917-18 is published by the Bank für Elektrische Unternehmungen, Zürich. It says that, in spite of war conditions, electrical enterprises in the different countries have been able to hold their own, and, on the whole, serious losses have been avoided. The main bank in Zürich has made a net profit of Mk.679,341, compared with Mk.4,052,549 in 1916-17. No dividend is being paid, and this profit is being carried forward to the current year. Speaking about affiliated concerns, the report states that the Societá Adriatica di Elettricita (Venice) raised its capital from Lire 36.80 million to Lire 60 during last year. The Negri Co. took over all the shares of the Societá per la Forze Idrauliche della Maira as well as the liabilities, and at the same time raised its own capital from Lire 20 to 50 million. Later this company procured the majority of shares in the Officine Elettriche Genovesi and increased its own capital further to Lire 110 million. The Petrograd Electric Lighting Co. of 1886 was declared the property of the Russian Republic during 1917, and had a loss of about R.545,000. Likewise the Moscow Electric Power Co. (Petrograd) has been expropriated, under protest on the part of the Swiss Government. This company has evidently had to deal with a heavy loss in 1917. The Societá Meridionale di Elettricita, Naples, paid 6 per cent., compared to 5½ per cent. in the preceding year. The Co. Sevillana de Electricidad Sevilla paid no dividends. The Elektr. Werk Strassburg paid 7 per cent., compared to 10 per cent. The Silesian Electric & Gas Co., Breslau, 5 per cent., compared to 9 per cent. The Upper Rhine Power Station, Mülhausen, 3 per cent., compared to no dividend. The Black Forest Electric Co., 5 per cent. The Unterelbe Elect. Works, Altona, distributed no dividend. The Unione Italiana Elect. Tramways, Genoa, paid 5 per cent., compared to 7 per cent. The Elektrochem-Werke G., Berlin, paid 15 per cent., compared to 12 per cent. The fate of most of these concerns is entirely dependent on what steps the authorities will take in future. The Rumanian Electrica fost Lahmeyer, Bucharest, hopes to receive compensation for war losses, and in the meantime has been nearly able to resume its former activities. The electrical companies in Portugal, Spain, and other foreign countries were particularly handicapped for lack of fuel.—*Kölnische Zeitung*, December 31st.

Adelaide Electric Supply Co., Ltd. Mr. J. B. Braithwaite presided on Tuesday over the annual general meeting of the company at Finsbury Pavement House. In proposing the adoption of the report, the Chairman said that they had had great difficulties to contend with in Australia during the year, but had continued to show fair progress, and had added 18 additional miles of streets, making a total of 478 miles where a supply was available. The number of their employés who had joined the Australian Imperial Forces was 91; that was 35.5 per cent. of their total pay roll. Unfortunately seven of those brave men had been killed; 12 had been returned to the company's employ, and 13 others were hoping to get back in due course. Owing to the improved plant that they had put in, although they had sold nearly 1½ million more units, they had been able to produce them with about 450 tons less coal. They had introduced a new power tariff for those who would use their supply between 10 o'clock in the evening and 8 o'clock in the morning. Already they had about 60 consumers on that tariff. The report was adopted.

Melbourne Electric Supply Co., Ltd. The annual general meeting was held on Monday at Finsbury Pavement House, E.C. Mr. J. B. Braithwaite, chairman, in proposing the adoption of the report, said that in spite of the very difficult conditions which they had had to face, the results were satisfactory. He hoped they would be willing, as in previous years, to pass a special resolution acknowledging their appreciation of the excellent services rendered by the staff in Australia. In Melbourne they had added 24 miles of streets to those in which they were giving a supply, making 623 miles in which current was available. In Melbourne coal cost them £27,464 more, a rise of 52 per cent., whilst the revenue only increased 16.5 per cent. They made a capital expenditure of £107,766 at Melbourne and about £26,000 at Geelong, so that the total capital expenditure was now about 1½ millions. In Melbourne 102 members of the staff enlisted, and from Geelong 32, 13 of whom had returned, and four had been killed during the year. Replying to a question, the Chairman said that all their concessions ran concurrently, and expired in 1923. The report was adopted.

Yorkshire Electric Power Co.—Net profit for 1918, after payment of mortgage and other interest, is £46,536, making, with the balance brought forward, a total of £50,927. After paying a dividend of 6 per cent. on the preference shares and 7 per cent. on the ordinary shares, and increasing the general reserve fund to £59,000 by transferring £15,000, the balance of £10,224 is carried forward. Dividend on the ordinary shares was 5 per cent. for 1917 and 3 per cent. for 1916. Under the provisions of the Yorkshire Electric Power Act, 1918, an agreement has been made with the Mexborough Urban District Council to form a Joint Electricity Board with the object of providing additional generating plant to supply the southern portion of the company's area. Agreements for supply have also been made with the Urban District Councils of Elland and Spenborough. Arrangements made for association with the Bradford, Sheffield, and Rotherham Corporations have already been reported. These and other arrangements mark substantial progress towards the concentration of very large units of generating plant in power stations, with a resultant economy of coal and a co-ordination of supply in the whole area of the Company. The continually increasing demands of the company's supply which must be met will shortly require the issue of further capital.

Costa Rica Electric Light and Traction Co., Ltd.—The net earnings for the year ended June 30th, 1918, amount to £10,503, a decrease of £3,877. The net deficit for the year is £6,645 18s. 10d. The volume of business shows a considerably larger income in the local currency than that for the previous year. Continued fall in the gold value of the Costa Rican "Colon" is the principal cause of the diminution of profits. The gold premium has averaged 345 per cent. during the year, as against 200 per cent. in the previous year, and 112 per cent. (the legal equivalent of the gold "Colon") in the year (1913-14) before the war. The interest on the 6 per cent. prior lien bonds has been paid in cash, but the holders of the 5 per cent. debentures accepted (under extraordinary resolution of a meeting held on January 30th, 1918) 50 per cent. of their interest in deferred warrants.

City of Buenos Aires Tramways Co. (1914), Ltd.—Balance dividend, 1s. 3d. per share, making 5 per cent. for 1918, less tax, £5,750 is transferred to general amortisation fund, and £88 carried forward.

Montreal Light, Heat & Power Co.—Dividend, 2 per cent. for the quarter to January 31st.

Montreal Light, Heat & Power Consolidated Co.—Dividend, 1 per cent. for quarter ending January 31st.

Greenwood & Batley, Ltd.—Interim dividend of 5 per cent. (10s. per share), less tax, on ordinary shares.

Llandudno and Colwyn Bay Electric Railway, Ltd.—The profit for the year 1918, after providing for expenses and interest on debenture stock and loans, amounts to £7,938, making, with the amount brought forward from 1917, a total available balance of £8,135. After deducting sinking fund instalment, £1,775, and transfer to reserve for renewals, £1,500, there remains £4,860, applied in payment of a dividend at the rate of 4½ per cent. per annum, and leaving a balance to be carried forward of £387. The sinking fund amounts to £12,224.

Yorkshire (West Riding) Tramways Co., Ltd.—The report for the year 1918 shows a net income, after providing for debenture interest and making provision for deferred repairs, of £15,303, which, with £20,609 brought forward, totals £35,912. Dividend, 6 per cent., less tax, on preference shares, £9,888; purchase of funded preferential dividend certificates, £11,187; £12,311 is placed to credit of renewals, depreciation, and reserve fund, and £2,526 is carried forward.

Metropolitan Railway Co.—Dividend on the ordinary stock for the past year, 1½ per cent., making 1¼ per cent. for the year, carrying forward £19,000, after placing £20,000 to the general renewals fund. Dividend on the surplus land stock is at the rate of 2¾ per cent. per annum, carrying forward £2,700, after placing £4,050 to reserve account.

French Companies.—The share capital of the Compagnie Générale Electrique de Nancy has been raised from 6 to 15 million francs, with a bond issue of 10,000,000 francs additional. The Société Française de Matériel Electrique has increased its capital from 100,000 to 500,000 francs.

Isle of Thanet Electric Tramways and Lighting Co., Ltd.—The accounts show a loss of £4,817, and after deducting the credit balance brought forward of £3,825, a debit balance of £982 is carried forward.

London and Suburban Traction Co., Ltd.—The accounts cannot be completed before the date for paying the preference dividend, but a notice respecting that dividend will be issued as soon as possible after that date (February 15th).

STOCKS AND SHARES.

Tuesday Evening.

What with the strikes, and the weather, and the National War Bonds, it is surprising that the Stock Exchange finds any business to do at all, but, curiously enough, in spite of all the disadvantages under which business labours at the present time, a fair amount of trade is going forward in stocks and shares, and so far as reports from provincial stock exchanges go, these bear a similar tale to those in London. Naturally enterprise is severely checked, and in many industrial branches people are refusing to buy stocks and shares so long as the present condition of uncertainty exists. There are nevertheless optimists who argue that the worse things become, the nearer we must be to a final settlement of some sort or another, and in the hope of its proving a satisfactory one to everybody concerned, some are willing to buy stocks and shares even at the current prices. Quotations for the tube stocks have not suffered to any material extent.

Underground Electric Railways income bonds gave way a point to 91½, but, on the other hand, the company's 6 per cent. income debenture stock rose ½ to 103½. The 1s. shares, back to 9s. 9d., and those of the £10 variety, unchanged at 3½, are considerably less active than they were before the trouble became acute, and in addition to this week's strikes, there is the proposal that the London County Council shall start 'buses of its own, a suggestion which carries the hint of competition not unexpected by those who have been following the fortunes of the London transport services. Although the L.C.C. proposal at present has to do principally with linking-up the dead ends of the tramway systems, this is obviously capable of development. Meanwhile, London & Suburban Traction preference shares keep firm about 8s., and for nearly all the low-priced tramway varieties, whether in London or the country, there is a noticeable demand. Districts remained without alteration at 27½, but Metropolitans rose to 31 in consequence of the increase of ¼ per cent. in the dividend for the year, the price reacting later to 29½ on the motormen joining in the strike.

Home electricity shares are stagnant pending what the latter part of the week may have in store in the way of a general strike of electricians. There are those in London who admit they would not be sorry to see everything brought to a standstill, and the battle fought to a direct finish. In the Stock Exchange no sympathy is expressed for the strikers. Indeed, there is strong indignation at what is regarded as an arbitrary and unreasonable dislocation of public facilities. The trail of the striker is over other departments as well as those most intimately concerned. India-Rubber shares are 5s. lower at 17, and Siemens at 6⅛ have fallen 5/16 on the week.

British Aluminium ordinary are a shade lower, but Edisons regained the dividend of 1s. 6d. a share deducted last week. General Electric ordinary have improved to 17¾, and Henleys are better at 2 5/16. British Electric Tractions eased off to 50½.

A rise of 5s. in Yorkshire West Riding shares lifted the price to 27s. 6d., and the preference are ⅛ up at 4⅛. In the London list, Metropolitan Electric 4½ per cent. debenture at 78 and the 3½ per cent. stock at 60 are both a point to the good. Marconis have come in for a little more support, and Americans stiffened to 30s., although there is no particular change in Marconis themselves at 4⅝, or Marconi Marines at 3⅜. The telegraph list is quietly steady, a fall of 10s. in Indo-Europeans being nearly balanced by a rise of 5s. in Eastern Extensions.

The foreign group remains depressed with the exception of Anglo-Argentine Trams. The strike in Buenos Aires appears to have been got well under control, and, by reason of this, a few bold buyers came in for the preference shares of the Anglo-Argentine Tramways Co., leaving both the first and seconds ⅛ to the good. Mexicans are somewhat irregular; this week's news from that country, scanty as the information is, encourages the idea that the United States is once more turning a watchful eye on the domestic affairs of her neighbour, and, although Mexican railway stocks are flat, there has been some inquiry for the preferred shares of the Mexican Light & Power Co. The bonds, however, together with those of the Mexico Tramways, have weakened. British Columbia Electric Railway issues are still on the down grade, and there has been no recovery in Brazil Tractions. The rubber market keeps tolerably firm, in spite of business having died away to a noticeable extent. The armament group is affected by labour possibilities, and amongst base-metal shares the tendency has been to lower prices, owing to the movements of prices in the metal exchange.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Feb. 4, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7⅜	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref...	4½	4½	3½	—	6 8 7
Chelsea..	3	5	4	—	6 5 4
City of London	8	8	12⅞	—	6 1 3
do. do. 6 per cent. Pref. ..	6	6	10⅛	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref...	4	5	4	—	6 5 0
Metropolitan	3	4	8	—	6 18 4
do. 4½ per cent. Pref. ..	4½	4½	3¼	—	6 18 6
St. James' and Pall Mall	8	9	7¼	—	6 4 2
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	7⅜	—	6 2 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	—	6 1 10
do. Def.	1½	1½	22	—	7 12 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10¾	+ ½	*6 10 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	157½	—	*5 1 7
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 5
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	58	— ½	5 12 0
Marconi	15	20	4⅝	—	4 6 7
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	6d.	1/3	1⅝	—	*8 17 6
Western Telegraph	8	8	15⅝	—	*4 16 3
Home Rails.					
Central London Ord. Assented ..	4	4	65½	—	6 2 2
Metropolitan		1	29½	— 1	4 4 9
do. District	Nil	Nil	27½	—	Nil
Underground Electric Ordinary..	Nil	Nil	3½	—	Nil
do. do. "A" ..	Nil	Nil	9/9	— 1/16	Nil
do. do. Income ..	6	4	91½	—1	*4 7 6
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	3 11/16	— ⅛	—
do. do. 2nd Pref. ..	5½	—	3½	— ⅛	—
do. do. 5 Deb... ..	5	5	71½	—	6 19 10
Brazil Tractions	—	—	55½	—	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	65½	—1	7 12 8
do. do. Preferred	Nil	Nil	48	—	Nil
do. do. Deferred	Nil	Nil	44	—1	Nil
do. do. Deb. ..	4¼	4¼	62	—	6 17 8
Mexico Trams 5 per cent. Bonds..	Nil	Nil	63½	—2½	Nil
do. 6 per cent. Bonds..	Nil	Nil	51	—1	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	49	+1	Nil
do. 1st Bonds.. ..	Nil	Nil	67½	—2	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅞	—	3 17 5
British Aluminium Ord.	10	10	1 11/16	— 1/32	5 10 5
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref. ..	7½	7½	2 1/16	—	6 0 0
Callenders	20	25	11	—	5 13 8
do. 6½ Pref.	5	5	5⅜	—	5 2 4
Castner-Kellner	22	20	3 7/16	—	5 16 3
Edison-Swan, "A"	—	—	20/- xd	+ 1/16	7 10 0
do. do. 4 per cent. Deb. ..	4	4	74½	—	5 6 0
Electric Construction	7½	10	1 3/16	—	8 8 5
Gen. Elec. Pref.	6	6	10¼	—	6 6 10
do. Ord.	10	10	17¾	+ ½	*5 12 8
Henley	25	25	2 5/16	+ 1/16	5 8 2
do. 4½ Pref..	4½	4½	4	—	5 12 6
India-Rubber	10	10	17	— ½	*5 17 8
Siemens Ord...	10	—	6⅛	— 5/16	*8 3 4
Telegraph Con.	20	20	48	—	*5 0 0

* Dividends paid free of Income Tax.

THE PAST, PRESENT, AND FUTURE OF ELECTRICITY SUPPLY.

A DISCUSSION upon this subject took place at the meeting of the MANCHESTER ASSOCIATION OF ENGINEERS held on January 25th. Mr. J. Butterworth, president of the Association, in his preliminary remarks, said this country was foremost in the development of steam power, and the time was now ripe for the development of the production of electrical power. Steam power, from its limitations, was necessarily dealt with individually, but electricity could be best dealt with on a national basis.

Mr. S. L. PEARCE opened the discussion. In the first place, he touched upon the legislation which governed the industry in its early days. Sir James Kidson might be said to have more or less standardised the Power Act legislation. Companies were granted powers of supply over very large areas, and the energy was to be supplied in bulk to the authorities to distribute, or it was to be given in detail to any consumer. There was little doubt that bulk supply and distribution were meant to be practically separate businesses, the former to be in the hands of companies operating over large areas, and the latter in the hands of the various authorised distributors whether local authority or company. Events had certainly not worked out as anticipated by Parliament. There had been a reluctance on the part of local authorities to enter into negotiations with power companies. On the other hand, the finance of some of the companies had been unsound, and with a dead weight of watered capital they had found it impossible to make things pay. Hence they cast longing eyes upon the large concentrated areas of local authorities. The position to-day was that apart from several purely tramway and railway undertakings the bulk supply of electricity to the general public was furnished by three classes of undertakings—something like 330 local authorities, something like 308 companies operating under what he termed a limited tenure, and about 35 power companies. The total capital invested in those three classes of undertakings was approximately 120 millions, the output nearly 3,000 million units, something like 2¼ million KW. of plant was installed, and something like 700,000 KW. of plant was at the present time under construction. Those large figures did not necessarily betoken success, still less, that the present state of the industry did not call for some radical reform. With the exception of the Newcastle Supply Co. and its allied undertakings, there was certainly no system in this country which compared with the large undertakings abroad. He believed it had been fully established that the needs of all classes of consumers could be met by means of a common interconnected network, which would operate with a high load factor, and cater for all classes of consumers, thus obtaining the benefit of diversity of demand. The difficulties incidental to reconstruction were not so much of an engineering nature as political, using that term in its widest sense.

During the past two or three years much work had been done by different bodies or committees in the direction of evolving schemes for the improvement of the industry. In 1916 a committee of engineers was set up to consider whether interworking or interconnecting of the undertakings in the Lancashire area was possible. The broad conclusions at which it arrived were these: That it was a commercial proposition to interconnect the several undertakings in four groups—three around Manchester, and one in the North, including Preston and Blackburn. The estimated capital outlay to effect the interworking was (at that date) approximately £281,000, and a coal saving of £82,000 per annum could be effected taking coal at 17s. 6d. a ton. The committee considered that the maximum demand of the whole system would be increased 30 per cent. It strongly recommended that a joint committee should be set up with power to raise capital for providing works for interconnection, to control the running hours of the various stations, to regulate the charges for supply, and generally to act in an advisory capacity as regarded all future extensions. That report was favourably received, and the committee was requested by the Board of Trade to work out the essential details and present a final report with full particulars. In the meantime the National Electric Power Supply Joint Committee had issued a report which was based very much upon the work done by the Lancashire and Cheshire engineers, the only difference being that it surveyed the country as a whole and suggested that the country should be divided into 16 areas. In each of those areas interconnecting committees had been set up, as they were set up in Lancashire. Several of them had reported, and a great deal of most useful pioneer work had been done, but with the exception of the North-East Coast, where interconnection was an already accomplished fact, there was no district which was so far advanced, at any rate with concrete proposals, as in the Manchester area. The second report of the Lancashire and Cheshire Committee contained a fully worked out scheme to give effect to the proposals contained in the first report. He thought the report might very well stand as a basis for any district that was contemplating a system of interconnection and nothing more. But the majority of the committee considered that this interconnection, joint working, or linking up, should only be the first step towards an ideal scheme to secure the cheapest and most reliable supply of energy in the future. They were led to the conclusion that the ultimate development would lead to a complete federation of the different authorities in a given area, so far as generation and main transmission was concerned, still leaving to the existing individual authorities their full rights in connection with the distribution and sale of energy. Therefore they made certain recommendations which were doubtless outside the scope of their reference. The most important one was that the proposed Joint Board should be enabled to erect new power stations where they were required, and to acquire, when and where desirable, the ownership and control of the existing power stations and high-pressure transmission lines. That second report was by no means unanimous; there was a division of opinion which even yet had not been healed, but as the chairman of the committee, and as one who signed the majority report, he was convinced that those further recommendations would have to be considered. He thought that view was also taken by the gentlemen who were signatories to later reports. In December, 1917, the report of the Coal Conservation Sub-Committee was issued. He did not think there had been issued any other report which created such widespread interest in this country. With the major portion of the sub-committee's main recommendations, apart from certain irrelevant side issues, he was in agreement. That report was, no doubt, fundamentally sound, but to-day one might say it was superseded by the report of the Board of Trade Committee presided over by Sir Archibald Williamson, which was appointed early in 1917. Rumour had it that the Government had prepared legislation more or less on the findings of the Williamson Committee's report, and that at an early date in the coming session they might expect to see the Board of Trade Bill introduced, but he could not say whether that was correct or not. Anyone who read that report must be struck by the striking likeness to the recommendations contained in the second report of the Lancashire and Cheshire Engineers' Committee. There were three points of difference. The Williamson Committee report advocated: (1) Public ownership of the generating stations and transmission lines as against capitalistic ownership and control; (2) amalgamation of existing interests on a national basis as against the creation of a gigantic electrical trust; (3) reconstruction by means of evolution rather than revolution. From what had been said before, he thought it would be agreed that there was a very large measure of agreement as to the lines on which the future progress of the industry would develop. There must be four cardinal points in any scheme that was likely to be acceptable to the country as a whole. The first was the creation of a central tribunal of Commissioners, who should be the supreme judicial authority to delineate the areas, to decide the voltages and periodicities, and co-ordinate the efforts of the District Boards. The second point was that there should be as far as possible unified ownership, control, and operation of the existing and future generating stations and transmission lines by the District Boards. The third cardinal point was that the operations must be over so large an area that diversity of demand and high load factor would be secured. The fourth point was that nothing must be done to interfere, generally speaking, with the rights of the existing authorised distributors to distribute and sell energy. That might be termed the administrative or political side of the subject. When they came to the engineering or technical side, his view was that the size and number of the power stations would be determined almost entirely by the problem of transmission and its cost. That was the most vital factor in any scheme for the reorganisation of the industry. He believed that, because of this transmission problem future power stations would not be placed more than, on the average, 20 to 25 miles from the load. In exceptional cases, where ample supplies of cooling water and cheap coal were available, it might be commercially possible to extend the distance. He believed also that the main transmission lines would be laid underground and worked at the highest possible pressure—30,000 to 60,000 volts; the use of overhead lines would be limited to subsidiary purposes. Certainly, having regard to the higher depreciation which must be allowed for overhead lines and the greater maintenance cost, a very good case could be made out for transmission at extra high voltage by underground lines. He was speaking of voltages from 30,000 to 45,000. Those were practicable to-day. The interconnecting mains between Manchester and Salford were designed for an operating pressure of 33,000 volts, and he did not think there would be any difficulty in pushing them up to 40,000 if necessary. The term "super-power station" was, of course, purely relative. It was a question not so much of the aggregate capacity that could be got into the power station as the size of the units installed therein. He thought in the power stations of the future they would be using units of at least 25,000 KW. capacity. The generating voltage was not likely to be much above 6,000, and it could then be stepped up to 33,000 or a higher voltage at the station for transmission. Steam pressures would undoubtedly go up. At the present time they were using pressures of 250 to 275 lb. on the boilers, and he thought the figure would go up to 350 or 375. A new station was going down on the banks of the Tees to-day where a pressure of 450 lb. was going to be used. Some figures obtained in the United States in connection with over-all station efficiencies were of very great interest as showing that they were in advance of any station on this side of the Atlantic. He referred more particularly to the Detroit Edison Co.'s station at Connor's Creek, where the coal consumption before the war was of the order of something under 1½ lb. of coal, or a little less than 20,000 B.TH.U. per KW.-hour. They were operating with a boiler house efficiency of 76 per cent., and their station efficiency—the ratio of coal to electrical energy—was also very high. But he did not think finality had been reached, particularly if the use of the higher steam pressures to which he had alluded came into vogue. A remark was attributed to Mr. Insull in which he said that the American engineers were aiming at producing a KW.-hour on the switchboard for a pound of coal. When he took into consideration the improvements that had already been made, and which were likely to be made in the future, he did not think that figure was impossible of realisation.

A vote of thanks to Mr. Pearce was passed unanimously.

Mr. J. S. Peck said that as a manufacturer he was anxious that the supply engineer should get on with his scheme and carry out the standardisation and all the suggestions for reducing the cost of energy and increasing the adoption of it for power purposes throughout the country. It would not only bring business to the electrical manufacturer, it would also increase the ability of the country to enlarge its output, and that was what they wanted. The suggestion that the size of the generating units would be 25,000 KW. was, he thought, about right. In America they were going to construct larger sizes, of 35,000, or even 50,000 KW. and there was some talk about 70,000, but in comparing figures one had to bear in mind that the American rating was usually higher than the British for a machine of the same size. The voltage of the generator would be determined largely by the question of the switchgear and the currents which could be handled. Probably 6,000 volts would be as high as they would want to go provided there were no switches between the generator and the transformer. With regard to underground and overhead transmission, he was rather surprised at what Mr. Pearce said about the commercial superiority of the former. In this country they had more experience with underground transmission than with overhead transmission, but in America the reverse was the case, and there overhead lines could be put up at very low cost. In 1912 his firm took a large contract in Tasmania, which included a transmission line about 60 miles long at 80,000 volts, and he went to America to see what he could find out about the practice there. He got in touch with an engineer who had erected several hundred miles of transmission line, and the figures he gave worked out at about £900 per mile. That cost was really worked out on an average of 231 miles of line, and it included wayleaves, legal expenses, all labour and materials, and interest on the capital while it was being erected. These were pre-war figures, and would probably have to be doubled to-day.

Mr. A. Saxon said Mr. Pearce had surprised some of them by his statement as to boiler pressures. They were expecting to hear that with superheat a somewhat limited boiler pressure would give very good results, but the development seemed to be rather in the increase of boiler pressure than in the use of superheat.

Dr. W. Cramp said: Suppose a private plant in the Lancashire and Cheshire area was used for the purposes of an electrochemical works or a flour mill, or anything with a good load factor. What were the conditions of supply that would tempt the owner to buy electricity from any authority? He must have an adequate supply at a price at least as good as he could generate it at himself, or, as he would get a little extra security, he might be prepared to pay a little more. Was it possible to supply him at such a price? He thought not. If they went into the question carefully, taking a small plant say, 400 H.P. with 75 per cent. load factor, it would be found it was possible even under existing war conditions to put down a plant which, with coal at 25s. per ton, would generate electricity at a cost of 0.38d. per unit. Under such a scheme as was suggested the capital costs per unit would approximate to that figure, and the generating costs had to be added. Even if the working costs were reduced to almost zero it did not seem to him possible for the super-station to attract a customer of that kind. But it was those consumers who were relied upon for the improvement of the load factor and the diversity of demand which Mr. Pearce rightly said were essential for the reduction of the working costs. The fact was that the costs of distribution were very high, and he could not see that the extension of the area and the increased size of the stations would help the generating engineer to reduce that cost. That being so, they could only look for the lowering of the cost to a reduction in the coal consumption or the labour charges, and it did not seem that sufficient benefit could be gained in that way.

Mr. F. Foster said a difficulty in front of the scheme was that for a given capacity the capital outlay was now twice or three times what it was in pre-war days. In all probability prices would come down, not to their old level, but to 25 or 30 per cent. above the old level. The success of any power scheme depended very largely upon keeping the capital outlay down. If that could not be done some means must be devised of providing for a very large depreciation fund, at least four or five times the present rate of depreciation—at any rate as far as municipal plant was concerned. He had recently come across a number of private plants, some of them on a fairly large scale, with a good load factor, and he did not think they could generate at anything like 0.38d. A plant using modern gas engines with by-product recovery, of several thousand H.P., did not get near to ½d. or ¾d. In pre-war days they did get somewhere in the neighbourhood of ½d. As they tabulated the facts and discussed them, he thought they would steadily lower the cost of distribution, and get to the stage when it would pay anybody who was near the main course of distribution to take current from the national system rather than put in his own plant. He thought that at all these large stations the by-products would be removed from the coal, that plant more or less of the coke-oven type which produced tar, gas coke, and other products, would be used, and the coke gasified, so that entirely gaseous fuel would be burned at high efficiencies under boilers. Or possibly coke would be used and supplemented by gas.

Ald. Walker said the question they had to consider first was the powers that ought to be given to the District Control Board. The only point on which unanimity existed was that there should be appointed immediately Electricity Commissioners who would have extensive powers of control over new schemes and generally over the development of the industry, which must be in conformity with the national scheme. In the past they had paid dearly for the lack of proper control. He did not think anyone would agree to the continuance of the 600 generating authorities now existing in this country. They must have a national scheme, which should be extended from area to area as required. He did not agree with Dr. Cramp's suggestion that it would be very difficult to attract a certain class of consumers. It was recommended in one of the reports that a large quantity of land should be acquired in order that there might be concentrated around the generating station the very kind of industries which Dr. Cramp suggested would not find it worth while to purchase energy. An example of that had occurred in Manchester, where they brought the British Carbide Co. right on to the bus-bars of the station, and were supplying at a price which was satisfactory to both. With regard to the question of the boiler pressure manufacturers were now prepared to manufacture water-tube boilers at 400 lb. pressure at any time the order was given. One such order had been given, and was now being installed. The use of gas in the manner suggested by Mr. Foster was being carefully considered, and experimental work was being done with a new system. They had also to consider the method which was gaining favour in the States of crushing the coal and burning it in the form of a very fine dust.

Mr. J. Parrett said he entirely disagreed with the suggestion that the capital charges for the transmission of current from a public supply station would be nearly 0.38d. per unit. He put them down at less than 0.1d. It was a great pity that so much was said in the Press about cheaper electricity, because he was doubtful whether these proposed developments would reduce the cost appreciably in districts already well equipped with fairly modern plant like Manchester, Bolton, and other large places. In those cases they had put down plant at a low capital cost, and they had facilities for obtaining coal. He did not see that a large unit placed at a considerable distance from the point at which the current was required in large quantities could effect such economies as would compensate for the capital cost of transmission. There was room for companies' as well as municipal undertakings and control. The companies had done good work in the past under very trying circumstances, and the fact that they were able to exist in spite of tremendous opposition showed that they were fit to continue.

Mr. Wood said there was no doubt that a reform was necessary, and he was satisfied that a scheme on the lines suggested would be to the advantage of the country. Many mistakes had been made in the past, but the experience gained to a large extent in small stations enabled designers and manufacturers to improve and produce larger units which were installed as the demand grew. So when they were talking about the 25,000-KW. plant they should not forget the pioneer work of those who preceded them.

Mr. Gem said some years ago a paper was read before the Association which advocated that electric power should be generated at the coal pits. Had Mr. Pearce given any attention to such a scheme, and was there anything in it?

Mr. F. Walker said on the North-East Coast there was a network of cables stretching from the north of the Tyne to the Tees, 30 or 40 miles from north to south, 10 to 20 miles from east to west. In that district it had been shown to be a sound commercial proposition to take power from the mains rather than generate it themselves.

Mr. S. Boswell said he had no doubt that boiler pressures of 400 or 500 lb. would become common.

In reply, Mr. Pearce said he did not think there was the slightest probability of large gas engines being adopted as prime movers in the power stations of the future. He regarded 25,000 KW. as being probably the minimum size. In Manchester they were now putting in units of that capacity. It was quite possible that units as large as those the Americans were putting down, 50,000 and 60,000 KW., would be used in the congested areas of this country. Probably the most important point was transmission. When preparing evidence to be given before the Board of Trade he went very fully into that matter, and took as a concrete proposition a transmission line from a station on the Mersey to Manchester (something like 35 miles) of 100,000 K.V.A. at 150,000 volts. The approximate cost of transmitting that energy over that distance at that period was £100,000. To compare with that he took the cost of transmitting the same amount of energy over the same distance by means of 40,000-volt underground cables, and the cost was put 25 per cent. higher. But it was very doubtful whether that 25 per cent. was a fair figure, the rate of depreciation on the overhead lines and the higher figures for maintenance would undoubtedly reduce it to some extent. Those were comparable figures taken out at the same time. He questioned very much whether it was possible to use a pressure of 100,000 volts under our climatic conditions, and if they were brought down to something lower, obviously the disparity between the overhead line transmission and the underground cable would become still less. But it was interesting to note that the opinion of an engineer who had probably had more experience of overhead systems than anybody in this country, was generally to the effect that the main transmission lines of the future would be underground. He was inclined to agree with that view. He was not in favour of dropping superheat. Turbine manufacturers said they were prepared to guarantee their machines for round about 750 deg F. There were sound reasons on thermodynamic grounds for pushing up the initial steam pressure; whether it should be as high as 450 lb. or whether 350 was more reasonable, might be a matter of opinion. Personally, he inclined to the lower figure upon economic grounds; there was a great difference in cost between the respective boilers. He arrived at the conclusion that a boiler pressure of 375 lb. and a superheat of 300 deg. F. were about the figures which would be adopted in the future. There were not many electrochemical or electrometallurgical plants in the country to-day. They might be established in the future, and the sites would be selected as near as possible to the station bus-bars in order to get energy at the lowest possible rate. One of the largest flour mills in the country was on the mains of a power company, and was being supplied with energy at a rate which was obviously satisfactory to both company and consumer. He thought Dr. Cramp had altogether overestimated the bearing of the transmission costs upon the cost of the supply to the consumer. The whole problem of private supply versus public supply was a question whether the extra transmission cost did or did not counteract the manifold advantages of centralised generation. What were the factors in favour of centralised generation? A very much lower capital outlay. A lower coal consumption per KW.-hour. Figures were being offered by turbine builders of between 8 and 9 lb. of steam per KW.-hour in modern turbines operating upon high pressure, high superheats, and high vacuum. No private plant could give anywhere near such figures. Labour cost was also reduced. To put the thing plainly, the plant in a central station went much further than a plant on private premises, by reason of the important diversity factor. When one realised how transmission costs were reduced by pushing up the voltages, and, on the other hand, saw the enormous advantage which centralised power production must have, it was evident that the cases would be very few and far between where a public supply would not beat the private company. He did not look forward to the supply of electricity being cheapened to any very great extent in those areas now served by modern stations and modern plant, but by the scheme outlined the conditions prevailing there would be reproduced all over the country. With regard to the generation of electricity in the coalfields, a factor of great importance should be considered. In the majority of colliery sites water was not present in the volumes required for modern steam turbine plants. It was exceedingly difficult to find a colliery site that was a good one from that point of view. Another point was that in transmitting energy from the Midlands to London the transmission losses would by no means be low, and the capital outlay would be enormously high, by reason of the mileage. He could not see any possible future for such a scheme. On the North-East Coast Mr. Sloan in 1916 stated that they were supplying not less than 350,000 H.P. to industrial plants in that district. By this time that figure was probably doubled or trebled.

MULTIPLEX TELEPHONY AND TELEGRAPHY.

In the *Telegraph and Telephone Age* of January 16th, Mr. Frank B. Jewett, Chief Engineer of the Western Electric Co. (Inc.), gives a brief account of the method employed in multiplex telephony and telegraphy, from which we extract the following particulars:—

The problem of multiplex telephony and telegraphy which the engineering departments of the American Telephone and Telegraph Co. and the Western Electric Co., working in close co-operation, have solved, demonstrated and put into practical day in and day out commercial operation, is nothing less than the simultaneous use of a single pair of wires for many non-interfering telephone conversations, or telegraph messages, or, if need be, for both. Actually, the commercial service in which the system was demonstrated provides for five pairs of simultaneous non-interfering telephone conversations and two ordinary telegraph circuits on one pair of wires.

The opportunities for multiplex telegraphy which are opened up are great, and for both telephony and telegraphy the practical limits are not now those imposed by physical possibilities.

It is now possible to operate many telephone circuits over a single pair of wires, be they long or short. But since terminal and intermediate apparatus to provide for the multiplexing involves considerable monetary expenditure, and since an extension of the number of multiplex circuits beyond a certain point would involve much expense in connection with the line, it is neither economical nor practical to employ the multiplex system on very short lines, nor to attempt to approach what it is physically possible to obtain in the way of large numbers of circuits.

When we talk into a telephone transmitter we generate feeble electric currents which have very curious and complex forms, and which involve a wide range of frequencies—a range which extends up to more than 2,000 alternations per second. We know that if our telephone transmitter, receiver, and line are good we will have in each part of the circuit a current which pictures a faithful reproduction of the disturbances which the voice produces in the air. We know also that if our circuit is to be satisfactory we must, so far as the receiver at least is concerned, be free from electric currents of voice frequency save only those produced in the transmitter used by the one to whom we are talking.

If this is so, and if, as we know, all human voices employ about the same range of frequencies, how is it possible to use a single pair of wires for many simultaneous messages and have each message go only to the terminal apparatus for which it is designed? Why do they not all become mixed up and inextricably tangled? It was this difficulty which baffled so many men for so many years, and led to such a great number of ingenious proposals designed to keep separate messages separate.

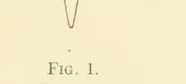

Fig. 1.

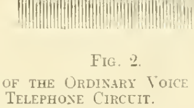

Fig. 2.

Fig. 1.—Diagrammatic Curve of the Ordinary Voice Current Produced in a Telephone Circuit.

Fig. 2.—Unmodified High-frequency Current.

We all know that there are ranges of frequencies, both electrical and mechanical, that are beyond the limits of perception by any of our five senses. But men have found out that currents of high frequency obey the same laws as currents of low frequency, and that these high frequencies have a particular liking for circuits specially dimensioned to receive them, and that each particular high frequency, or range of high frequencies, if given a chance to choose between a number of different circuits, will select the one best adapted to its needs, and travel down it in preference to all other circuits.

It is this peculiar property of selectivity between different high-frequency currents which we have employed for combining and separating the various messages which are destined to travel together over a common pathway. But we must in some way impress upon each of the high-frequency currents the characteristics of the particular voice frequency which we wish to transport to the distant end of the line.

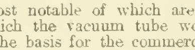

Fig. 3.—High-frequency Current Modified by Voice Current.

The same ingenious device, the vacuum tube amplifier, can serve equally to divorce completely a union of high and low frequencies which may be handed to it. All this, of course, if properly associated with numerous other pieces of apparatus, the most notable of which are the filtering circuits, without which the vacuum tube would be impotent.

Here, then, is the basis for the commercial plant referred to, and now giving service between Washington and Pittsburg. Actually, the multiplex section of the line extends from the Tuxedo test station, just outside the city of Baltimore, to the Brushton test station, just outside the city of Pittsburg. From Washington to Tuxedo, and from Pittsburg to Brushton, there are provided as many ordinary telephone circuits as are required for the ordinary and multiplex use of the toll line between Tuxeda and Brushton—in this particular case five. None of these five circuits is in any way different from an ordinary telephone circuit, either from the standpoint of talking, signalling, or operating. At Tuxedo or at Brushton each of the ordinary telephone terminals runs into its own particular piece of apparatus. One of the terminals, namely, that one which is to use a toll line in the ordinary way, goes directly to the latter through an equipment which prevents any of the outgoing or incoming high-frequency currents from going back on the terminal. Each of the other terminals goes through an apparatus which, for outgoing transmission, combines the voice currents with a particular high-frequency current or carrier. This latter, when modulated by the voice currents, passes out to the toll line through an apparatus especially adapted to that particular carrier when loaded with its heterogeneous mass of voice frequencies, and to no other carrier. At the distant end of the line the first, or ordinary, conversation passes through its proper selecting apparatus directly on to the terminal designed for ordinary working, and each of the four other carriers selects its own designated circuit, where, after being divested of its carrier, the demodulated voice frequency goes out on an ordinary telephone line to the distant subscriber.

In the meantime, telegraph currents have been passing back and forth over the wires of the circuit without interference to or from the various voice and carrier currents that have been in play.

Thus it happens that at any given instant the two wires of the toll line have impressed upon them a heterogeneous mass of high-frequency carriers, human voice currents, telegraph currents, and such control currents as it may be necessary to employ for the proper operation of the terminal apparatus. An electrical picture of what is taking place in the toil line itself would be unintelligible to any of our senses.

IRON AND STEEL ELECTRIC FURNACES.

By J. BIBBY.

(*Abstract of paper read before the* Manchester Association of Engineers.)

(*Continued from page* 137).

The arc furnace subject has been divided into two schools; one maintains that the best results can be obtained with a single arc, and the other is equally emphatic in believing that more than one arc is necessary, especially as the furnaces get larger in capacity. Last month Prof. Miles Walker read a most able paper at the Institution of Electrical Engineers advocating the single arc for steel making,* and as this paper deals with the multiple arc it will be asked what are the author's reasons for the rejection of the single arc.

The reason for employing a number of arcs is to accomplish certain metallurgical effects, and not for any electrical reason. To melt a quantity of steel scrap at a reasonable rate we must distribute the heat as much as possible; also, in order to refine steel we must have a certain area of contact between the metal and the refining flux, and the whole of the slag must be kept above the temperature at which the direction of the reactions takes place in favour of the transfer of the impurities from the metal to the slag. To ensure this it is necessary to distribute the heat well over the slag by having a suitable number of arcs.

As to the liability of short circuits, when a number of arcs are employed it is very unlikely that the short circuit will occur on more than one; if the arc of a single-phase furnace is ruptured, the whole of the load is thrown off, whereas in a multiple arc furnace only a fraction of the load is thrown off the mains.

It is difficult to see how a single arc furnace can work at a greater voltage than multiple arcs to do the same duty. The circumstances are precisely the same. There are very good and sound reasons for employing a low voltage in the arc of a steel furnace. For steel refining a short arc is preferable to a long one, and does far less damage to the furnace roof. Metallurgists demand a low voltage for refining steel, but should a case occur in which a long arc is required, this can be provided in the multiple arc furnace just as well as in the single arc furnace. Another reason for employing low voltage is the safety of the men. A number of fatal accidents have occurred on the high-voltage furnaces, since the conductors are not insulated. On low-tension furnaces there has been no such accident.

It is difficult to see where the alleged saving in copper is made on a single arc furnace, even at a greatly increased voltage. The distances between the transformers and the furnace are the same in both cases, and in the single arc furnace there must be full current leads to and from the furnace. The Electro-Metals four-phase furnace only requires the same section of copper when working at 95 volts as the Snyder furnace when working at 155 volts, or about five-eighths of the copper when working at the same arc voltages.

As to the advantage claimed for the single arc furnace in that it is built in the form of a sphere, it would be quite easy to make a multiple arc furnace in this form also were it not for the fact that the hemisphere shape of bath is unsuitable for steel making on account of the small surface contact area available between the slag and the metal.

Is it not obvious that the single arc furnace is made spherical because of the inevitable concentration of the heat, thus making a small slag surface operative? There is no case on record of a single arc furnace manufacturing steel commercially. It is only being used for melting purposes with an acid hearth.

The consumption of electrodes has been reduced by the fitting of glands in the roof of the furnace, so that the consumption of electrodes is now only about 10 lb. of graphite per ton of steel; 7 lb. is consumed in melting and 3 lb. in refining.

The above remarks are made in view of the efforts which are being made in the interest of the single arc furnace, but experience undoubtedly points to the necessity for a sufficiently large slag-metal contact area with heat well distributed over that area, and although two arcs sufficiently cover the bath of a five-ton furnace, for all furnaces above this capacity more arcs must be provided. The arcs must be distributed so that they are not too near the refractories at any point, or the upkeep of the hearth will be excessive, and they must not be too far away at other points, or excessive labour will be involved in pushing the unmelted charge into the melting zones.

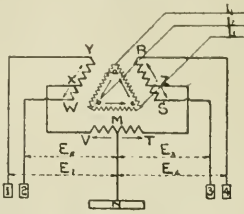

Fig. 2.—Method of Arranging Four-arc Furnace with Neutral Current.

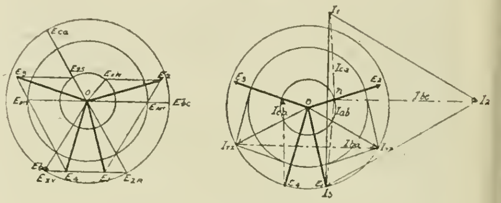

Fig. 3.—Vector Diagrams.

The ideal system is that which has a number of equal phases, and in which the current through the hearth is equal to that of one of the phases, so that as far as regulation is concerned each of the four phases is practically independent, and when starting up a furnace the arcs can be struck consecutively. Various methods have been tried in order to get a four-arc furnace with a neutral current. A simple way out of the difficulty is that shown in fig. 2, which requires only three single-phase transformers, two of which are called the main transformers and one the teaser.

From the terminals R, S, Y, W of the main transformers independent leads are taken to the upper electrodes, and from the centre M of the teaser secondary a lead is taken to the neutral electrode beneath the hearth. The terminals V T of the teaser are connected to intermediate points X Z respectively of the main transformers. We now have four independent phases with a common neutral and one arc in each phase.

In the vector diagram, fig. 3, the three circles represent respectively the numbers of turns in the sections of the secondaries. For convenience the turns in the primaries are considered equal. The radius of the outer circle corresponds with the turns in X Y and R Z, the inner circle to the turns in Z W and Z S, and the intermediate circle to half the turns M V and M T in the teaser. The voltage induced across No. 1 arc is equal to the vector sum of the voltages induced in M V and X Y. The directions of the primary line voltages are represented by the vectors E*ab*, E*bc*, *and* E*ca*. We therefore mark off along the various directions radii representing the turns involved, for example. E*mv* in the direction *bc* and E*xy* in the direction *ab* giving the resultant E 1 as the voltage in No. 1 arc. The voltage in No. 2 arc is equal to the vector sum of the voltages induced in M V and X W, so that we mark off E*mv* along E*bc* and E*xw* along E*ab* reversed, and obtain the resultant E 2. Similarly, the voltages in the other arcs are represented by E 3 and E 4. It is a simple matter to proportion the turns so that these voltages are equal.

To secure four equal voltages is only one condition for an electric furnace transformer system. It is necessary that when equal currents are taken through each of the arcs, the currents in the primaries will also be equal, so that the system will be balanced for currents as well as voltages. The directions of the secondary currents can be taken as being relatively the same as the voltages, so that in the third diagram we redraw the vectors E1, E2, E3, E4. The main transformer secondary W Y is under the influence of the currents in No. 1 and 2 electrodes. The current in No. 1 electrode acts on X Y turns, and that in No. 2 on X W turns.

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* Elec. Rev., December 13th, 1918.

Since the currents in the electrodes are equal we can mark off along E_1 a distance I_{xy} representing the turns in P Y and along E_2 a distance I_{xw} equal to the turns in X W, and then obtain the vector difference I_{ab}, which will represent the ampere turns in W Y, and consequently in the primary *ab*. Similarly, the ampere turns in *ca* are represented by I_{ca}, and in *bc* by I_{bc}. Since the windings in the primaries have been considered equal, these lines will represent the currents in the primary windings. When delta connected we obtain the currents in the primary lines as represented by the sides of the equilateral triangle I_1, I_2, I_3. For normal working this system of connections satisfies the conditions for both voltage and current balance between the primary and secondary lines.

(To be concluded.)

ELECTRIC WELDING.

By THOMAS T. HEATON.

(*Abstract of paper read before the* Institution of Mechanical Engineers.)

In February, 1914, the author read before this Institution a paper on "Some Modern Methods of Welding," to which the present paper is intended to be a sequel.

Following descriptions of the various methods of electric welding, the following examples are given as showing the power required, and the cost of energy per weld:—Tube welded $1\frac{7}{8}$-in. diameter by 3/16-in. thick. Maximum input 30 K.V.A. This tube was welded very slowly, so as to do away with any thickening of the metal at the weld. These tubes are cut off quite square. On completion of the weld, and while hot, the outside diameter is reduced by tongs closing on to and worked around the tube, gaps being cut in these tongs to allow the scale to come away freely. No hammering is done, and no lump is left on the inside of the tube. These tubes stand a hydraulic test of 3,000 lb. per sq. in., and failures are less than 1 in 500.

Where thickening at the weld is not detrimental, solid drawn steel tubes were welded in 25 seconds, with a maximum input of 34 K.V.A., the diameter of the tube being $1\frac{3}{8}$ in. outside by 3/16 in. thick.

Steel tire $2\frac{1}{2}$ in. by $\frac{1}{2}$ in. Hard springy steel for gun carriage wheels took 0.7 unit applied for 58 seconds, maximum load 56 K.V.A.

Steel tire $3\frac{1}{2}$ in. by $\frac{1}{2}$ in. Hard springy steel for gun carriage wheels took approximately 0.9 unit applied for 30 seconds, maximum load 120 K.V.A. There is no question that the welds are good, provided the conditions are right, and proper care and skill employed.

With mild steel 20 B.G. thick perfect welds may be made at a speed of about eight seconds to the lineal foot between rollers. The welds are very strong and sound, and probably the metal is left in a better condition with this than with any other system of electric welding. The best work in spot-welding is produced when the machines are regulated automatically. In roller welding the feed must be automatic.

To weld successfully, and to produce the best results so far as the metal at the weld is concerned, the metal to be welded must be suitable. The author refers more particularly to mild steel. It should be made by the open-hearth process, sound, of regular thickness, and low in carbon, sulphur, and phosphorus. Otherwise it may be difficult to weld, or the weld when made may be brittle. More especially in resistance welding of thin steel the metal must be clean and free from scale. Too much phosphorus tends to make the steel brittle when cold; too much sulphur tends to prevent welding and to hot shortness. Too much carbon prevents welding. It is best to keep the carbon content below 0.1 per cent., and the sulphur not above 0.05 per cent. Where sulphur is high it seems to cause boiling of the metal, which after cooling is full of the craters of burst blisters. The great heat of the arc and the freedom of fusing enable this phenomenon to manifest itself.

The author particularly desires to draw attention to this question of quality, which has not hitherto received the general attention it deserves. He is of opinion that careful scientific investigation of the effect of each of the constituents of ordinary mild steel would be of considerable value. There are special hard steels made, however, which will weld, and mild steel can be welded to them. Most effective welds of high-speed tool steel to mild steel have been made in such a way that only the cutting edges of the tools are of the high-speed quality.

Different kinds of high-speed steel require various methods of treatment, and to make successful welds requires some experience of the steel in order to regulate the welding temperature. The temperature appears to be a matter of the greatest importance to enable such welds to be effectively made. In some cases it is found that the high-speed steel heats much more quickly than the mild steel to which it is being welded, and some high-speed steel heats much more quickly than others. In welding this steel the current is applied until the high-speed steel reaches a red heat, and is then cut off to enable the heat to be communicated to the mild steel.

The economy effected by using a small quantity of the comparatively dear high-speed steel for the cutting portion of the tool as compared with the larger quantity of mild steel in the shank is very considerable. It is scarcely possible to obtain analyses of the various high-speed steels, but among others the high-speed steel known as "Stellite" is effectively welded in this way.

It is the author's opinion that an efficient system of testing should be applied as far as possible to all welds. Nothing goes out of the author's works that is not tested. The tests should be designed in relation to the welds made, and the purpose they are required to fulfil, and should be as thorough as possible without over-straining the material. A good test for metal not subjected to pressure is to hammer the welds when cold to break superficial skin welds, and then to apply petroleum to the weld.

For vessels subject to internal pressures, it is best to apply either a test with compressed air for low pressures, say, up to 20 lb. per sq. in., or a hydraulic pressure test for higher pressures. A high-pressure test with compressed air is dangerous, and should not be used. A slight air-pressure may indicate defects either by dipping in water, in which case bubbles appear, or by applying a soap solution to the surface.

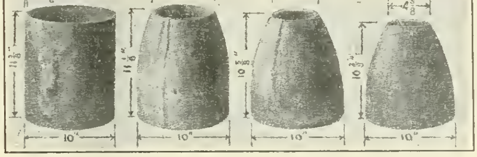

Fig. 1.—Result of Three Compressions of Electrically-welded Cylinder.

There are certain welds, however, that cannot be very easily tested, *e.g.*, the hull of a ship. In such a case V joints should be carefully prepared, and the welds made by the quasi-arc process if electric welds are desired. Petroleum could then be dabbed on to the inside of the plates at the welds, and defects would be indicated and could be remedied. Before applying the petroleum the welds should be smartly hammered to break superficial skin welds.

The stresses upon the hull of a ship are so varied and incalculable that a petroleum test alone would not be adequate. To make dependable welds in such a case demands the highest skill in the welders, whose reliability should be proved by tests upon selected welds of a similar nature. Provided really good welds can be ensured, they are stronger than the best riveted joints, and are tight. The question of welding the hulls of ships is a very serious one, and while the author would encourage experiment and research with confidence, he would at the same time advise caution in such a matter.

In testing welds there are, of course, the well-known methods of testing for tensile strength, for elongation, for hardness, &c. Adequate tests of reliability and good quality seem to be especially necessary in view of the recent rapid development of welding. Very few people are capable of making reliable welds of varied character.

A very remarkable test of the metal composing the welds has recently been made, involving a disturbance of the structure to an extent which the author would have expected the welds would not resist. A number of mild steel cylinders (fig. 1), each about 1 ft. long by 10 in. outside diameter, of open-hearth mild steel of 26 tons per sq. in. ultimate tensile strength, $\frac{3}{8}$ in. thick, were welded longitudinally. These were reduced by means of dies in a hydraulic press at one end to about $4\frac{1}{2}$ in. outside diameter. The cylinders were reduced in three heats, the first reduction being 4 in. in diameter, the most severe of the three. These were welded by means of the Benardos electric arc with carbon electrode, and so long as the welds were properly made they withstood the operations successfully. Welds made with metallic electrode broke early in the first pressing and overlapped in the dies. These articles were compressed, and at the same time drawn to retain the desired length of about $10\frac{3}{8}$ in. This treatment is scarcely to be recommended as a commercial transaction, as it is exceedingly difficult to find a welder of sufficient skill to make a certainty of success without considerable training. There were some hundreds of these pressings made.

In addition electricity is being used for cast-iron, for aluminium, and other metals. Even pure nickel has been spot-welded.

Discussion.

The paper was discussed together with three papers on other methods of welding.

Mr. Kennedy (British Arc Welding Co.) said that in every form of welding temperature was the all-important thing. All processes had their own particular applications according to the temperature required. It was necessary to adjust the poles according to the nature of the material that was being worked, *i.e.*, the heavier the mass the higher the temperature. In one case when it was desired to enclose some diamonds in small disks to make a saw for cutting stones, he reversed the poles, because the small disks were of less mass than the pencil. In that case he used metallic electrodes. The matter of temperature was very important indeed, because there was a very small range indeed in welding temperature, only about 100 deg. with iron. Welding required very great skill on the part of the workmen; he considered it took nearly two years to make a really skilled worker, although a welder, in part, could be trained in from four to six months. Mr. Heaton stated that cutting was possible with a metallic electrode by keeping the electrode from contact and maintaining an arc. His own experience was that that had nothing to do with it, but that it was purely a matter of temperature.

Mr. Aiton said that for ordinary commercial work it was necessary to have more than one system. He used the carbon arc and the quasi-arc, as well as the oxy-acetylene process for various classes of work. He used the carbon arc process for the heaviest classes of work. So far as the training of welders was concerned, he did not think it necessary that a man who could weld sheet metal should also be able to weld copper. A special type of man would have to be bred if welders were to have the qualities mentioned in one of the papers, and then they would soon want something better than welding. He wished to know whether welds of ¼-in. thickness by the electric process were hammered. All his heavier welds were hammered, and it was found decidedly necessary also to anneal them. Mention had been made of the carbon welding of cast-iron; he had never heard of that being successful. He would not think of competing with the carbon-arc against the oxy-hydrogen process for cutting purposes. In all cases, the steel was of the greatest importance; many of them during the past four years had discovered that, for instance, shell discard could not be welded.

Mr. H. W. Wolton said he used the electric resistance process of welding, there being in his factory seven butt-welding machines, each of 160-KW. capacity, used for the welding of the steel foundation bands for solid-rubber tires. The purity of the metal was an interesting question to him, because when he first started welding work in 1915 he had a very constant supply of steel of good analysis. With that material the percentage of breakages of welds was from ½ to 1 per cent. In September, 1918, however, the percentage rose considerably, and on analysing the steel it was found normal. Further analysis, however, showed that it contained copper varying from 0.015 to 0.13, and nickel from 0.05 to 0.09. As he was using 200 tons per week, 5 per cent. of breakages was a very serious matter. He tested the bands to which he had referred in an hydraulic press which worked in the opposite direction to a shell bander, *i.e.*, the bands worked outwards towards the internal diameter of the rim. He put a permanent stretch in the bands, after they were welded, of about ½ to 1 per cent., *i.e.*, a band with an internal circumference of 2,000 mm. was given a stretch of about 20 mm. On testing a weld to destruction a little while ago he found that a band having a circumference of 2,200 mm. could be stretched to 2,500 mm. before the weld broke. His consumption of electrical energy was somewhat higher than that mentioned in the paper. For 3½ by 1½-in. welds the consumption would be about 1.3 units. The average number of welds per hour in his works was 24, and during the eight-hour shift the men got through about 170 welds per machine. The machines had been designed throughout in the works, and during the time they had been used about 500,000 steel bands for tires had been welded.

Mr. J. H. Newton was particularly interested in the part of Mr. Heaton's paper which referred to the welding of high-speed steel tips to tools. If it was possible to put a small tool steel tip securely on the tool it enormously reduced the capital expenditure involved. He knew from experience that the satisfactory welding of tips was by no means easy. One of the chief points in welding was the state of the surrounding metal. If this was cool there was great danger of the weld cracking on cooling, and he had found it was a good thing to heat the whole of the part before welding, to avoid distortion. When this was done the quasi-arc process was preferable to the acetylene process, because the local heating which could be applied was very much greater.

The discussion was adjourned until February 21st.

The same papers were read and discussed at a meeting of the Institution of Mechanical Engineers, in Manchester, on Thursday last week.

Mr. A. Saxon, dealing with welding by the arc process, quoted the case of a large cylinder casting with one or two slight defects in it, which was electrically welded, and when put on the boring machine no tools that they could get, either hardened or of the best steel possible, would touch it. The result was they had to construct a small set of grinding tackle and grind it down to the bore, the job in the end being satisfactory.

Mr. Graham remarked that up to the present the welding of cracks in the breech end of gas engines had not been a success, and it would be interesting if the authors would tell them how a good job could be made. Thousands of pounds must be wasted every year in replacing breech ends, and if the castings could be welded and put back there would be a great saving of time and money.

Mr. Pollock did not agree with the view expressed by Mr. Davis that the oxy-acetylene process held the field against all others. He knew a firm which had been operating very largely with electric welding, and had obtained some very successful results. Electric welding had proved very successful in locomotive works, frames of locomotives welded by that process having been running for over two years without giving out. With reference to the suggestion that the cost was prohibitive, he mentioned the case of a Diesel engine crank shaft, to renew which would have involved the expenditure of over £700, but which was welded satisfactorily for £95.

Mr. Dunlop, as a user of oxy-acetylene and the electric resistance processes, favoured the latter for repetition work of a suitable nature, both from the point of view of speed of operation and cost. His firm had not done any arc welding, but when they made inquiries from the different equipment makers they found there was a difference of opinion as to which was the most suitable electric supply.

Replying to the discussion, Mr. Heaton said his opinion was that the direct current was preferable. Welding could be done by the alternating current, but the operation was not so easy, and the results were not so good and reliable. Speaking of the human element, he remarked that a welder required as much training as a fitter, and it was a very rare thing to find a man who was capable of making a good weld in a variety of jobs. The system he had followed had been to take a man who knew nothing about the process and keep him on one particular job. He had men in the works who had done exactly the same job for the last 18 years, and they had become so highly skilled that no one could produce better work, but none of them could make different kinds of welds.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

1,363. "Dynamo-electric machines." C. J. Hunt & Bruce Peebles and Co. January 20th.

1,379. "Electric incandescent lamp sockets." J. Darby. January 20th.

1,384. "Table, &c., stands for flowers, candles, menu cards, electric lights, &c." C. E. Procter. January 20th.

1,392. "Electromagnetic wave-signalling arrangements." F. Lowenstein. January 20th. (U.S.A., January 19th, 1918.)

1,404. "Telephone repeater systems." K. E. Edgeworth. January 20th.

1,416. "Supporting insulators for electric high-tension conductors." E. Schwank. January 20th. (Switzerland, January 21st, 1918.)

1,420. "Telephonic systems." E. A. Graham. January 20th.

1,430. "System of control for maintaining relative speeds of a number of electric motors." F. G. Warburton. January 20th.

1,455. "Contact-making and breaking devices." W. J. Antliff. January 20th.

1,457. "Electric signalling apparatus." P. Francois. January 20th.

1,464. "Electric terminals." G. A. Parker & G. J. Parker. January 20th.

1,470. "Signalling systems for use in mines, &c." F. G. Bell, W. C. Davey and Sterling Telephone & Electric Co., Ltd. January 20th.

1,512. "Electric door bolt." J. Maggs. January 21st.

1,527. "Electric switches." J. W. Ewart. January 21st.

1,531. "Incandescent electric lamps." F. Harbison & J. J. Russell. January 21st.

1,543. "Dynamo-electric machines." A. Huart. January 21st.

1,549. "Fusible electric cut-outs." W. J. Elms & F. W. Salway. January 21st.

1,552. "Arc-rupturing devices, &c." T. Zweigbergk. January 21st.

1,558. "Means for securing pole-shoes of magneto-electric machines." A. E. Bennett and British Lighting & Ignition Co. January 21st.

1,562. "Telephone transmission systems." Western Electric Co. (Western Electric Co., U.S.A.) January 21st.

1,571. "Electrically-heated crucibles for type-casting." W. J. Mellersh-Jackson (Cutler-Hammer Manufacturing Co., U.S.A.). January 21st.

1,591. "Electric cable sockets." J. Oxspring. January 22nd.

1,598. "Telegraphs." F. J. Matson & W. H. Roberts. January 22nd.

1,632. "Dynamo-electric machines." J. C. Seailles. January 22nd. (France, January 30th, 1918.)

1,633. "Sparking plug and method of manufacturing same." C. E. Gerbaud. January 22nd. (France, May 29th, 1918.)

1,635. "Electric fittings." J. V. Fletcher & C. W. Saunders. January 22nd.

1,643. "Electric motors." J. Martin & British Thomson-Houston Co. January 22nd.

1,650. "Electric furnaces." Soc. Electro-Metallurgique Francaise. January 22nd. (France, February 11th, 1918.)

1,668. "Electric motor-control systems." T. Zweigbergk. January 22nd.

1,682. "Apparatus for electrically testing magnetos, &c." A. Hewlett. January 23rd.

1,731. "Electrolytic cells." H. W. Matheson. January 23rd.

1,732. "Electrolytic cells." H. W. Matheson & F. T. Karlin. January 23rd.

1,737. "Electric starting mechanism for internal-combustion engines." C. L. Breeden, H. W. F. Ireland & H. Lucas. January 23rd.

1,738. "Electric heating apparatus." M. Abese. January 23rd.

1,742. "Electric radiators." Soc. Anon. Calor. January 23rd, 1919. (France, January 24th, 1918.)

1,743. "Electric generators and starter." W. Hemingway. January 23rd.

1,747. "Means operated by a rise in temperature for cutting out electrical apparatus and effecting mechanical operations." A. Dunhill. January 23rd.

1,753 & 5.—"Telephone systems." B. S. Cohen. January 23rd.

1,773. "Means for starting internal-combustion engines." Sir E. W. Moir. January 24th.

1,776. "Electric line selectors." I. H. Parsons. January 24th.

1,811. "Automatic telephone systems." Automatic Telephone Manufacturing Co. & P. T. Bates. January 24th.

1,846. "Sparking plugs." C. W. Higgs. January 24th.

1,848 "Pocket electric lamps." H. Rottenburg. January 24th.

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. FEBRUARY 14, 1919. No. 2,151.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: AGEERAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: Messrs. Atkinson & Co., Gresham Street.
AUCKLAND N.Z: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
BRISBANE. Gordon & Gotch, Queen St.
CHRISTCHURCH, N.Z.: Gordon and Gotch, Manchester Street.
DUNEDIN, N.Z.: Gordon & Gotch, Princes Street.
JOHANNESBURG, CAPETOWN, BLOEMFONTEIN, DURBAN, PORT ELIZABETH, &c. Central News Agency, Ltd.
LAUNCESTON: Gordon & Gotch, Cimitiere Street.
MELBOURNE: Peter G. Tait, 90, William Street; Gordon & Gotch, Queen Street.
MILAN: Fratelli Treves.
NEW YORK: D. Van Nostrand, 25, Park Place
PARIS: Boyveau & Chevillet, 22, Rue de la Banque.
PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch 132, Bay Street
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving his copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE ELECTRICAL STRIKE FIASCO.

THE threatened strike of the London Branch of the Electrical Trades Union, which was to have plunged London into darkness, last week, proved to be stillborn; of illegitimate conception, it had no right to be, and the darkness that was threatened never saw the light. From the moment that the Government declared itself upon the side of law and order, the result was not in doubt, and the only course left for the votaries of Anarchy was to find a way out of the *impasse* with the least loss of prestige—if the word can be used in such a connection. Let us clearly understand what it was all about.

On January 3rd the electrical workers in the London district were granted an award reducing the hours of work from 54 to 47 (or 56 to 48), without reduction of pay; and on January 23rd the National Joint Industrial Council for the Electrical Contracting Industry, meeting at Leeds, also adopted the 47-hour week for that branch of the industry, throughout the whole country. The threatened strike had nothing to do with either of these agreements. The reason given for striking was, in fact, entirely remote from the interests of the London electricians; it was a demand that the Government should intervene on behalf of the workers in the strikes at Belfast and on the Clyde, and should at once take steps to impose a 40-hour week on the whole country, in order to "absorb" unemployment. The strike leaders, therefore, took it upon themselves to throw out a challenge to the Government about a matter with which they had no concern, and sought to demonstrate the reality of the power which was their boast — that by stopping the supply of electricity in the metropolis they could compel the National Government to submit abjectly to their autocratic decrees.

It may be objected that the problem of unemployment was not without the scope of the Union's interests; but the contention is absurd. One of the leading promoters of the strike declared the other day that so short-handed was the electrical industry that 2,000 men could be set to work at once in London alone, and the reduction of the working hours in power stations would involve the employment of another 1,000 men, if they could be got. We know well that so many of the best of the electrical workers—the most highly skilled and capable men—enlisted in their country's service that for years past there has been a constant scarcity of skilled men, and the supply authorities and contractors have had to do the best they could by engaging any man who claimed to possess electrical knowledge. There is no lack of work for qualified electricians, and to mention unemployment in that connection is utter nonsense. Neither is there any scarcity of work for the engineering trades on the Clyde or at Belfast. The fact is that all these strikes, while parading under the cloak of solicitude for brother workmen, are based upon a common aim—a desire to overthrow the established order of things and to substitute the "reign" of Anarchy and social chaos. In a word, it is not philanthropy or altruism that actuates the agitators—it is Revolution that they seek: and what that means may be gathered from the hideous tales of immorality and lawlessness that come to us from Russia.

That was the real object of the strike—there was no unsettled grievance or outstanding dispute between employers and employed in the London district; not only had they come to terms on the subject of working hours and rates of pay, but they had set up, for the electricity supply systems, a standing conference on which both parties were represented, for the express purpose of settling differences—practically a Whitley Council—and a similar arrangement had been offered for the contracting industry. The strike was undertaken purely in order to further the revolutionary movement.

Let us now consider why it failed. First, as we have mentioned, the Government, under the Defence of the Realm Act, put in force a penal clause which ought to have been embodied in the Electric Lighting Acts in the first instance, as it already was in the Gas and Water enactments, and which imposed heavy liabilities upon any person whose actions menaced the continuity of supply of electricity as a branch of the public services; this regulation, no doubt, hampered the strike leaders by exposing them to instant arrest in the event of their taking any action contrary to the public interest. But would the fear of D.O.R.A. have daunted the electrical workers themselves, and prevented them from leaving their posts when called upon *for adequate reasons*? Not for a moment! The strike was a failure before it even began; it was broken by the loyalty and patriotism of the men themselves, who flatly refused to come out in such a cause, despite the efforts of their would-be leaders. We have stated on previous occasions that the members of the Electrical Trades Union are *not* disloyal or unpatriotic, and that the clique of mischief-makers who control the Union do not truly represent the men; and we have the greatest pleasure in stating that at meetings called by the shop stewards of the supply industry to consider the resolution of the London Executive Committee, the summons to strike was rejected by a majority of the order of 10 to 1. To put the matter in the plainest terms, the strike was prevented by the loyalty of the electrical workers of the supply undertakings. They were on thoroughly good terms with the employers; they saw no reason why they should be made to serve the political ends of a gang of revolutionaries: and they took a pride in their work—hence, almost without exception, they carried on, and we think they have well earned the gratitude of the community.

Next, let us consider what would have happened if the electrical workers had taken the opposite course. Directly the strike was announced, the Electrical Power Engineers' Association, composed of the technical staffs of the supply undertakings, declared its intention of maintaining the supply of electricity, with the aid of voluntary labour. To do this would have necessitated strenuous exertions on the part of the members, for obviously the employment of strangers, many of them entirely untrained and unskilled, would have involved incessant supervision and instruction, and would undoubtedly have cast a heavy burden on the shoulders of the engineers. But they expressed their determination to prevent the cessation of supply, and we may add that their words were translated into action, for very complete preparations were made for the feeding and resting of the staffs, while plans were made for the temporary reorganisation of the undertakings with a view to facilitating the work.

Moreover, the National Association of Supervising Electricians, comprising a body of men of first-class training and ability, offered the services of its members, to assist the station engineers, and the Association of Engineers-in-Charge, whose members also would have rendered invaluable assistance, came forward with a similar offer. Voluntary aid was tendered from a variety of other sources—many replies to our appeal for volunteers were received from readers, to whom we tender our cordial thanks—and, in fact, it was clear that there would be no lack of helpers. The E.P.E.A., we may add, had at the time important negotiations in progress with the employers throughout the country, which had reached an extremely critical stage, and no doubt the E.T.U. counted upon this fact to influence the Association in favour of the strike; but the Association deferred its private aims in view of the public need, and we feel that the thanks of the community should be accorded to the Electrical Power Engineers' Association, the Supervising Electricians, and the Engineers-in-Charge, as well as to the power station and other members of the E.T.U., for their loyal conduct and enlightened patriotism in the face of a national emergency.

What has been the result of it all? The strike has failed miserably; the vaunted power of the leaders of the E.T.U. has been shown to be an idle boast, and a victory, of which the importance can hardly be exaggerated, has been won by the forces of law and order. For what would have followed a successful strike? The capital, and the Government, would henceforth have been at the mercy of a coterie of irresponsible Bolshevists, and no limit could be set to the excesses to which this might have led. The danger was grave; we trust the lesson will be borne in mind by the Government, by the supply authorities, and by the leaders of the Electrical Trades Union.

We may add a word as to the ostensible object of the strike—the adoption of the 40-hour week. As we have pointed out above, this was not the real purpose of the movement; but suppose it had been: what then? The electrical industry, as already stated, had just agreed upon a working week of 47 or 48 hours, in place of 54 or 56, without reduction of pay, but the new arrangement had hardly come into force, and could not be said to have been tried—yet a proposal was put forward further to reduce the working week to 40 hours! We are not concerned here to discuss the subject from the social or ethical point of view, but solely from the industrial standpoint, and we would ask the members of all Trade Unions—and there are many connected with the electrical industries—whether it would not be wise to give a fair trial to the 47 hours first. The difference is considerable; it may involve a heavy addition to the cost of production, and therefore may impose a heavy handicap upon our national prosperity. We shall have very keen competition to meet, and heavy costs to bear: and the question must arise—Can we do this, and live? It is a very grave question indeed; it is not a matter of labour *versus* capital, or anything of that sort—it is a question whether the worker can *afford* to shorten his hours of work. Output is the key to employment and prosperity: beware lest that key be lost!

As regards the general aspect of the question, it appears to us exceedingly regrettable that, at a time when every ounce of strength that we possess ought to be devoted to the restoration of our industries, our energies should be sapped by these senseless strikes, which, while nominally intended to reduce unemployment, in fact continually and inevitably tend to its increase. A very gratifying feature was the absolute unanimity with which the lay Press condemned the strikes on the one hand, and whole-heartedly supported the Government and the supply authorities and railway management on the other. The maintenance of the public services—lighting, power, and transport—is vital, not only to the well-being, but also to the safety of the residents in the whole of the Metropolitan area, and it is deplorable that the interests of some seven million persons should be at the mercy of a few persons who are devoid of patriotism, humanity, and common-sense. The strikes were denounced by the recognised leaders of the Trade Unions, and the least penalty that should be imposed upon the strike leaders ought to be suspension by the National Executives *sine die*.

Excess Profits and the Law of Rating.

We happen to know of at least one electric lighting undertaking which is in the fortunate—or unfortunate—position of having to pay Excess Profits Duty. Some of our readers will, therefore, note with interest a recent decision of the King's Bench Division in relation to this heavy tax.

It arose in connection with the law of rating. Rates are based upon the rental value of property, and in the case of an ordinary house the rateable value is comparatively easy to arrive at. But when the rates which have to be paid by a gas or electric lighting company fall to be assessed, how is rental value to be ascertained? To solve the problem the lawyers rear up a dummy known as the hypothetical tenant, and they then set themselves to ascertain, by the application of divers rules, what rent he would pay—"On a tenancy from year to year, free of all usual tenants' rates and taxes, and deducting the average annual cost of repairs, insurance, and other expenses necessary to maintain the hereditament in a state to command the rent." Who, in his senses, would "rent" an electric lighting undertaking? No one but a hypothetical tenant. What rent would he pay? That is the question which the rating authorities have to solve, and to do it they have regard to profits. The question for the King's Bench was: "Is Excess Profits Duty to be regarded as part of the profits?" The judges have answered the question in the affirmative, and have held that in arriving at the rateable value of premises in which a business liable to the payment of Excess Profits Duty is carried on, the liability to such duty may be taken into account. This is an interesting decision, because, strange to say, the view generally held by rating authorities is that income-tax ought not to be taken into account. There is no definite decision on this point, and as there is very little distinction (at any rate, to the mere lay mind) between income-tax and Excess Profits Duty, some electric lighting company which pays income-tax may think it worth while to raise the question on its new assessment.

National Electricity Supply.

The report of the Association of Municipal Corporations on this subject, from which we give extracts elsewhere in this issue, generally endorses the main principles formulated by the Board of Trade Committee on Electric Power Supply, and approves of the proposal to give the Commissioners a free hand to deal with each district in accordance with local conditions. While it makes no demand for the exclusion of company representatives, it claims for the municipalities a preponderating voice, as might be anticipated, and condemns the suggestion that the operation of a district undertaking might be leased to a company. The right of a municipal corporation already supplying power on a large scale to continue and develop the supply, at its own risk, is upheld, with the proviso that its area shall be extended in accordance with the requirements of the district; this meets the point which we raised some time ago, when we urged that if a large municipal undertaking were authorised to carry on, it must not be allowed thereby to prejudice the interests of small neighbouring communities which would stand to gain by the pooling of the areas in the hands of a District Board.

With regard to the financial proposals, the Association naturally objects to the terms suggested by the Committee, which cannot be regarded as satisfactory: the principles which the former puts forward as fair bases for the transaction appear to be unexceptionable, and the Association wisely leaves their application to the discretion of the Commissioners in each case; but we consider that provision should be made to carry the matter to arbitration if either party so desires.

On the whole, the report is moderate and judicial; while, of course, it leans towards the municipal side of the question, it is free from the extravagances which disfigured previous municipal reports on this subject, and from the reactionary tendencies of others. A notable omission, which we observe with regret, is that of reference to the compensation due to officials who may be displaced by the operation of the scheme. Such compensation ought to be made compulsory, on definite lines. But it is no new thing for municipalities to ignore their obligations to their servants.

National Industrial Council for the Electric Supply Industry.

In a recent issue we commented on the proposal which is at the present moment before the electric supply industry to form a National Industrial Council on the lines of the Whitley Report. The reason for forming Industrial Councils is that it seems to be the one possible method of superimposing some sort of order upon the interminable labour disputes which are coming up every day. So far as the electrical industry is concerned, there would appear to be the most pressing reason for an Industrial Council to be formed. The industry is a "key" industry to a large section of the industrial world, and, obviously, may be also a "key" industry to the Trade Union world. As such it is in a particularly vulnerable position, and Trade Unions which have nothing to do with electricity supply might readily bring about a strike in the supply industry as a way to bring the country to heel in respect of their own grievances. In addition to this, there is the possibility of the "strike" being used for political purposes, which we have recently seen exemplified both in the Provinces and in London, and in this case the electricity supply industry would evidently be the most useful catspaw. It is obvious, of course, that the National Industrial Council could not directly deal with these extraneous dangers, but if the industry itself was satisfied, and there was confidence and close co-operation between both parties inside the industry itself, the danger of the industry being used as a tool by other parties would be reduced to a minimum.

At present the whole scheme of these Industrial Councils is on an entirely voluntary basis. There appears to be, however, a great likelihood of pressure being brought upon the Government to compel it to give a legislative standing to these Councils and a legal effect to their decisions. As showing the trend of opinion, we may quote the *Daily Mail* of February 3rd, where it suggests that "the National Joint Standing Committees recommended under the Whitley scheme should be compulsorily established, and the suggested law to give them powers of adjusting hours and wages should be passed without delay"; and in a previous issue it is premised that "the sooner the Government establish these Councils with full powers, the sooner are we likely to substitute peace by negotiation for the present ruinous guerrilla warfare"—important facts which should be given full consideration by the electricity supply industry in deciding on this momentous question.

The "Electrical Review" (Limited).

Our readers will have noticed that recently the familiar style of the firm of "H. Alabaster, Gatehouse & Kempe" has been replaced by the title at the head of this paragraph, and may have been led to speculate upon the reason for the change. In point of fact, it is a very simple matter—a change in form but not in substance, for the identity of the proprietors remains exactly the same as before. The registration of the firm as a limited company was found to be desirable for purely private and personal reasons, related to the technicalities of partnership and company law, and, apart from the change of style, it will make no difference in any respect to the conduct of the journal.

It is not without a sense of pride and satisfaction that the proprietors look back over the long period during which their names have been associated with the Electrical Review. Inaugurated as a monthly journal on Nov. 15th, 1872, it was published bi-weekly six months later, and after a few years it became a weekly paper; from its first appearance to the present day, it has never missed an issue, and, as the late Sir William Preece remarked, in congratulating it on its fortieth birthday, the files of the journal form a "complete historical record, not only of the growth of the practical applications of electricity, but of the science itself on which these industries are based." Founded in the same year as the Society of Telegraph Engineers, which is now the Institution of Electrical Engineers, the Electrical Review has enjoyed the rare privilege of recording contemporaneously the marvellous developments which have taken place in every branch of electrical science, of which the resources seem to be inexhaustible, and throughout by far the greater portion of its existence the journal has been in the hands of the same proprietors, and has maintained unchallenged its position as the organ of the British electrical industries.

During the past four years we have had many difficulties to contend with; in some respects these still continue to handicap our efforts to cope with the mass of information that we wish to lay before our readers, but as time goes on we have no doubt that normal conditions will return and we shall be free to develop our plans for improvement in the efficiency and usefulness of our pages. In the meantime, the tide is already flowing strongly in our favour—our circulation is advancing at a rate unprecedented in our experience, and we discern in this an indication that a period of intense activity in the electrical industries is about to dawn. We trust that the internal economy of the industrial organisation of this country will soon be freed from the disturbances which at present hamper progress, and that all ranks and classes throughout the industry will enjoy many years of unbroken prosperity.

THE MEASUREMENT OF MAXIMUM DEMAND.

By C. W. MARSHALL.

AMERICAN journals have given considerable attention to the question of the determination of the "maximum demand" on a circuit, and it is thought that the time may be opportune for a few notes on the subject from a British standpoint.

This article deals only with the "kilowatt" demand, as the problem of measuring the K.V.A. demand, in spite of its importance, has not as yet been considered very thoroughly.

Where the information required is the maximum number of B.O.T. units consumed in a given time, without reference to the time of day or night at which this maximum occurs, it can easily be obtained by the Merz maximum-demand indicator, the construction and working principle of which instrument is well known, and need not be gone into here.

To obtain the time at which the maximum occurs, entails the use of much more complicated apparatus, and, so far as the writer knows, the only commercial instrument on the British market for this purpose is the British Westinghouse printometer. This instrument gives a printed record of the essential figures of the meter reading for each half-hour or hour. From this record the amount and time of the maximum demand can be obtained. The chief disadvantage of the system lies in the large amount of labour involved in working out the results. The performance of the meter on light loads, on 25 cycles per second at least, is also disappointing. The latter defect is very important in cases where it is a question of determining the aggregate maximum of a number of circuits whose individual consumptions are being measured by printometers.

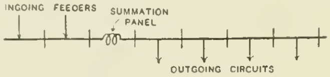


Fig. 1.

This problem of determining the aggregate demand of a number of circuits is one which deserves close attention. Where it is possible to have a summation panel, as in fig. 1, there is no difficulty from a measuring standpoint, but the switchboard arrangement is not convenient for cleaning or extending.

On A.C. circuits,* as an alternative to the arrangement of fig. 1, the summation can be done on the secondary side of the current transformers of the branch circuits. This method is exemplified by a simple case, as shown in fig. 2.

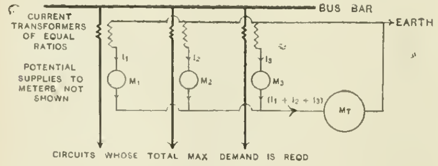

BUS BAR
EARTH
CURRENT TRANSFORMERS OF EQUAL RATIOS
POTENTIAL SUPPLIES TO METERS NOT SHOWN
i1
i2
i3
M1
M2
M3
(i1 + i2 + i3)
MT
CIRCUITS WHOSE TOTAL MAX DEMAND IS REQD

Fig. 2.

In this figure meters M_1, M_2 and M_3 measure the individual supplies, while M_T measures the total supply. The potential circuits are not shown, for the sake of clearness, but, in general, all meters would be supplied from a common source. The summation meter in the case shown would be geared for the same current-transformer ratio as the subsidiary meters, and its current coils would be of sufficient capacity to carry the sum of the currents in the subsidiary circuits.

In most cases, the capacities of the individual circuits are not all alike, and, accordingly, current transformers of various ratios are used. No hard and fast rules can be established, but two methods which have proved useful will help to show how such problems may be attacked. The examples shown are taken from practice.

In fig. 3 $M_1 \ldots M_5$ represent the meters used to measure the outputs on the individual circuits, the current transformers in 1, 2, and 3 having a ratio of 100/5, while those in 4 and 5 have a ratio of 50/5. To obtain the maximum demand a special two-element meter M_T is used, connected as shown in the diagram. Element A has a current element wound for 15 amperes, while B has one for 10 amperes. The elements A and B are wound so that with the same power in each secondary circuit A produces twice the torque of B. In the above case, it was possible to adapt an ordinary polyphase meter for use as a summation meter, but in many instances it would be necessary to make up special meters. In America meter manufacturers have developed such meters to a considerable extent, and at least one 30-element meter is in use. So far as the writer knows, the Aron Co. is the only British firm which has studied the question of multiple meters. This firm has built meters comprising five standard clock-meter elements with a summation counter and demand indicator.

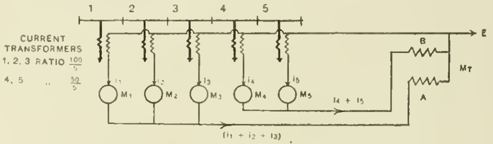
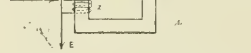


Fig. 3.

It is generally advisable to avoid the use of non-standard meters, and this can be done by using multiple-primary current transformers to supply the summation meter. The scheme outlined in fig. 4 gives an example of this type, where the principle had to be applied to some very old apparatus. The drawback of this system lies in the fact that it is difficult to avoid circulating currents, due to the rather high impedance of the summation current transformer and the unequal loading of the various circuits.



Current transformers, ratio 1/6.
1, 2, 3 „ 600/5.
4 „ 400/5.
5. 6 „ 300/5.
T_c = summation current transformer.
Primary windings = x, y, z.
x has n turns to carry 10 amperes.
y „ $4n/3$ „ „ „ 5 „
z „ $2n$ „ „ „ 15 „
Secondary winding = a.
a has $28n/3$ turns to carry 5 amperes.
(Secondaries of current transformers only shown.)

Fig. 4.

It will be noticed that the primary turns of the various sections of the summation transformer are proportional to the transformation ratios of the various branch circuits 1 to 6.

The methods mentioned above are suitable only for A.C. circuits where the distance between the branches is not great. Where D.C. or widely separated A.C. circuits are concerned, another method has been successfully used. The method is illustrated by a practical example, but the principle involved is quite general in its application. An ordinary meter is installed in each branch circuit, and each meter is fitted with a contact maker, which closes an auxiliary circuit whenever a predetermined consumption, say, 10 KW.-hours, has been registered. The auxiliary circuit is used to operate a relay on the special instrument used for recording the maximum demand. The recorder is of the simplest possible form, and it is presumed that its action will be clear from the accompanying sketch, fig. 5. This figure shows complete connections for one meter, and indicates how extensions for further circuits can be made.

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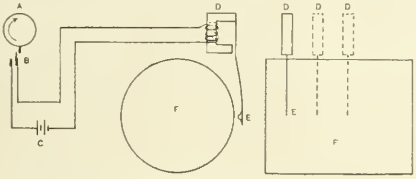
* For the sake of simplicity, one phase only of each circuit is shown in the diagrams, but the extension of the system to polyphase work is obvious.

The record obtained from the simple form of instrument shown in the figure consists of a succession of dots; the distance between successive dots on any line is inversely proportional to the power, or the number of spaces per hour is directly proportional to it.



A = Wheel in meter (1 rev. = 10 units).
B = Contact maker closed by projection on A.
C = Battery or other source of current for electromagnet D.
D = Electromagnet for pressing pen E on to drum F once every revolution of A.
D′, D″ = Additional electromagnets for extra circuits.

Fig. 5.

A sample chart is reproduced below (fig. 6). The unimportant parts of the day are omitted:—

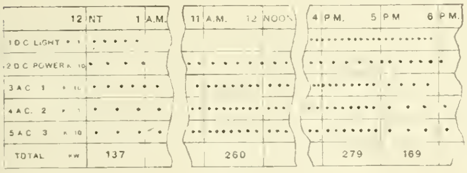


Fig. 6.

Where K = 1, each space (between two dots) represents 1 unit, and where K = 10 each space represents 10 units.

The load curve of the installation can be plotted from the above chart, and then the maximum demand can be found by making accurate estimates of the load at hours determined from the curve.

In important cases, it is better to use a fast recorder—say, 6 in. per hour—of the continuous roll chart type, so as to obtain high accuracy.

All the measuring systems mentioned in this article have been used in commercial installations for several years, and very little trouble from a mechanical standpoint has been experienced; they have given consistent and fairly accurate results during that period. It should, however, be borne in mind by engineers, when they are making agreements with clients, that in order to get the best results it is necessary to make proper provision for measurements from the start. They cannot reasonably expect meter men to make precision measurements on installations which have been designed by men who have not the remotest idea of the difficulties involved in determining accurately the data on which their costs so largely depend.

Sheffield Industrial Developments.—The Sheffield Corporation has set up a Development Department for encouraging new commercial and industrial businesses in the district.

ELECTRIC FURNACES IN THE LABORATORY.

By G. C. CASTLE.

A GREAT deal has been heard during the period of the war of electric furnaces as used for the manufacture of steels, ferro alloys, calcium carbide, carborundum, and other similar materials.

A new era has been brought about, also, in the last few years by the use of electric furnaces in the laboratory, but little has been written upon the subject.

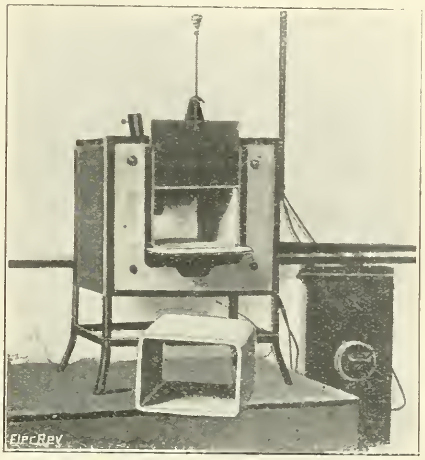


Fig. 1.—Laboratory Muffle Furnace.

These furnaces are constructed on the resistance principle, and the two general types used in the metallurgical department of the works are the muffle and combustion furnaces, as shown in the accompanying illustrations, figs. 1 and 2.

In the writer's opinion, they show superiority over gas furnaces in every respect. They are clean, and easily portable. The consumption of energy is, of course, regulated by the size of the furnace, but a fairly large furnace, such as one of those reproduced herewith, consumes at its maximum approximately 10 amperes, which will give a temperature of about 1,850° F. A temperature higher than this is rarely required in a laboratory. The cost of energy used, say, for a 10-hour working day, per month, for the two types of

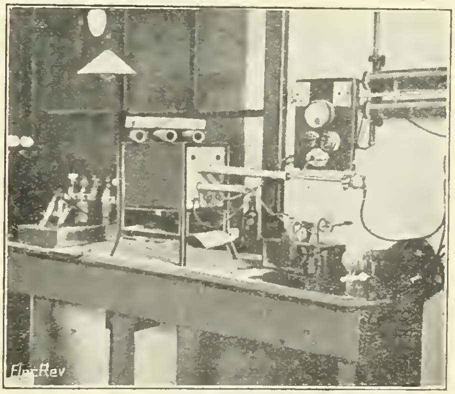


Fig. 2.—Combustion Furnace.

furnaces runs at something like £1 10s. when the cost of energy per unit is moderately high.

The benefits obtained by the use of these furnaces are

They are very durable.

They need very little repair.

They radiate very little heat, and thus do not appreciably affect the atmospheric temperature in a small laboratory.

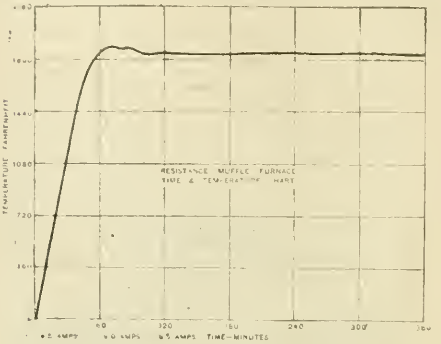


Fig. 3.—Time and Temperature Chart.

They quickly reach the maximum temperature and maintain it constant for an indefinite period, provided the voltage does not fluctuate. This is shown by the accompanying time and temperature charts.

The applications of these furnaces to general analysis and research work are very varied, and the writer has been able to use the muffle furnace for the following purposes :—

Research on heat treatment, in which the muffle is indispensable.

Fusions.

Rapid incinerations.

The combustion type is, of course, used for the estimation of carbon in materials, and it gives very accurate and reliable results. It enables 50 estimations of carbon in steels to be accomplished in eight hours, using a four-tube furnace.

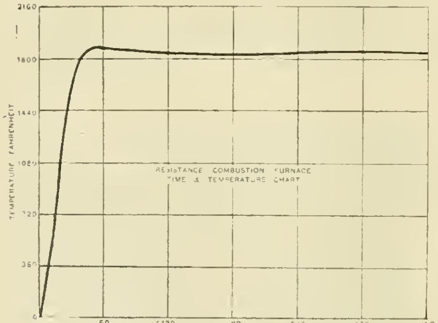


Fig. 4.—Time and Temperature Chart.

The initial cost of these furnaces is very little more than that of gas furnaces of the same size, and the reduced running expenses prove them to be a good investment.

The Metric System.—It is again announced that the Russian Government has decided to introduce the metric system of weights and measures, and all traders will be required to quote their prices in future in both the old and the metric system. It is expected that the new system will be adopted throughout Russia by the end of next August, and it is understood that from the end of 1924 the use of the old system will be prohibited in that country.

SCIENTIFIC MANAGEMENT FACTORS.

By Major E. A. PELLS, R.E.

Management has been described as the function of handling human nature in conjunction with machines and materials, and "scientific management" may be described in brief as the efficient inter-relation for the purposes of production of men, minutes, and materials.

In all branches of scientific research, definite factors have a certain and definite effect on the ultimate result, and (1) whereas some may be ignored for all practical purposes : (2) yet others are of such paramount importance that not only must they be very carefully studied, but they must be reduced to very accurate values ; (3) again, others are of such a variable character that no fixed value can be placed on them, and everything then depends on the ability and experience of the experimenter or the calculator. In considering our management factors, let us take that which, in my opinion, is most important—namely, "men." Of course, when I speak of men, in these days of emancipation, I mean to include women as well. Now, in dealing with this factor, we are dealing with one of those which come under the heading (3), and it is often of such diverse values that it is difficult to bring its value into concrete form. We have, in considering this factor, very often a very interesting psychological study, as individual ability, energy, industry, reliability, temper—all have various effects on the final value. Regarding these individual characteristics, we find that ability can be improved by careful and systematised training and tuition ; energy may be improved by good feeding at regular hours and carefully-arranged rest periods, according to the demands of the work in hand ; industry can be improved by equitable wage systems, with an incentive ; reliability presents more difficulties than the foregoing, but by careful inspection of work even that may be improved. Having improved the other characteristics, it usually follows that the greatly-improved conditions and environment automatically produce a more equable temper.

There is no doubt that this human factor is one of great importance, and cannot be ignored, as many short-sighted employers have ignored it when introducing efficiency systems into their businesses. Flesh and blood can never be treated as machinery, however you systematise the work they have to do ; there always remain the idiocyncracies of the human which constitute such an interesting study for the student of psychology and efficiency engineers.

Now let us consider "Minutes." These come under the heading (2). They constitute a factor which must be most carefully observed and valued, as, unless this is done, the rest of the efficiency studies are likely to become absolutely valueless. Waste time must be closely studied and all unnecessary waste eliminated, whilst proper rest periods must be planned. Then this factor, carefully reduced to its correct value, may be used in the compilation of standards, which are the bases upon which all efficiency work must necessarily rest.

Coming next to "Machines," this is the widest of all factors, comes under heading (2), and embraces everything of a mechanical nature with which the worker labours. Unless you provide your worker with the most efficient tools wherewith to do his work, you cannot expect good results. It is often said that the bad workman always grumbles at his tools ; this may be so, but it is also true that many good workmen are frightfully handicapped, and never have an opportunity of showing what they can really do. There are many what may be termed "sub-factors" which crop up under this heading. The situation of the works in relation to the workers' homes is of importance, and this has been recognised by certain well-known motor, cocoa, and soap manufacturers who have built model villages for their employés, thus killing several birds with one stone, as the scheme for the betterment of their home lives and environment has resulted in better health of the workers and a finer and more sympathetic feeling between employer and employé. Where workers have to journey some distance from and to their work the consequent fatigue shows most distinctly in the results of their work; also we must add very often the fact of the crowded character of their tenements and small houses resulting in ill-health and lack of energy.

Works layout and route is another sub-factor of prime importance, as a great deal of duplicate handling and congestion can be obviated by careful attention to this. Tools are in themselves the study of a lifetime; finality is never reached; material used in the manufacture, method of making, shape, system of issue to workers, are all things requiring a great deal of study and research to arrive at the best values. Machines themselves must be studied as to the best method of drive, speed, possible mode of application, and maintenance periods. The question of power supply is a matter needing careful consideration and calculation to decide whether to install one's own power plant or take a supply from a power company. Finally, we have the question of control. The old idea was a kind of "human driver"; but the newer ideas accentuate the value of the square deal for all men as the first control factor of all. F. W. Taylor advocated functional foremen, and he is very sound in his theory; but for the questions of shop discipline, a kind of court of inquiry of the offenders' co-workers is a very fine idea, and has given excellent results.

Under the various headings touched upon, many minor factors occur, and it is only by hard experience that the efficiency engineer will know when he may treat any one of them as coming under heading (1).

In "Scientific Management," as in any other science, it is not advisable to cast out any factor until you have proved that it is of no practical value in the equation under study.

In this brief *résumé* of a great subject I have touched lightly on many things, and my advice to any man who wishes to become a manager or a ruler among men is to carefully study his fellow-men, for a manager who ignores the human factor is a fool!

TESTING TRANSFORMER OILS.

In a paper read at a meeting of the London Section of the Society of Chemical Industry on January 6th, Mr. Arnold Philip, the Admiralty Chemist at Portsmouth Dockyard, gave an account of some work that had been done there to estimate the small percentages of water in oils used for transformer purposes. When working at very high voltages, such as those used in wireless telegraphy, serious troubles occur through the sludging of the oil. That question, the author said, had for some years been under investigation by a Committee of the Institution of Electrical Engineers, but probably due to the war that work of the Committee had been delayed. At the same time, another cause put forward to explain the delay in the work of the Committee was that there was no means of determining the amount of water in the mineral oils used for these purposes. It was known, however, that the most minute quantities of water had a serious effect on the insulation resistance of the oils, and also on the hysteresis of the oils at high frequencies, the quantities of water producing these effects being as low as .02 to .04 per cent. At Portsmouth, in connection with oils for transformers used in wireless telegraphy, they had gone into this matter, and had succeeded in devising methods which appeared to be in every way satisfactory. It had been suspected that there was more than one cause of the formation of moisture in oils, but during his experiments it had not been found possible to separate out the various causes on account of the quantities being so minute. The method which he had used was to pass a stream of air, under a pressure of 20 to 30 in. of mercury, in very fine bubbles through, say, 2 gallons of oil, the rate being about two or three bubbles per second. The oil was heated to about 100 deg. C. The air was sucked through the oil in this fine stream, and then passed through glass U tubes which were immersed in a cooling mixture of ice and hydrochloric acid, which gave a temperature of about .5 deg. F. That stream of air was passed through for about two hours, at the end of which time the U tubes were washed, dried, and weighed, and the weight of water was calculated. As an indication of the quantities of water found the following figures were given:—0.006, 0.014, 0.017, and 0.0074 gramme per 100 cc of oil. The last figure related to a sample of oil required for the wireless telegraph installation at Portsmouth. That particular oil was required to stand a test of 12,000 volts, but as supplied it withstood 22,000 volts before breaking down. After determining and removing the moisture in it, the break-down voltage was raised to 28,000. This indicated that these minute quantities of water did have a serious effect upon the insulation resistance of oil. An interesting point in connection with that particular oil was that it was afterwards exposed in close proximity to water for 36 hours, but subsequent tests showed that it had not absorbed any moisture in that way. If it had, the quantity was too mall to be detected.

In the discussion which followed, Mr. N. A. Anfilogoff said that the quantities of moisture which had been detected at Portsmouth were so small that they might almost have been caused by the breath of the chemist who made the investigation. It appeared to him that oils might absorb much larger percentages of moisture when in use in the transformer than those which had been given in the paper as existing when the oils were purchased. He could produce oils which were perfectly dry, but he would not guarantee that they would remain dry after they had been put into the transformer.

Dr. Ormandy thought the author had proved the importance of detecting these small quantities of water by the instance he had quoted where the breakdown voltage had been increased from 22,000 to 28,000 after the moisture had been removed. He would like to know if the oils which the author used were a particular type of paraffin oil, and whether he had distilled any of the heavy boiling oils of the coal-tar series. Further, had any experiments been made in the converse direction, viz., to extract small quantities of oil from water, using similar methods to those mentioned in the paper, or was it possible to remove them by electrolysis?

Mr. G. L. Addenbrooke agreed that the question of small traces of water in transformer oils was important. Methods had been used by electrical engineers for many years to remove the water, such as by the use of fused sulphate of copper and also calcium carbide, but these methods did not determine the amount of water present. It had been shown by Mr. Rayuer, of the National Physical Laboratory, in a paper before the Physical Society, that water existed in oil in two states; it existed in an ionised form and also in the form of an emulsion. It was possible that a good deal of moisture could be taken out of oil by the use of an electric current, by attraction, and sometimes sparking was obtained from the globules of water and the electrodes. Certainly the disturbance which these minute quantities caused was astonishing. He was anxious to find out what the exact proportions of water in oils really were, because it was quite clear that the state of the oils changed considerably even during testing. A year or two before the war, the Reichsanstalt published some figures which were of the same order as those given in the paper.

Dr. R. Lessing asked whether an inert gas had been used instead of air. If nitrogen or CO_2 were used, it might exclude the possibility of oxidation during the test. There might be an oxidation taking place in the oil itself in the absence of moisture which would produce results such as those found by the author.

Mr. Neville Huntley said the design of apparatus used did not appeal to him. He had seen a good many tests made by it, but it was liable to be contaminated during the test; indeed, he believed that had been the case.

Mr. E. L. Lomax thought there was some misapprehension on this question of moisture in oil. It was quite possible to get oils perfectly free from moisture in the refining and sent out in that state. He did not believe an oil absorbed so much moisture as to affect its electrical properties, and the results which had been noticed by the author were probably due to unsaturated hydrocarbons, which were easily broken up by high-tension currents.

Mr. T. H. Durrans asked why water was estimated by freezing in favour of using a drying agent. Was it because the former method would detect also any other volatile constituents that might be present?

Mr. Philip, replying to the discussion, said that although the actual quantities of water shown by the experiments were small, in practice they were not inconsiderable, whilst the effect had been shown in the particular case he had mentioned where the voltage had been increased from 22,000 to 28,000. The reason why freezing was adopted was because this method would detect any other constituents, as mentioned. He was unable to answer Dr. Lessing as to the use of an inert gas, whilst as to a possible oxidation in the absence of moisture, he could only refer to the improvement in the electrical properties of oils after the moisture had been removed, which he had already mentioned. As to the absorption of moisture by the oil whilst in the transformer, to which reference had been made by Mr. Anfilogoff, only a very small area was left exposed at the neck, in order to reduce this possibility. The oil which he experimented with was a pure mineral oil. He had not tried the removal of oil from water by electrolytic methods, as suggested by Dr Ormandy, although he had tried the removal of water from oil, and had obtained extremely concordant results on repeating tests on the same oil.

Electric Coal Cutters.—The number of electrically-driven coal-cutting machines in use in this country at the end of 1917 was, according to the *Engineer*, 1,739, an increase of 149 over the number in use at the end of 1916. The total horse-power of electric motors in use on the surface and underground was 913,640, of which 521,000 H.P. was in use underground.

IRON AND STEEL ELECTRIC FURNACES.

By J. BIBBY.

(*Abstract of paper read before the* Manchester Association of Engineers.)

(*Concluded from page* 167.)

A furnace transformer system must finally be judged by its action under the fluctuating conditions inevitable in practice. If a rupture is caused in any one of the four arcs, it is interesting to see what effect this has on the currents in the primary mains; for example, arc No. 4, in fig. 3. In the vector diagram the sides of the heavy triangle represent the current in the three primary mains under this extreme condition. The currents are certainly out of balance, but for an extreme condition it is quite tolerable. There is also the possibility that one transformer for some reason or other may be put out of service, and the conditions are represented in the next diagram. In this case we get the two transformers overloaded, and currents in the primary mains represented by the sides of the heavy triangle. Again, the out of balance is not excessive and the power factor in each primary phase is high.

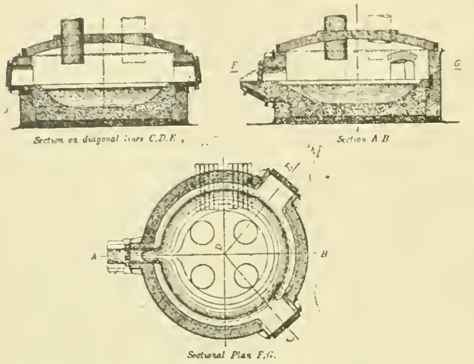


Fig. 4.—A 30-ton, 5,000-k.v.a., 4-phase Electric Furnace.

The largest furnace which is at present being built is of 30 tons capacity, 5,000 k.v.a., on the four-phase system. The furnace is circular in plan, having four electrodes and three doors (fig. 4), one for pouring and two for charging, so arranged that the whole of the hearth can be surveyed and repaired if necessary between heats. The hearth is of dolomite mixed with dehydrated tar for binding purposes, and hot rammed into position. The hearth is supported on the bottom and sides by refractory bricks, the neutral conductors being fixed between the bottom course and the hearth. No conducting materials are fitted in the hearth since, owing to the low current density, the conductivity of the dolomite hearth is sufficient.

This feature is of importance, since it eliminates one possible source of trouble. The side walls and roof are of silica bricks. The four electrodes are supported from independent carriages which travel vertically on the masts, and are operated by electric motors, the direction of the motors being automatically controlled. The furnace is supported on rockers and tilted by means of an electric motor and thrust screw. The current is brought from the transformer terminals through flexible cables to copper plates on each electrode carriage, and thence to the electrode. The connection between the conductors and the electrodes is made in the manner shown in fig. 5.

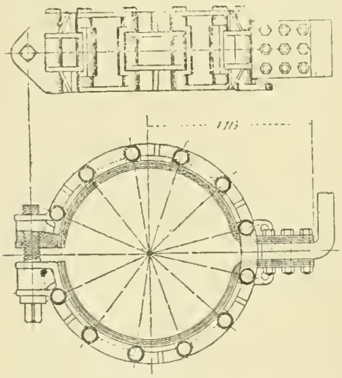


Fig. 5.—Manner of Connecting Conductors and Electrodes.

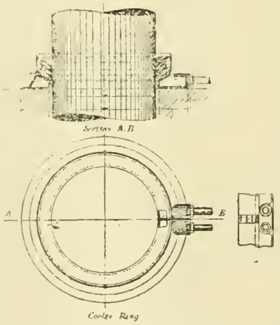


Fig. 6.—Roof Electrode Gland.

To the main conductors are connected two semi-circles of laminated copper plates, bent to the circumference of the electrode. These laminated plates are pressed against the electrodes at 12 points by a chain system, consisting of links as shown. The terminal links are pulled together by the manual screw, and the laminated copper is pressed evenly against the electrode throughout the circumference. This clamp has proved very effective in practice, no appreciable heat taking place between the contact surfaces. One type of roof electrode gland which has given complete satisfaction is shown in fig. 6. With this gland the graphite electrode consumption is only about 10 lb. per ton of steel melted and refined. It consists of a circular water jacket with sloping outer surface on which rest a series of rings of oval section. These rings are in segments, and the edges gravitate to the surface of the electrode and thus kill the flame.

Discussion at Manchester.

Mr. J. **Butterworth**, President of the Association, in the chair, remarked that steel smelting and refining furnaces were not extensively used in the Manchester district, and many of their members would have liked to hear more of a smaller type of furnace suitable for the production of small castings.

Mr. **Lang** said the paper was of great interest to the construction engineer who was anxious about his future sources of supply. It was probably necessary to bring about a universal system of production and distribution of electricity, upon which the future of electric steel and iron melting depended in this country. He gathered from the paper that if the electric furnace was to become a practical proposition in this country the cost of power must be reduced to a tenth of a penny, so there was a very long way to travel before the ordinary blast furnace would be supplanted. A good deal was made of the superior purity of electric steel, but experience in the war had taught experts to be rather more lenient in their views on the subject of sulphur and phosphorus, except in certain special cases. He agreed with Mr. Bibby in preferring the multiple arc as against the single arc furnace. The rôle of the latter was really confined to quite small production, and in particular to small foundry practice.

Mr. J. P. **Benson** asked what the cost of energy was in the Italian furnaces, where it was produced by water-power.

Mr. **Bibby** replied that it was about one-tenth of a penny, in some extreme cases it was one-twentieth. The countries where water-power was available had got a start in this matter, but it was satisfactory to find that immediately current could be procured at a reasonable price British engineers went ahead. Other countries came to England for their furnaces.

Mr. **Lee** asked whether trouble was anticipated from the graphite combine. It seemed to him that the carbon electrode would be very expensive to maintain, and it would not work very regularly.

Mr. **Walker** inquired as to the kind of load that was obtained.

Mr. **Bibby** replied that the load factor with the single furnace he took as being 30 per cent.; it depended on the number of furnaces in operation. The chief thing one wanted to know was the overload; they could take that as being about 50 per cent. The power factor varied from 70 to 80 per cent.

Mr. **Foster** said the presence of oxygen in cast-iron was undesirable; it was probably one of the greatest causes of unsound castings, but the matter had not been fully investigated. The electric furnace might help to solve that problem, and its use would be justified in cases where materials of special quality were required. When it was wanted in connection with an ordinary steel foundry the important question was the cost of the energy. Some information about the composition of the gases coming from the furnace would be desirable. It was not wise to attempt to get too much fuel value out of the gas, and in dealing with an output on a commercial scale the main consideration was not the quantity, but its thermal value measured by the heat it generated. Government experiments in the United States had shown that the rocking furnace gave excellent results with non-ferrous metals.

Mr. **Bibby**, referring to the point at which it would pay to put down an electric furnace, said that it greatly depended upon the class of work. If small, delicate castings were to be produced a half-ton furnace would pay. Freedom from sulphur counted with small castings, because one did not get the sulphide eutectic; in cooling there were not the weak places or the small cracks which occurred with high sulphur pig-iron. In making tool steel it would pay to have a furnace with power at 1d. per unit instead of the crucible. If large castings were in question, it would be possible to compete with the open-hearth furnace if the energy could be got at a fifth of a penny. The gas which circulated through the furnace could not be considered as playing any chemical part; it was there merely to convey the heat from the crucible to the upper parts. The voltage across the electrodes in the blast furnace varied from 35 to 70, and they had six tappings on the transformer. The steel furnace varied its heating surface by the amount of current; the blast furnace varied it by the voltage. He had investigated non-ferrous furnaces using an arc, and came to the conclusion that it was not the right principle for anything with zinc in it. Two furnaces were put down in this country—not a rocking furnace, but a similar type—where the heating was done by the radiation from the arc, and they both turned out heavy zinc losses. The latest report from America was that the rocking furnace had been used mainly for melting copper, not so much for yellow metal. He thought the non-ferrous problem would have to be solved by resistance furnaces, where the temperature could be kept down to just above the melting point of the ore.

Mr. J. Butterworth, the chairman, said he had thought of putting a furnace down at some time, but he had been advised by people in Sheffield not to do so; they considered it a most difficult and complicated trade. As a technical man, he was quite aware that there was a lot of truth in that statement; the difficulty was not in the casting alone, bu also in the melting. Owing to the great contraction met with in steel castings they were subject to "drawing." Manganese bronze was an analogous case; it was easy to melt, but very difficult to cast, and for that reason the price of the castings as compared with the price of the manganese ingots went up tremendously. He agreed with Mr. Foster that the presence of oxygen in cast-iron was very deleterious in foundry practice.

Mr. Gass said this ore reduction furnace had great possibilities if it could replace the ordinary blast furnace. Had anything been done in the way of melting of pig-iron in the electric furnace for the purpose of making castings?

Mr. Bibby: Yes! In France they are using the electric furnace in the form of an ordinary blast furnace for making some steel shell, and it is doing high-class work. With the electric furnace you have control of the temperature and of the atmosphere, so that you can refine the material to any degree required. For making special castings it has certainly a very wide field.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Electric Pressure Regulation.

In your issue of January 17th, Mr. Kimmins mentions the difficulty of automatically governing the voltage of a dynamo run by a water turbine. What happens appears to be something like this:—

When the turbine speed increases, the automatic regulator weakens the field. This reduces the torque, and this in time causes the machine to run faster than ever.

Mr. Kimmins suggests that a very heavy fly-wheel might improve matters. There is, however, an alternative method which is worth trying, and that is to throw an artificial load on to the dynamo whenever its speed increases beyond a certain limit. The artificial load could consist either of a series of carbon plates, which could be brought into contact and put under pressure in the well-known manner, or a regulating resistance with a slider could also be used.

The artificial load would be worked by the turbine governor, and would be brought into action when the speed of the machine exceeded a certain limit. This would steady the turbine, and give time for the gates to be closed. As the speed settled down to normal the artificial load would be gradually cut out, and the voltage regulator would then take complete control.

C. Turnbull.

Electricity Works, North Shields,
February 4th, 1919.

"State Salary Expected."

On looking through the advertisements of "Situations Vacant" in the Review, one is struck by the very small proportion of those which state the remuneration.

In most cases the applicants are asked to state salary, &c. In your issue of January 31st I believe this is so in 87 cases out of a total of about 111. However, this number includes those for wiremen, armature winders, &c., whose rate is known approximately, but of the remainder there are some in which the possible remuneration may lie between limits which differ by several pounds per week. Again, some are so vaguely worded that it is very difficult to say exactly what sort of position is offered.

Why is it that employers and managers will not state the wages they are willing to give? Surely they are not out for the cheapest man who can be obtained? At any rate, the advertisers must know what they are prepared to give, and by stating the amount they would save many of us from wasting time on applications for positions which we either could not get or should not want, owing to the salary being either too high or too low. To write an application is a matter that involves considerable time and some little expense, and consequently we do not wish to undertake it unless there is at least a chance of obtaining a suitable appointment.

It would be interesting to have the opinions of some of your other readers on this question. In the meantime, may I appeal to those who may have situations vacant in the future to state definitely what the job is worth, in order that we may know whether it is worth our while to apply for it or not?

Applicant.

February 4th, 1919.

A Protective Association for Non-Technical Clerks.

It is pleasing to see so many interested in the question of the protection of non-technical staffs in connection with the electric supply undertakings.

Whilst we are all agreed, I think, that some association is essential for the protection of our interest, there appears to be a difference of opinion as to the best methods of attaining this object.

"Power Company Clerk" suggests that we join the N.U.C. under the guild system, but I think that it would be more in our interests to form a new union which, if the proper support was forthcoming, could approach the E.P.E.A. with a view to affiliation, and the two sections would then cover the whole of the staff of the industry.

It would be interesting to hear more as to the general standing of the Clerical Assistants' Association (Electric Supply Undertakings) mentioned by your correspondent.

Could not those interested meet in the near future at convenient centres, say, London, Birmingham, Manchester, Leeds, Newcastle, Glasgow, in order to get a move on?

Supporter.

February 5th, 1919.

Balanced Three-phase Furnace.

With reference to my contribution to the discussion on Prof. Miles Walker's paper, and the author's reply in the current number of the I.E.E. *Journal*, will you allow me space to explain that in a practical application of the idea I was intending to meet the difficulty of obtaining sufficient resistance by means of the form of the furnace bowl or well. It would be divided to secure a restricted path between the bottom electrodes, or even to force a secondary arc through the slag from the surface of the metal in one half of the well to the other.

Otherwise the heavy current could be put into the metal by the inductive method. I fully recognise that the practical details require careful elaboration, but there may be germs of usefulness in the suggestion.

James Whitcher.

Ruislip, *February 5th*, 1919.

Electrified Seed.

Your correspondent "Wide Awake" is too clever by half. He has the acute penetration of the sailor's mother. "No, John," she said, "I believe you when you say you discovered mountains of sugar and rivers of rum, for where else can sugar and rum come from? But when you tell me you have seen flying-fish, you are trying to impose on your old mother. Fish don't fly. It is against their nature." So "Wide Awake" can believe in electrified chickens, for he has seen them himself, but that seeds can be electrified is too much for him.

He says that farmers are not as a rule competent to carry out scientific experiments. Perhaps they are not, and it is fortunate that in growing electrified seed they are not required to experiment; but they are as good judges as other men of whether their banking accounts show a profit or a loss, and when they find that electrification of their seed corn increases their returns by an average of about £5 per acre, they don't trouble themselves about scientific experiments. They just pocket the money and do it again.

I am not a matchmaker, but I cannot but suggest that if "Wide Awake" were to marry the sailor's widowed mother, they would be mated—and matched.

Chas. Mercier.

Parkstone, *February 10th*, 1919.

The Abortive Electrical Strike.

I attended our last branch meeting; usual business, &c. On Saturday, saw notice in the Press *re* important meeting of members of the E.T.U.; being on shift, could not attend. On Tuesday, saw notice in Press *re* strike; Wednesday, saw more about strike; Thursday, having heard nothing official by post or otherwise, I interview shop steward, who knows nothing, except that he has attended one or two meetings, proceedings of which he will not divulge. At a meeting that was held on Friday, members were informed that they ought to have come out, notice in the Press considered sufficient. In conclusion, I think it is time that members of the E.T.U. protested against their union being used to advocate George Lansbury's political views, *re* Albert Hall lights out, and the sale of *Heralds* at meetings; if there is a strike, it is nothing more than camouflage to advocate George Lansbury's views, and not those of the members of the E.T.U., but the officials only. Otherwise, do I belong to a trade union or a political party? as I, for one, in return for better conditions, &c., do not intend to accept any political views with it, in return for those services which I pay for, otherwise, where does the motto, "Light and Liberty," come in?

Member, E.T.U.

Thursday, February 6th. Time, 12 o'clock M.D.

Scene: A large London electric light and power station.

Threat: 6 p.m. to-night, London in "darkness."

The Station Chief, wondering what's going to happen.

The Shift Engineer, thinking, Let all the E.T.U. men go, what is going to happen?—practically nothing, we shall go on as usual, with substitutes on the switchboard, that is all.

The Switchmen: What is he thinking? He knew, but said nothing, and so we waited.

Six o'clock came, nothing happened; not even a blink on the lights.

Now, what do the public think in general of these E.T.U. men in the power stations, who failed to do as Mr. Webb (who apparently did not know the position of his union in an electric light station) said they would do?

I think, under the circumstances, something should be said about these men, who knew at 9.30 on Wednesday night all would be well, because all these had voted against such an action, but we could only wait and see.

I, a member of the E.P.E.A., think these men should have the credit for voting thus, and not be blamed for the threat of someone else, a threat that could not have been carried out.

Do not let the public blame the power station branch of the E.T.U., but thank them for remaining loyal to their employer, and saving us any trouble in running the stations.

Shift Engineer.

London, *February 8th*, 1919.

You may be interested to hear of our experiences during the strike last week.

The whole of our station staff, with the exception of three or four labourers, went out at 6 p.m. on Thursday, together with many of the outside workers. The shift engineers, who are members of the E.P.E.A., of course, remained at work.

The strikers were at once replaced by an ample supply of voluntary labour. The volunteers were fed, and in many cases given makeshift sleeping accommodation at the works. No difficulty whatever was experienced in maintaining the full supply until the strike collapsed, and the men returned to work on Saturday afternoon.

We feel deeply indebted to the public spirit of the townsmen of Twickenham and neighbourhood which induced them to volunteer to help to keep the supply going. We had so many offers of help that we were only obliged to call on a proportion of those who kindly offered their services, and we were quite prepared to carry on indefinitely had the strike been prolonged.

Many soldiers on furlough offered their services, and we were also assisted by several members of the special constabulary.

It has been an interesting object lesson of the futility of the threat of the E.T.U. that they would "plunge the town into darkness."

Twickenham & Teddington Elec. Supply Co., Ltd.
M. Farrer, *Engineer & Manager.*

Twickenham, *February 10th*, 1919.

In connection with the recent threatened electricians' strike, the Press need not have whipped the public into a panic. As a body, the members of the E.T.U. are patriots to the last fibre of their being, and are not being blindly led away by a small Bolshevic element in their midst. The strike would never have materialised for such an object, and few of us indeed could have stood by our honour to the Union. Had the object been a wage dispute or similar trouble, the Government would have seen the futility of their theatrical resuscitation of the moribund pseudo-laws by which they threatened us. E.T.U. members are *Englishmen and* unionists. As Englishmen they would have the courage of their convictions, and stand out for their just claims. As unionists they would have supported trade unionism only in so far as the principles applied. If the E.T.U. officials think they are going to make a political and Government-fighting body of us, they make a grave error, and the sooner such ideas are abrogated the better for the E.T.U. and its membership. I speak as a one-time representative of a large body of E.T.U. men.

A. Bridges.

Teddington, *February 9th*, 1919.

Electrical Contracting.

I noted with pleasure the footnote and reply by the Editor to Mr. H. Fowler in your issue of January 24th, but cannot understand why it was not pointed out that you had special columns and rates for advertisements. It would have been better if Mr. Fowler had devoted his spare time to finding out the real facts about the work which he states has been condemned. If he will do this he may find that it is not the system or materials that are at fault, but the workmanship, for which the same union wages are paid by any firm. It is so easy for one to sound his own trumpet, to curry favour, and at the same time to work in an advertisement that "we are the only people."

As a Liverpool contractor I feel that Mr. Fowler's statements are unwarranted, and perhaps when he has had more experience as a boss, and carried out a few installations in that capacity, he will wish that he had written a book of instructions for his fellow-workmen, instead of trying to tell us contractors in an advertisement what we all agree upon.

In Liverpool we have Corporation and insurance inspectors of high knowledge and experience, who may give Mr. Fowler many an anxious moment in the near future.

Amused.

Liverpool, *February 7th*, 1919.

I am afraid Mr. Marryat is discussing something entirely different to the subject which I dwelt upon under the above heading some few weeks ago in the Electrical Review. I cannot find anything relating to members of the Electrical Contractors' Association, as being responsible, or any suggestion that they have been responsible, for putting in unsound electrical installations, in any part of my letter. In fact I was not aware that I mentioned the Electrical Contractors' Association at all. I shall be pleased if Mr. Marryat will produce the evidence in my letter, which he describes as an assertion against the Electrical Contractors' Association.

I may, for Mr. Marryat's future guidance, point out to him that I have the list of members before me at the moment of writing. I regret to find that some large electrical and contracting local firms, which I know of, are not mentioned in that alphabetical list.

The object of my letter was to uplift the electrical installation profession; it is immaterial to me who undertakes the work, so long as it is carried out in a proper manner. Whether the contractors be in a big way or only in a small way, it is to be hoped that they will always try to put in a good job, not always with the object of grabbing all they can get out of it, regardless of how long the installation will stand good.

H. Fowler.

Liverpool, *February 7th*, 1919.

On reading through the correspondence column of the Electrical Review of January 24th last, I came across a letter under the heading of "Electrical Contracting," signed by Mr. H. Fowler, and, in my opinion, as a bare-faced and cheap advertisement, both for himself and the house-furnishing firm which he says he represents, it would be hard to beat. After setting forth his various desires that this thing and that thing might be done, and also making statements on electrical matters with which we are all conversant in this district, and that he is more than pleased that the matters which he has so weakly taken up are (after your informing him of the fact, Mr. Editor) in the right hands, he accuses firms, firms only known to himself, perhaps imaginary, of doing shoddy work. He also tells us that he is now a representative of a large contracting firm (presumably he is referring to Messrs. Waring & Gillows, who, as everyone knows, are far more interested in the house-furnishing line than in the electrical engineering business), and seeing that he is in such an exalted position, and refrains from expressing any opinion on the matter he has so poorly taken up, excepting to make accusations against other firms, apparently his meek modesty far exceeds his knowledge of electrical matters generally.

In conclusion, the matter he has tried to write about from beginning to end is, as before stated, a cheap form of advertisement, and you would have been quite justified, Mr. Editor, in sending Mr. Fowler (representative of large firm of electrical contractors) your account before inserting it.

Live and Let Live.

February 8th, 1919.

Engineer Surveyors' Salaries.

The inspecting staffs of insurance companies and also "would-be" inspectors should be grateful to Mr. A. T. Abraham for his letter to you which appeared in your issue of January 17th. It may be of interest to your readers to know that after 21 years' service some inspectors are rewarded with a salary of £230, whilst in pre-war days the figure was £198. These 21 years' men had also to be very careful "how they walked," or they were discharged, and new men put in their places at a lower salary. It may also be of interest to quote a few dividends paid to the shareholders of these "leading insurance companies" doing engineering business: Royal, 100 per cent.; Norwich Union, 70 per cent.; London and Lanc. (Law Accident), 66 per cent.; Commercial Union (Ocean & Union Assurance), 140 per cent.; Yorkshire (Scottish), 50 per cent.; Vulcan, 25 per cent.; British, 25 per cent.; National, 35½ per cent. These figures were circulated by the Engineer Surveyors' Association a few months ago. Oh, yes! there is an association to watch over the interests of its members, and the scale of salaries offered may be taken as a criterion of its usefulness! About 75 per cent. of the inspectors employed by the insurance companies are members, and the majority are in favour of the association being registered as a trade union. The stumbling blocks in the way of this becoming a concrete fact appear to be the Manchester and London branches, and as the head offices of the majority of the companies are in these cities, the inference appears to be pretty obvious.

The reasons advanced against registration as a trade union appear to be that to be a trade unionist is to lose in self respect more than one gains in £ s. d., or, in other words, to be shabby genteel, and a non-unionist is "a far, far better thing" than to be a trade unionist and own a row of houses.

In short, the reason why leading insurance companies can offer such small salaries is that the inspectors are not organised as a body—their employers are.

Pitman.

Early Wireless Telegraphy.

With reference to the letter of Mr. A. A. Campbell Swinton which appears in your issue of January 31st, I quite agree with his statement that there is no foundation for the suggestion that when I first came to this country I failed to meet with sympathy in official circles, at any rate so far as the late Sir William Preece, Sir John Gavey, and Mr. H. R. Kempe, of the General Post Office, are concerned. It is quite incorrect, however, to say that the assistance of this department "included the use of a considerable sum of public money." This is an allegation which I have repeatedly denied, notably in evidence which I gave in 1907 before the Select Committee of the House of Commons on the Berlin Radiotelegraphic Convention of 1906, and again in 1913 before a Select Committee of the House of Commons appointed to inquire into the agreement of 1912 with the Marconi Co.

In the interests of ordinary—as well as historical—accuracy I cannot do better than reproduce here two extracts from the aforesaid evidence. In 1907 I said:—

"If you will allow me, with reference to a general idea that there is in existence about my early relations with the General Post Office, I wish to state that I shall always feel grateful for the encouragement they gave me, and the interest they took in my methods during those early trials. At the same time, I would also like to state, on account of a belief that there is about it, that I obtained no financial assistance from the Post Office; fortunately I did not require it at that time; I only thought it necessary and thought it desirable to interest them in what I was doing, and to show them what I could do."

And in 1913 my words were as follows:—

"I think it right to repeat what I stated before the Select Committee on the ratification of the Radiotelegraphic Convention of Berlin, that I feel grateful to the Post Office authorities for the encouragement they gave me, and the interest they took in my work during those early trials. I wish, however, most emphatically to state that at no time have I ever received from the Post Office or any Government department anything in the nature of a favour which would not have been in common courtesy afforded to any scientific worker by any Government in any other country of the world."

Neither Mr. (now Sir) John Gavey, who gave evidence before the 1907 Committee, nor Mr. (now Lord) Buxton, who was then Postmaster-General, and who was a member of the committee, said anything that could be construed as a refutal of the evidence I have reproduced above.

What I greatly regret, however, and, if I may be allowed to say so, this constituted to my mind a mistake on the part of the Post Office, is that I was practically compelled to allow my experiments in South Wales in May, 1897, to be witnessed in all their details by Prof. A. Slaby, of the Charlottenburg Technical Institute, and a personal friend of the Kaiser. Previous to these tests I did not know Prof. Slaby, nor had I expressed the slightest desire to allow him to witness my experiments, but did so out of courtesy to the British Post Office officials, who introduced him, and who made the request.

G. Marconi.

London, *February 5th*, 1919.

The Shorter Working Week.

May I be allowed to give a few facts concerning the shorter working week? Several months ago we learned that the Government were lessening the period for delivery of war material, and the chances of the war ending were discussed. Out of these discussions arose the question of after-war unemployment. Some of the members were in favour of demanding a 48-hour week, others a 44-hour week; while one of the north country representatives advocated 40 hours per week, *i.e.*, 8 hours per day for 5 days and off all day Saturday, or if in all day Saturday, then off all day Monday. This shortened working week was favoured as the best means for steadying employment. The trade unions were faced with a tremendous problem. Assuming that 8 millions of workers had to be displaced from the munitions factories or demobilised from the Army and Navy and reabsorbed into private industry, there appeared to be but one way to secure this reabsorption without the wholesale sacking of those who had been engaged on private work through the war, and that was by way of the shorter working week and the abolition of overtime. The women did not present so much of a problem as the men. The women, it was taken for granted, would want to get away home as soon as their husbands secured their release. If we take into consideration at this juncture the number of women who can be reasonably replaced by returning men, and the redistribution of jobs so that two men are made to work, say, 40 or 47 hours per week instead of one man working 80 hours, the difficulties can be got over in a fairly smooth manner, with the chances of unemployment for even a small residue reduced to nil. The problem of the shorter working week is also one for the sociologist as well as the economist. To-day commodity prices are so high that wives of returned soldiers may have to continue at some form of work to make both ends meet. But we know for a fact that soldiers are expressing resentment and disgust at being robbed of the chances of the full benefit of home life on their return, by reason of their wives having to go out, and thereby neglecting the usual home duties, or as a compromise by both remaining at home in the evening to do the cooking and cleaning.

The movement for a shorter working week and more money is bound to become a national one, and the power stations will, of necessity, become involved in it.

John Vincent,
Secretary,
National Amalgamated Union of Enginemen,
Firemen, &c.,
Marylebone Branch.

London, N.W., *February 10th*, 1919.

[Several letters are unavoidably held over.—Eds. Elec. Rev.]

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

The following further contributions have been received in response to the appeal made by Mr. Hunter, the chairman of this Institution:—

	£	s.	d.		£	s.	d.
McKenzie & Moncur, Ltd.	2	2	0	J. W. Darling		10	6
Fernand Espir	1	1	0	F. J. Rayment	5	5	0
Battersea Electric Works (Staff)		15	0	H. J. Riddell		10	6
H. A. Sharples	1	1	0	Electric Installation, Ltd.	2	2	0
W. Young		10	6	C. T. Walrond	1	1	0
Newcastle-on-Tyne Electric Supply Co., Ltd.	50	0	0	Mersey Power Co., Ltd.	10	0	0
George Ellison	5	5	0	A. Davy		10	6
H. J. Cash & Co.	2	2	0	Cryselco, Ltd.	10	10	0
Chas. Silcock	1	1	0	A. F. Roffey	1	1	0
				H. L. Leach	1	1	0

LEGAL.

British Accumulator Co.'s Liquidation and German Patent.

In the Chancery Division, on February 5th, Mr. Justice Astbury had before him a summons taken out by Mr. Geo. Walker, liquidator of Walton & Clough, Ltd., creditors of the British Accumulator Co., Ltd.

Mr. Cunliffe, K.C., appearing for the liquidator, said that the Accumulator Co. was formed to work a certain patent; the vendor was a German named Vilne, and apparetly no one could manufacture these things but German workpeople, and that was the explanation why the company came to grief. They entered into an agreement with Walton & Clough, of Bradford, under which the latter set aside part of their works in order that the British Accumulator Co. should set up plant for the manufacture of accumulators. It was in respect of the expenditure in connection with the setting aside of these works, erecting the necessary buildings, and setting up the plant that the liquidator of Walton and Clough made a claim in the liquidation of the British Accumulator Co. The claim was for £1,500.

Mr. F. Russell, K.C., for the liquidator of the British Accumulator Co., said they regarded the claim as wholly unjustifiable.

Mr. Ashton Cross, for the claimants, read evidence, to the effect that the company's production of accumulators was satisfactory, but the work could not be finished, because the Accumulator Co. did not obtain lamp cases from Germany.

His Lordship, in giving his decision, said the whole matter depended upon the construction of the agreement, and under that document he held that the applicants could only claim under Clause 21, and that applicants had put themselves out of court in respect of any such claim. The summons must be dismissed without prejudice to any claim other than that included in the present claim which the applicants might rightly make against the company in respect of accumulators. The applicants must pay the costs.

Electrical Worker's Inadequate Compensation.

In the Shoreditch County Court, on February 6th, before his Honour Judge Cluer, there was an application under the Workmen's Compensation Act in the case of Charlotte Kennedy, of 37, Goswell Street, Hackney Road, an electrical worker, against the Little Wonder Battery Co., Ltd., of Willow Street, Great Eastern Street. On November 11th, 1918, the ceiling fell on the girl's head, causing rather bad contusions, and she was still suffering. She had been receiving compensation at the rate of 25s. a week, and it was now sought to settle the matter for a lump sum of £10; but the Registrar had refused to agree to it, as it was much too small a sum. The matter, therefore, had come before the Judge. The girl now said she suffered very badly with headaches, but for the respondents it was suggested that there were the usual cures for such things, and perhaps it was questionable if they were there.

Judge Cluer said the sum offered was totally inadequate, and he would refuse to agree to a settlement.

Forty Bosch Electrical Patents.

Before the Controller of Patents, in the Patents Court, London, on Friday, February 7th, an application was made by the British Lighting and Ignition Co., Ltd., of Tottenham Court Road, London, W., for licences to use a batch of 40 of the patents of Robert Bosch, of Stuttgart. There was no opposition to the application.

For the applicants, Mr. Mellersh-Jackson said that the firm had previously been granted licences in respect of several of these enemy patents. The patents now applied for comprised sparking plugs, ignition apparatus for the electric lighting of motor vehicles, and also starting appliances for motors, and were over various dates in the years 1905 to 1915. Those having relation to electric ignition and lighting appliances were closely connected with one another. All were intended to be used in motor vehicles.

Mr. Temple Franks, the Controller of Patents, asked whether the firm was taking up all these patents.

The Advocate replied that they proposed to manufacture on a very large scale, and would probably use them all.

Mr. Temple Franks intimated that the granting of licences would be recommended on the same terms as in the previous cases.

Harris *v.* Grant Hughes.

This action, which was a claim for an account of the sale by the defendant of a quantity of asbestos, came before Mr. Muir Mackenzie, in the Official Referee's Court, on February 10th, when the parties came to a settlement in the early stages of the proceedings.

Mr. A. Powell, K.C., with Mr. Lincoln Read, appeared for the plaintiff, and Mr. Compaton, K.C., with Mr. Neilson, for the defendant.

Mr. Powell said that the action was brought for an account respecting dealings with asbestos, a quantity of which was over here and in the hands of the defendant for sale, and he frequently said that he had sold it to Callender's Cable Co. at £40 a ton. The plaintiff asked for an account, but did not get any. Having got some information, he thought it better to write to the defendant respecting the business. He did so on several occasions, but could get no answer, in consequence of which he placed the matter in the hands of his solicitors, who issued the writ in June last, after having written to the defendant without result. Since the action the defendant had delivered no fewer than four different accounts.

At this point of counsel's opening, Mr. Compston asked for a brief cessation of the proceedings, in order that he might consult with plaintiff's advisers with a view to an arrangement.

After a short interval, Mr. Compston said he was glad to be able to announce that the Court would not be further troubled with the case. There were certain difficulties in the way, and his client had placed himself unreservedly in the hands of his counsel, with the result that there would be judgment by consent for £300, with costs, £250 to be paid down, and the remaining £50 in a month, the defendant giving his acceptance for that amount. The costs were to be paid after taxation.

Judgment was entered in accordance with these terms, the Referee observing that execution would only issue in the event of the terms not being carried out.

Mr. Compston said that the asbestos remained in defendant's hands, and the judgment was on the holding that it had all been sold. The £300 represented the plaintiff's share of the profits.

BUSINESS NOTES.

The Government and the Railways.—The directors of the Lancashire and Yorkshire Railway begin their report with the following:—

"The proprietors will have noticed in the Press announcements as to the future control of railways. Those responsible for the management of the railways have endeavoured, in the interests of the shareholders, to obtain some definite information from the Government as to their intentions in the matter, but, so far, without success. All that we know to date is that, during the recent election, a member of the Government intimated that it was the intention of the Government to acquire the railways; and whilst since then we have endeavoured to ascertain exactly what are the views of the Government, the only information we have is the public announcement made in the Press that the Prime Minister, in an interview with a deputation from the National Union of Railwaymen is reported to have said that the Government contemplate the establishment of a Ministry of Ways and Communications to deal with the whole of the railways and the electrical industry, both for transport and power purposes, and that a Bill conferring the necessary powers upon the Government will be the earliest measure introduced into the new Parliament, and will be speedily passed into law. It has not been possible to elicit any information from the Government as to the method of future control, nor as to the terms under which such control will be initiated or exercised.

Non-Ferrous Materials.—Stocks (exclusive of old metal and scrap) in this country in the possession of the Minister of Munitions on February 1st, 1919:—

Copper	41,882 tons	Soft pig lead ...	86,493 tons
Spelter, G.O.B ...	23,905 „	Nickel	2,388 „
Spelter, refined ...	7,734 „	Antimony regulus	3,731 „
Aluminium ...	13,092 „		

British Orders for British Firms.—The Executive Committee of the British Empire Union has addressed a circular letter to public authorities, suggesting that, as peace is approaching, it would be extremely desirable if they would issue a public announcement that no tenders will be received from, and no contracts given to, any firms connected, directly or indirectly, with the enemy Powers, and that preference will always be given, as far as possible, to genuinely British firms employing British labour. Such an announcement, it is added, would go far to ensure that taxes, which must necessarily be heavy, would be expended for the benefit of British trade and industry instead of for the advantage of enemies, whose atrocities have placed them outside the pale of civilisation.

Book Notices.—"*Journal* of the Institution of Electrical Engineers." Vol. LVII, No. 278. January, 1919. London: E. & F. N. Spon, Ltd. Price 7s.—This issue contains a paper by Mr. J. H. Shaw on "The Use of High-Pressure and High-Temperature Steam in Large Power Stations," and one by Prof. Miles Walker on "The Supply of Single-phase Power from Three-phase Systems."

"The British Dominions Year Book, 1919." Edited by E. Salmon and J. Worsfold. London: The Eagle, Star and British Dominions Insurance Co., Ltd. Price 1s.

"*Bulletin* of the Société Belge des Electriciens." Vol. XXXI, August-December, 1914. Vol. XXXII, 1915-16-17-18. Brussels: Emile Bruylant. Price 1 fr. 75 each.—It is with great pleasure that we welcome the return of the *Bulletin*, and read on page 1 of the four-year issue the note of triumph and rejoicing (not without a tinge of sadness) with which the publication is resumed. We echo the exultant "Vive la Belgique" with gladness that Belgium still is.

"Electrolysis and its Mitigation." By E. B. Rosa and B. McCollum. Washington: Government Printing Office. Price 35 cents.

Ways and Means, the new sixpenny weekly review which Mr. Ernest Benn is shortly bringing out, is not intended to be a trade paper in the ordinary acceptance of that term. Its object will be to keep the public better informed than it has been in the past in regard to general industrial matters, and the principles of industrial administration, industrial reconstruction, and self-government for industry. It will endeavour to be to trade what the *Spectator* and the *Nation* are to politics, and will contain the views of manufacturers, Trade Union officials, and others seriously interested in industrial questions who may be willing to record their experiences or to express their opinions. The publishing office of *Ways and Means* is at 8, Bouverie Street, E.C. 4.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 1. January, 1919. New York: The Institute. Price $1.

Trading with the Enemy.—The *London Gazette* of February 7th contains a further list of names of bodies and persons abroad with whom trading is prohibited, or whose names have been removed from the list.

Batti-Wallah Talk on Foreign Competition.—At the next luncheon of the Batti-Wallahs, which is to take place at the Holborn Restaurant on Monday next, at 1 o'clock, Mr. J. H. C. Brooking, general manager of the St. Helens Cable and Rubber Co., Ltd., is to give a short talk on "How Shall we Meet Foreign Competition?"

Tyneside and New Industries.—At a meeting of the Newcastle-on-Tyne Chamber of Commerce on 6th inst., Mr. D. Stephens presiding, a report of a special committee appointed to consider new industries for the Tyneside was considered. It was pointed out that as foreign competition with the two staple local trades—shipbuilding and engineering—became more keen, it would become increasingly important to have new industries established. Industries dependent upon electrical energy which might be established in the neighbourhood were electrochemical work generally, and the manufacture of carbide of calcium, sodium, potassium, phosphorus, silicon, magnesia, &c. It was thought that the following commodities might be provided in the district:—

Steel boiler-plates, steel castings, forgings, furnaces for cylindrical boilers, tubes, steel, iron, brass and copper rivets, stampings, general equipment, such as marine engineers' stores, engine fittings, such as pressure and vacuum gauges, air gauges, mechanical indicators, telegraphs, lubricators, radiators, flour, cocoa, tin-ware for packing tobacco, drysalters' and ships' stores, biscuits and other goods, paper-making industry, locks of all sorts, boot faces, buttons, cheap clocks and watches, soap, starch, steel files, cutlery, special tool steel, chain-making, flexible wire, yellow metal plates, motor cars, aircraft, scrap tin, the recovery of zinc from galvanised scrap steel and iron, the making of coal briquettes, and agricultural machinery and other articles.

The committee desired the possibilities of development in the neighbourhood to be as widely known as possible. The report was adopted.

Sir Robert Hadfield's Views on the Industrial Situation.—Sir Robert Hadfield has written an article for the *Pall Mall Gazette* in which he looks at some of the causes of "Labour Unrest." First, he says, many employers failed in the past to advance with the times, which is unquestionably true; indeed, the failure is not entirely a thing of the past. Secondly, he says that the workers are tired out after the long strain of war; that, too, is equally true—true of us all, whether we be privileged to count ourselves as "workers" or no. Sir Robert refers to his own company's 23 years' experience of the working of the eight-hours' day, and he says that if other firms had adopted that change when they were criticising Hadfield's for so doing the country would not now have been faced with almost universal unrest in the ranks of the workers. Employers proved too tenacious of old methods—they moved too slowly—with the result that workers to-day were determined to force the pace, and were making all sorts of vigorous demands. If changes had been effected gradually, the country would by now have been ready to discuss a 44-hour week. We were so chary of making experiments, so fearful of new ways. We could learn from the lessons of the past not to be so timorous in our dealings with Labour. "The experience of firms which had tried the 48-hour week shows conclusively that it does not mean the end of all things." Sir Robert agrees that many times trivial grievances have been allowed to develop into unrest. He cites a case where the workmen represented that it would be a great boon if they were allowed to have a smoke after breakfast. Given that the character of the work does not make it dangerous, why not allow it? "You and I like a cigarette after breakfast, and should probably grumble if it were forbidden us!" This may be regarded as a typical case where the human element may be introduced without sacrifice of anything material. As to the demand for larger production per worker, Sir Robert says that when all are over-tired by reason of war strain it must be recognised that there is a limit to each man's capacity for output, and no one can desire to keep up the war rate.

"The present demand for shorter hours is, in a considerable measure, a reaction against the terrible pressure which was maintained during the war. But if shorter hours are to be introduced, what becomes of the predominant demand for greater production? There will be an output above the pre-war level, but it must be achieved by machinery, and not by human sweat. We must use the mechanical element, and the improvements and developments which are always being accomplished. This, to my mind, is the true line of progress, and is in the best interests of all concerned. Speeding up workers in order to obtain greater production will, if pushed to extremes, defeat its own object, because it will lead to endless friction. The chief point is to speed up the mechanical element rather than the human one." Sir Robert finally desires that international industrial conditions should be equalised as much as possible. "If the many nationalities now represented at Paris could agree on a basis for the hours of labour, production, and other important questions, many problems would be solved. It should not be beyond the wit of the leading statesmen of the world to draw up a basis for the eradication of excessive, and therefore unhealthy, competition, while still leaving the field open for fair and friendly rivalry."

Siemens's and South Africa.—In the course of an article appearing in the *South African Mining Journal* for January 4th an account appears of the objects of a special mission that was recently sent to South Africa by Messrs. Siemens Bros. & Co., Ltd., of London. The mission was composed of Messrs. W. B. Hopkins and F. H. Leonard, and its work is threefold: to make clear the change in the nationality of the firm; to notify the enlargement of the scope of the company's business; and to make known the conclusion by the company of industrial alliances in various directions. Incidentally, the mission is studying in South Africa and elsewhere the possibilities of electrical engineering, as well as the scope of the market for electrical plant and material of all kinds. The article continues:—

"As far as export business is concerned, the selling end of the business will be handled by representatives appointed by the associated firms, and the mission now here is charged with reporting on the most feasible method of establishing these in accord with local conditions. By this means duplication of representatives is avoided—a form of wasted effort very common in the past. Siemens Bros. & Co., Ltd., erected the first telegraph lines in Cape Colony 55 years ago, and have constantly supplied such material to the South African Governments since that time. They hope that now that the German influence has been eliminated they will be able greatly to extend this field of electrical enterprise throughout the whole of South Africa. Mr. Hopkins and Mr. Leonard have expressed their conviction that this working alliance of such powerful electrical industries under the protection and consent of the British Government will enable them to secure a large share of the many installations of electrical plant that will undoubtedly be wanted in the near future. Both also expressed themselves as greatly pleased with the co-operation they had been accorded by the British Trade Commissioner for South Africa, Mr. J. L. Wilson Goode. They expressed the opinion that if British Government officers continue to co-operate as heartily with all British industrial representatives as they have with them, it will be a long step towards beating the Germans who, before the war, were already well established in South Africa. Both gentlemen also voiced their warm appreciation of the kindness and sympathy with which they had been everywhere met throughout South Africa. They leave shortly for India and the East, in continuation of their trip round the world. In their tour round South Africa, Mr. Hopkins and Mr. Leonard are accompanied by Mr. A. J. G. Simpson, representative in South Africa for Messrs. Siemens Bros. and Co., Ltd."

Fire.—A large wooden shed on the premises of Messrs. E. Brook, Ltd., electrical engineers, Empress Works, Huddersfield, used for storing cores, was completely destroyed by fire last week.

Export Restrictions Relaxed.—The *London Gazette* of February 7th contains a notice of further relaxation of export restrictions.

Trade Announcements.—Mr. Arthur Powell, electrician, of Church Hill, Ramsgate, has resumed business on his return from active service.

Messrs. Ashton & Holt, electrical engineers, of 15, Cross Street, Ryde (I. of W.), have reopened the business, the principal of the firm and several of the staff having been demobilised.

Messrs. Wellman Bros. & Co., of 42 and 43, Peascod Street, Windsor, have reopened their electrical department under the management of Mr. C. Howlett, late R.E.

Mr. Thos. Speak, who has been released from the Army, is reopening as an electrical engineer and contractor at Library Street, Blackburn.

Mr. Henry Joseph has now opened business in Birmingham as the Midland Electric Power Installation Co., with Old Mill Street, Wolverhampton, as his address. The premises have been taken for motor repairs, and, in fact, for the repair of anything electrical in connection with factory driving. The firm undertakes lighting as well as power work in factories, both in Wolverhampton and Birmingham. A staff will be kept at both towns, but business will be conducted from Wolverhampton.

We understand that the Newall Engineering Co., which during the latter part of the war was taken over by the Ministry of Munitions and operated as a national gauge factory, has now reverted to its former proprietors, Messrs. Peter Hooker, Ltd. Accordingly, it is understood that the company intends to reorganise and develop its well-known pre-war business in gauges, micrometers, and measuring machines, together with additional specialities which will shortly be announced. The Newall Engineering Co. has appointed Captain R. J. Bray, Director of the Machine-Tool Section, Aircraft Production Department, as general manager, and interesting developments are anticipated.

Mr. Alan E. Dent, A.M.I.E.E., of Nelson, Lancs., has recently acquired the business of Mr. Arthur Peel, electrical engineer, Russell Street, Nelson.

Messrs. L. G. Hawkins & Co., are to-day removing to larger premises at 116, Charing Cross Road, W.C. 2, where new departments are being opened for the supply of electrical materials. Temporary telephone number, "Gerrard 2490." The firm issues a fortnightly publication, *The Electrical and Mechanical Exchange*, for trade concerns and individuals actually engaged in the electrical or mechanical industries.

Plant for Disposal.—Gillingham Corporation electricity department has for sale one 50-kw., three-phase, 2,000/2,200-volt, 50-cycle B.T.H. alternator and exciter, direct coupled to a two-crank compound Willans engine, one main and exciter panel, one 22-h.p. compound vertical engine, and one 5-h.p. single cylinder vertical engine.

Bermondsey Borough Council invites offers for one Willans and Robinson 75-kw. steam dynamo. For further particulars see our advertising pages to-day.

Liquidations.—Radium, Ltd., 66, Basinghall Street, E.C. —First and final dividend of 20s. in the £. payable at 33, Carey Street, W.C.

British Telegraph Instrument Co., Ltd.—A meeting of members will be held at 179, Clapham Road, S.W., on March 12th, to hear an account of the winding-up from the liquidator, Mr. J. H. Webb.

Bankruptcy Proceedings.—Charles Mayfield, 19, All Saints' Road, Clifton, Bristol, electrical engineer.—The first meeting of creditors was held on February 5th at the Official Receiver's office, 26, Baldwin Street, Bristol, before Mr. W. Ormiston, Deputy Official Receiver. It appeared that the gross liabilities amounted to £1,345, all of which was expected to rank, and the assets to £4 7s. The failure was ascribed by debtor to heavy expenses in experimenting and developing inventions, inability to develop his electrical business on account of the war, and interest on loans from moneylenders. The Official Receiver remains trustee.

A. Matson, electrical engineer, Stockton-on-Tees.—Application for debtor's discharge granted on January 14th, subject to conditions. Last day for proofs for dividend, February 22nd. Trustee. Mr. H. M. Hardy, O.R., Court Chambers, Albert Road, Middlesbrough.

A. F. Hawdon, electrical engineer, Gosforth.—Debtor's discharge suspended for two years and six months from January 16th, 1919.

Presentation Dinner.—The resignation of Mr. John A. Crabtree, works manager of Messrs. J. H. Tucker & Co., Ltd., King's Road, Hay Mills, was fittingly marked by numerous presentations from the various departments of the firm. On Tuesday evening, the 28th ult., the office staff assembled in the canteen, and, after some musical items rendered by the Telac Musical Society, accompanied at the piano by Mr. H. Pratt, Mr. R. H. Lamb in a few well-chosen words recalled the time when Mr. Crabtree first went to Messrs. Tuckers, Ltd., about twelve years ago as a draughtsman. He had risen by successive stages to the position he was now relinquishing—works manager and chief designer. Mr. Lamb then asked Mr. Crabtree's acceptance of a gold Masonic medallion with a diamond centre, suitably inscribed, on behalf of the office staff. Mr. Crabtree thanked Mr. Lamb and all the members of the office staff. During Friday afternoon, Mrs. Cruickshank, on behalf of the canteen staff, presented Mr. Crabtree with a gold-mounted fountain pen and a pearl paper-knife. In the evening, the works employés held a presentation concert in the canteen, Mr. A. B. Bateman, the production manager, being in the chair, at which Mr. Bisby presented Mr. Crabtree with a writing desk.

Mr. Crabtree, in accepting the presentation, remarked that in regard to the work done during the war, letters of congratulation had been received from the Admiralty and high officials thanking them for the high standard of quality and the quantity of fuses they had turned out. He enumerated how the output of fuses had increased, and said that although the figures were not tremendous, they ranked among the highest in the whole of the country for the number of fuses turned out per person. He thanked all for the conscientious way in which they had surmounted the difficulties experienced in 1917, and offered his congratulations for the way they had been able to change over from war to peace conditions. During the presentation, solos were rendered by various members of the works employés.

On Saturday, February 1st, the works staff entertained Mr. Crabtree to dinner at the White Horse Hotel (Mr. A. B. Bateman in the chair), when Mr. Willmott asked Mr. Crabtree's acceptance of an illuminated address on behalf of the works staff, and Mr. Mills read a letter on behalf of the outside representatives, who also made a presentation of a set of gold cuff links set with diamonds and a dress set of enamel and pearl studs.

During the evening musical items were rendered by various members of the works staff. The menu arranged by the Presentation Committee was a very fine one, the cards being designed as souvenirs of the occasion.

The New "C.M.A. Label" Design.—We desire to direct our readers' attention to an announcement of the Cable-Makers' Association that appears in our advertisement pages to-day concerning the new and very distinctive design of label by which genuine C.M.A. cables can be recognised on and after March 15th, 1919. This design, which is eloquent of strength, and should soon become known as indicating "the world standard of supreme quality," has been copyrighted by Mr. L. B. Atkinson on behalf of the Association for the protection of buyers who may be—as they are almost certain to be—offered alleged "C.M.A." cables by "unscrupulous competitors" of the members of the Association. The design will appear on all labels issued by C.M.A. firms on and after the date mentioned above, and the buyer is asked to watch for the label, which should be attached to all C.M.A. coils thereafter delivered to him.

Brown-Boveri Contracts.—Among the orders that Messrs. Brown, Boveri & Co. have in hand at the present time, mostly in an advanced state of completion, are eight single-phase railway generators, having a frequency of $16\frac{2}{3}$ cycles, for the Norwegian and Swiss State Railways (three of these being 11.500-K.V.A., 16,000-volt machines); two 25-cycle, 10,000-KW. turbo-generator sets, complete with condensing plants, for the Anzan Steel Works, South Manchuria; four 12,000-KW. turbo-generators, running at the exceptional speed (for the output) of 3,000 R.P.M., for different users; and 22 single-phase locomotives, each of 2,000-H.P. continuous rating, for the Swiss Federal Railways.

Trade with Siberia, Serbia, and Rumania.—Exporters may apply for general licences to ship to Siberia all classes of goods except goods whose export is prohibited to all foreign countries—those on the A or B lists. Applications for licences should be addressed to the War Trade Department, 4, Central Buildings, London, S.W. 1. The restrictions imposed by the Trading with the Enemy (Occupied Territory) Proclamation no longer apply to trading with Serbia and Rumania, and consequently commercial transactions with these countries may now be resumed.

A Banker on the Labour Situation.—At the end of his speech as chairman of Lloyd's Bank, Sir R. V. Vassar-Smith, Bart., said :—"With regard to labour, the recent events must have caused considerable anxiety and dismay, but, however deplorable, I am not inclined to think that they can be construed as an expression of the views of the general body of labour. I believe the unions to be patriotic, and anxious to meet the requirements of the country. From its commencement I have been connected with the National Alliance of Employers and Employed, formed to promote the common interests of Capital and Labour, and much good work has been done. Our belief has been that, by conference, differences of opinion may be adjusted, and a basis made for mutual understanding. It is only by an interchange of thoughts that we can appreciate divergent points of reasoning. On the general question of the relationship between Capital and Labour, some straight talking is necessary on both sides. It is obviously impossible for the country to go on if organised labour is to put in claims that have no possible relationship to economic conditions, and often have no relationship to the question of wealth production. On the other hand, the country will not progress if the rather blood-thirsty expressions of the narrow type of employer ultimately result in definite action. The Alliance has long desired that there should be an all-round national conference, called jointly by the National Alliance, the Federation of British Industries and the Parliamentary Committee of the Trades Union Congress, to which representative trade unionists and capitalists could be invited, and thresh the whole matter out. Often in English industrial history has the country arrived at the edge of a precipice, and, after looking over, turned back again. I have no doubt now that, if it can be shown the danger of proceeding on the present lines, common sense will come to the rescue."

Indian Fibre Resources.—Mr. R. S. Finlow, the fibre expert of the Government of Bengal, is to make an investigation of the fibre resources of India.—*Times.*

LIGHTING AND POWER NOTES.

Accrington.—Proposed Extensions.—At the T.C., last week, Alderman Higham stated that it was necessary to extend the electrical plant to meet the growing demand, and they would have to install the plant rapidly, or some other authority would to do it for them. The electrical engineer was preparing a scheme for extensions.

Ballymena.—Proposed E.L.—The U.D.C. proposes to consider the question of installing an electric lighting scheme.

Banff.—Proposed E.L.—The T.C. has appointed a Committee to consider the question of an E.L. scheme for the town.

Belfast.—Strike.—At a conference between the Strike Committee and the principal employers, on Monday, an agreement was reached on the following conditions:—That on the men resuming work on the terms in operation on January 25th, a national conference of engineering and shipbuilding trades would be called to consider the question of hours of labour within 30 days from the resumption of work; that it would be suggested to the conference that a shorter working week than 47 hours would be a better system for working on the one-break system; and that, failing a settlement by such conference, that Belfast employers would arrive at a settlement with their own employés within 21 days after the national conference. The working week in operation on January 25th was 54 hours. The Trades Unions concerned decided to hold a ballot on Thursday, and if the result was favourable, work would be resumed. The Corporation had arranged for the resumption of the public services at the earliest possible moment, and the gas supply was resumed on Monday night. In order to prepare for the general resumption of work, a number of men returned to the electricity works and the usual supply was available on Tuesday morning. A limited tramway service was commenced at noon, but the strikers protested that this was a breach of faith, and the cars were withdrawn at 3 o'clock.

Bradford.—Forty-Seven-Hour Week.—The differences between the E.L. Committee and the shift workers at the electricity works have been settled by the introduction of the 47-hour week and the payment of double-time rates for Sunday shifts.

Proposed Extensions.—The Electricity Committee has asked for permission to borrow £2,165 for mains and extensions, and £74,000 for mains, transformer chambers, and other equipment for the next two years.

Brandon (Co. Durham).—Street Lighting.—The U.D.C. has decided to obtain terms from the Electrical Power Co. for public lighting. Before the war, energy was obtained from colliery companies, and it is asserted that they now ask exorbitant prices.

Burnley.—National Electricity Supply.—At a meeting of the T.C., reference was made to the B. of T. report on the future of electric power supply. The chairman of the Electricity Committee said that Burnley was suitably situated for a super-power station, and such a station at Rosegrove could deal with the whole of the district, including Nelson, Colne, and Accrington, with small transmission loss.

Canterbury.—Wages.—The T.C. has decided to increase the war bonus of the workmen at the electricity works by 10s. 6d. per week, plus 12½ per cent.; and that the technical staff shall have an advance of 20 per cent. on pre-war salaries, plus merit and grade increase between that date and March 31st last, plus a total sum of £90 a year, to be paid as from March 31st, 1918, all allowances and bonus to be merged in this arrangement.

Cheltenham.—Salaries.—In connection with the application of the members of the E.P.E.A. for an advance of £90 per annum, plus 20 per cent. on pre-war wages, the T.C. has offered 10 per cent. advance, plus £30. This has been accepted by the men concerned. pending the decision of the arbitration arranged between the E.P.E.A. and the Standing Conference of E.S. authorities.

Chesterfield.—Extension.—The T.C. has agreed to supply a minimum of 60,000 units per annum, at 0·75d. per unit, plus a coal clause, to the iron foundry of Messrs. R. Hyde & Sons, at Woodseats.

Continental.—France.—The *Journal Officiel* announces the appointment of a Committee to prepare and co-ordinate schemes and investigations which have been undertaken by technical institutions and private individuals with the object of promoting the utilisation of the hydro-electric resources of the country.

Dewsbury.—Extensions Scheme Rejected.—The proposal of the Electricity and Tramways Committee to expend the sum of £83,000 on the extension of the electricity works was rejected at the meeting of the T.C. last week. Sir Mark Oldroyd's observations with reference to the Government's electricity supply proposals preceded the decision.

Dublin.—Lighting Restrictions.—In view of the fact that it has 200 tons of coal in stock more than at this time last year, the Electricity Committee has asked the Coal Controller to remove the lighting restrictions. The restrictions have resulted in a reduction in consumption of 18 per cent.

Dundee.—Breakdown.—A breakdown, last Friday, of one of the alternators at the electricity works resulted in the stoppage of the tramway service for an hour, and mills and factories dependent on electric lighting and power were cut off for several hours.

East Grinstead.—Proposed E.L.—The E.L. Committee has recommended the U.D.C. to proceed with the installation of an electricity supply scheme as soon as B. of T. permission can be obtained; Mr. J. B. Morgan has been appointed consulting engineer to the scheme, at a fee of 5 per cent. on capital expenditure up to £10,000, and 2½ per cent. above that amount.

Edinburgh.—Salaries.—The E.L. Committee has agreed to participate in the arbitration proposed by the Ministry of Labour on the demand by the technical staffs of electric lighting undertakings for an increase of salary.

Hetton (Co. Durham).—Street Lighting.—The U.D.C. is to consider the question of the street lighting of the district at its meeting next May.

Hereford.—Proposed Extensions.—The T.C. has decided to apply for sanction to a loan of £13,000 for the extension of the electricity undertaking, in order to supply the area within a 15-mile radius. The T.C. has also asked that £9,770 per annum be granted to cover the charges on capital advanced to the Council by the Ministry of Munitions for the extension of the electricity undertaking.

Huddersfield.—Inadequate Supply.—The mayor and several members of the Corporation have interviewed Sir Charles Sykes, M.P. for the borough, with respect to the inadequacy of the supply of electricity in the town, and an interview with the B. of T. upon the matter is to be arranged.

Leeds.—Proposed Extensions.—The Finance Committee has recommended the T.C. to apply for sanction to a loan of £50,000 for expenditure on electricity mains, and £25,000 for sub-stations. The Electricity Committee has recommended the installation of two 6,000-kw. turbo-alternators, at a cost of £41,130, and extensions at the Whitehall Road Works, at a cost of £135,550. The Tramway Committee proposes to install a new booster, at a cost of £2,600, and a rotary converter, to cost £3,000.

Manchester.—Price Increase.—The Trafford Power and Light Supply Co. has increased its charges for lighting to 40 per cent. over pre-war charges, and for power to 40 per cent.

London.—House of Commons Lighting.—It is stated in the daily Press that, owing to the recent threats to cut off London's electricity supply, it is proposed to provide the House with its own E.L. plant.

Hackney.—Yesterday the B.C. was to consider a report by the Electricity Committee on an application from the Leyton U.D.C. for a bulk supply of electricity, to commence next autumn. The supply is to be at 6,000 volts, 3-phase, 50 cycles, and the charge recommended is £1 per quarter per kw. supplied, plus four-tenths of a penny per unit, with a coal clause making a variation of ·01d. per unit for every variation of 6d. in the price of coal from 20s. per ton; the minimum account is to be £5,000 per annum.

Hackney.—Salaries.—On the recommendation of the I.M.E.A. and the Standing Conference of Electricity Supply Associations, the Electricity Committee has recommended the B.C. to grant the demand of the members of the E.P.E.A. for an advance of £90 per annum, plus 20 per cent., on pre-war wages.

Stepney.—Salaries.—The application of the E.P.E.A. for increased wages for its members has been referred by the Electricity Committee to arbitration.

Morley.—Price Increase.—The T.C. has increased the charges for electricity for lighting purposes from 7d. to 8d. per unit; for power the charges are to be increased from the present rate of 33⅓ per cent. over pre-war charges to 66⅔ per cent., and for motors of less than one horse-power 2½d. per unit is to be charged.

Portumna (Co. Galway).—Proposed E.L.—The Town Improvement Committee is considering the question of introducing a public electric lighting scheme.

South Shields.—Electric Cooking.—The Corporation Kitchen Committee has decided to install electrical cooking apparatus at the communal kitchen.

Street Lighting.—The electrical engineer has recommended the T.C. to use "half-watt" lamps in place of arc lamps for street-lighting purposes.

Stoke-on-Trent.—Proposed Linking-up.—After considering a recommendation of the E.S. Committee that Mr. J. H. Rider be appointed consulting engineer in connection with a scheme for a joint electricity undertaking for the areas of the Wolverhampton, Walsall, West Bromwich, Wednesbury, and Stoke Corporations, the Midland Electric Power Corporation, and the County of Salop, the T.C. referred the matter back for further consideration.

South Wales.—Strike.—The strike of electrical workers in South Wales, which started at the works of Messrs. Troupe, Curtis & Co. over conditions of labour, resulted in the whole of the members of the E.T.U. in the district coming out on Wednesday, last week. The men formulated a demand for a 44-hour week, a basic wage of 2s. per hour for wiremen, fitters, armature winders, &c., and 1s. 9d. per hour for all other grades, overtime and holiday work to be paid for at double rates, and treble rates for work between Saturday midnight and Monday morning. Owing to the fact that the stoppage of the South Wales E.P. Co.'s supply would result in the flooding of several mines, certain men in the company's employ were allowed to remain at work. The electricians at the collieries and steelworks were also allowed to remain at work. There was practically no interruption of the electricity supply, most of the strikers being wiremen, fitters, &c.

Tasmania.—Hydro-electric Department's Report—In his report for the year 1917-18, Mr. J. H. Butters, the chief engineer, states that during the year the extension of the mains to Electrona, the erection of an outdoor sub-station, the construction of a 5-ft. diameter wood pipeline, the widening of the canal in order to increase its capacity from 10,000 h.p. to 20,000 h.p., and other work were completed, and the construction of other pipelines and extensions is proceeding. The power station has also been altered to accommodate an 8,000-h.p. set now on order. Anxiety was felt as to how the large carbide furnace of the Hydro-Electric Co., which consumes over 3,000 h.p., would affect the plant, which was already overloaded, but owing to the use of special starting devices, no appreciable disturbance took place. The undertaking has been greatly hampered by the delay in the delivery of the plant on order, and the existing plant was altered to allow of additional power being obtained as an overload. It was impossible to supply the 4,000 h.p. required by the Electrolytic Zinc Co. in January; 2,500 h.p. was supplied then, and the full amount three months afterwards. The company expects to be undertaking important new developments in the near future. The Hydro-Electric and Metallurgical Co. has given notice that it requires a further 6,500 h.p., and will need still more as soon as extensions are possible. Work is in progress on several big water-power schemes, and others are under consideration. Designs are approaching completion for the extension of the Great Lake scheme to a capacity of 42,000 h.p., and for the development of the Arthur's Lakes and the King River. A concern called the G.M.C. Syndicate has been established at Launceston for the manufacture of white lead, and expects to be in a position to use 10,000 h.p. in the near future The sum of £127,150 is estimated to be required by the department for essential work during the present year. Owing to the fact that definite answers to inquiries cannot be given immediately, especially if Parliament is not in session, unfavourable replies have had to be given to many inquiries for large amounts of power, and Mr. Butters recommends that special legislation be passed to deal with such cases. During the year the units sold in bulk totalled 14,256,000, against 3,658,240 in the previous year, and the connections increased from 7,635 kw. to 24,205 kw.

United States.—Strike.—It is reported that large numbers of sympathisers are striking in support of the shipyard workers at Seattle. Many industries are paralysed, and tramways have stopped running. Electricity works are being operated under police protection, and wireless apparatus has been installed in case the telegraph wires are cut. Armed troops are preserving order, while the Mayor of the city has given notice that unless conditions improve at once he will take steps to operate all essential industries, and place the city under Federal control.

A later message states that the strike is coming to an end. The tramways were again working normally on Monday, and sympathetic strikes were called off.

Warrington.—Year's Working.—In his report for the year ended March 31st, 1918, Mr. F. V. L. Mathias, the borough electrical engineer, states that the new 3,000-kw. turbo-alternator is expected to be running shortly, and a new boiler is to be installed during the present year. The turnover of the sales department amounted to £7,077, an increase of £1,523 over the preceding year. The gross revenue was £50,334, against £41,204, and the working expenses were £35,901, against £28,577. Interest on loans absorbed £4,220, against £3,473; sinking fund, £5,704, against £5,158; and £5,025, against £4,171, was carried to the appropriation account. The capital expenditure amounted to £146,710, of which £8,376 was incurred during the year under review. Units generated totalled 8,695,682, of which 6,908,531 were sold, including power, 5,824,218; lighting, 461,662; public lighting, 52,142; and traction, 570,509; 1,311,997 were used on the works, and 475,154 were unaccounted for. The maximum demand increased from 3,125 kw. to 3,882 kw. The works cost per unit increased from ·702d. to ·807d., and the total cost from ·889d. to ·972d. The average price obtained was 1·46d. per unit.

Worcester.—Salaries.—At a meeting of the T.C., last week, it was stated that, in connection with the application of the members of the Electrical Power Engineers' Association for an increase of £90 per annum, plus 20 per cent. on pre-war wages, an intimation was received by the Council on February 1st that unless all the supply undertakings agreed to the demand within seven days, the members of the E.P.E.A. at all undertakings not complying with the demand would be withdrawn; and further, that unless within 14 days all undertakings throughout the country complied, members would be withdrawn from all undertakings in sympathy. The chairman of the Electricity Committee said that a further communication had been received from the I.M.E.A. stating that, as a result of negotiations with representatives of the engineers, it had been decided to grant a further few days' grace, subject to further provisions. The chairman was given authority to negotiate with the engineers.

Worthing.—Proposed Loan.—The town clerk has been instructed to apply to the L.G.B. for sanction to borrow £16,392 for electricity extensions.

Yorkshire.—Proposed Extensions.—The Yorkshire Electric Power Co. has come to an agreement with the Mexborough U.D.C. for the formation of a Joint Electricity Board for the provision of further generating plant for the southern portion of the company's area. The U.D.C.'s of Elland and Spenborough are also to be supplied.

TRAMWAY AND RAILWAY NOTES.

Ashover.—Light Railway.—The Light Railway Commissioners have sanctioned a scheme for the construction of a light railway from Stretton to Ashover, for the Clay Cross Co. The estimated cost is £68,700.

Birmingham.—Extensions.—The Tramways Committee has received authority to promote a Bill for the extension of the tramways from Selly Oak to Longbridge, and from Gravelly Hill to Erdington.

Bolton.—Track Renewals.—The Tramways Committee has authorised the relaying of the track on the Daubhill route, and the purchase of the requisite rails, points and crossings for the work.

Bradford.—New Tramcars.—The Tramways Committee has been empowered to place an order forthwith for the supply of 26 tramcars and 52 sets of motors.

Railless Cars.—The Tramways Committee has approved of separate services of railless cars being run between Bolton Woods and Frizinghall, and of the overhead wires in Canal Road being doubled, at an estimated cost of £250.

Alderman Enoch Priestley, chairman of the Tramways Committee, has been elected a member of the Town Planning Sub-Committee, because of the importance which is attached to the proper and adequate provision of tramways in the new areas when they are planned out.

Burnley.—Whitley Committee.—The principle of a Joint Works Committee, on the lines of the Whitley Report, has been accepted at Burnley. The new body will consist of five members of the Tramways Committee and five representatives of the Tramway and Vehicle Workers' Union; before its decisions become operative they must be approved by both the Committee and the Union.

Bury.—Extensions.—The T.C. proposes to reconstruct two tramway routes and to purchase 13 new tramcars, at a total cost of £139,200.

Canada.—Toronto.—"P.A.Y.E." Cars.—The "pay-as-you-enter" tramcars have been placed on several sections of the Toronto Street Railway.

Continental.—Belgium.—The Brussels tramway service was resumed on February 1st, following the settlement of the strike.

France.—The Compagnie des Chemins de Fer d'Orleans has applied for the reservation of most of the water power of the River Dordogne, in view of the construction of the Bordeaux to Geneva line.

Spain.—The municipality of Valencia has taken over the control of the tramways to put an end to the strike, and troops are running the services.

Doncaster.—Proposed Extension.—After members of the Tramways Committee had visited the proposed new tramway route to Rossington, the engineer was requested to report on an alternative route.

Dover.—Extension of Time.—The B. of T. has granted an extension of time for the construction of the light railway from Dover to St. Margaret's and Martin Mill.

Hull.—Extensions.—The Corporation has decided to extend the tramway routes to Newland Park and Lee's Homes, and along Waterworth Street. It has also decided to apply for powers to extend the tramways to various places within a five-mile radius. The Tramways Committee is inquiring into the practicability of constructing a tramway along the Humber side.

Liverpool.—New Plant.—It is proposed to spend half a million on new plant for the improvement of the tramway service and the purchase of motor-'buses.

The T.C. has agreed to the recommendation of the Tramways and Electricity Committee that application be made to the L.G.B. for sanction to borrow £200,000 for generating plant and £190,000 for electric mains.

Rate Relief.—The T.C. proposes this year to appropriate for the relief of the rates, £140,000 from the surplus of the tramways department, against £125,000 last year, and £50,000 from the electricity department, against £65,000.

London.—New Junctions.—The L.C.C. Highways Committee has recommended the construction of junctions on the tramway system at Stockwell and Tooting, at a cost of £6,945.

Proposed Omnibus Services.—The Committee has also recommended the Council to consider the provision of omnibus services to connect up the tramway system.

Depôt Equipment.—The Committee has sanctioned the expenditure of a sum not exceeding £700 for the erection of overhead equipment at the Evelyn Street Depôt.

Underground Railway Strike.—At a meeting between the Railway Executive Committee, representatives of the men's Union, and the President of the Board of Trade on Thursday, last week, it was agreed that, pending further negotiations on the 12th inst., the men should return to work on the understanding that they should be booked on for eight hours' work, exclusive of meal times, but that all reasonable facilities to meet the needs of the men would be afforded by the companies. This officially terminated the strike, but the N.U.R. introduced further complications, and it was Sunday afternoon before a restricted service was commenced; and on Monday it was still not normal. Owing to the prolonged frost, it took 16 hours to raise sufficient steam at the Lots Road generating station, and several hours were occupied in thawing out brake blocks on the trains; in places the points on the track were also frozen.

District Railway Accidents.—Two accidents on the District Railway caused inconvenience on Monday. In the early evening a train going east stopped in the tunnel between Aldgate East and St. Mary's (Whitechapel) Stations. Traffic was stopped on the line for some hours. Later in the evening a train going westward was derailed at almost the same spot. At 10 o'clock both lines were blocked. The first accident is said to have been caused by a live rail defect and the second by a broken carriage axle.

Maidstone.—Proposed Extension.—The T.C. has engaged Mr. C. C. Hawtayne as consulting engineer, with reference to the proposed extension of the tramways to the North Ward and to Chatham, at an estimated cost of £200,000.

Manchester.—Proposed Tube Railways.—A private meeting of business men was held on February 8th to revive the project for constructing tube railways in Manchester. The scheme was favourably considered, and substantial financial support was promised.

Northampton.—Frozen pipes at the Corporation electricity works are said to have delayed the running of the tramways on Monday morning.

Romney Marsh.—Proposed Light Railways.—A conference of local bodies is to be held at Ashford (Kent) on March 11th, to consider the construction of light railways from Ashford to New Romney, *via* Bilsington and Newchurch, and from New Romney to Hythe.

St. Helens.—Municipal Purchase.—The negotiations between the T.C. and the Tramways Co., for the purchase of the system by the Council, have been settled in principle, but the questions of track repairs and the disposal of the tramcars have not yet been decided.

Stockton.—Tramway Bills.—The R.D.C. has decided to oppose the tramway bills of the Stockton and Middlesbrough Corporations, so far as they affect the Council's area.

United States.—Tramcar Robberies.—An up-to-date highwayman has been terrorising the inhabitants of Brooklyn, New York, by boarding tramcars in lonely districts and holding-up the occupants with a revolver. After robbing the driver, conductor, and passengers, the man escapes on a motor-car, which has been following the tramcar. So far, three cars have been held up in this manner, without any clue being obtained by the police.—*Daily Telegraph.*

Warrington.—Track Reconstruction.—The Tramways Committee proposes to convert the present single line on the Sankey and Cemetery routes into a double track.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—The Eastern Telegraph Co. states that, owing to cable interruptions and the very heavy increase in traffic, abnormal delay is at present unavoidable. Before the outbreak of war there were nine lines of communication between the United Kingdom and India, the Far East, &c., six by the Eastern Co., two *via* the Indo-European Co., and one by the Great Northern Co. The two latter companies carried a large amount of the Indian and Far East traffic, but these lines, which passed through Germany and Russia, have been interrupted since August, 1914, and all the traffic has been thrown on to the Eastern route. Of the six Eastern Co.'s cables from Porthcurnow, Cornwall, two are at present interrupted, and while everything possible is being done to effect repairs, the weather for more than two months has rendered it difficult for the cable ships to work; the cable ships are standing by the breaks awaiting favourable conditions. The traffic on the Eastern Co.'s lines, compared with 1913, has increased by 150 per cent., chiefly accounted for by Government telegrams, which have to be transmitted in priority to all other traffic, and by the increase in the average number of words in commercial messages, *i.e.*, from 12 in 1913 to 21 in 1918. Since the Armistice the Government traffic has still further increased, and now practically occupies the total capacity of one-and-a-half cables.—*Daily Telegraph.*

New Wireless Service.—A direct wireless service is shortly to be established between the American Mission in Vienna and Paris.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices," Jan. 31st.

Melbourne.—March 4th. Deputy Postmaster-General. Cables (schedule No. 1,504).*

March 10th. City Council. One 5,000-kw. frequency changer, high-tension switchgear. Specification (£1 1s.) from City Electrical Engineer.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Aylesbury.—Corporation Electricity Department. One 1,000-kw. generating set complete; two 500-kw. rotary converters. See "Official Notices" to-day.

Belfast.—February 15th. Tramways Committee. Tramway stores (including several electrical items). See "Official Notices" January 31st.

February 24th. Electricity Department. Electric and hand cranes, pumps and tanks. See "Official Notices" January 17th.

Birmingham.—March 5th. Tramways Committee. Additional rolling stock. See "Official Notices" February 7th.

Dundee.—February 14th. Corporation. Electric power installation at Corporation yard, East Dock Street. Specification from Mr. J. Thomson, city architect, 91, Commercial Street.

February 24th. Tramways Committee. Stores for one year, including several electrical items. Town Clerk.

King's Lynn.—March 3rd. Corporation. One 1,000-kw. turbo-alternator, one 400-kw. rotary converter or motor-generator, and one 400-kw. transformer and switchgear. See "Official Notices" February 7th.

Lincoln.—March 5th. Corporation. Four water-tube boilers with stokers, &c., complete; two 3,000-kw. turbo-alternators with condensers, &c.; extension of E.H.T. switchboard, &c.; two 750-kw. rotary converters, &c.; two 2,000-k.v.a. three-phase transformers, &c. Specifications from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices" Feb. 7th.

London.—Stepney.—February 20th. Electricity Supply Committee. Two water-tube boilers, with chimneys; economisers, flues, &c. See "Official Notices" February 7th.

Hammersmith.—The Electricity Committee recommends that tenders be invited for 6 or 12 months' supply of stores including electric light sundries, insulated wire, jointing materials, joint boxes and connections, &c.

Manchester.—February 17th. Tramways Committee. Electric tramcar bodies. Specifications, &c., from Mr. J. M. McElroy, general manager.

Mansfield.—Corporation Electricity Committee. 1,250-1,500-kw. turbo-alternator, condensing plant, 500-kw. rotary converter, transformer, and switchgear. See "Official Notices" to-day.

New Ross (Co. Wexford).—February 20th. Gas and Electricity Supply Co., Ltd. Suction-gas plant and dynamos, storage battery, main switchboard, overhead lines and street lamps. See "Official Notices" January 24th.

Portsmouth.—March 4th. Tramways Committee. Tramway stores for six months. See "Official Notices" to-day.

Rhondda.—March 5th. U.D.C. Electricity Department. Twelve months' supply A.C. meters, cable, joint boxes, compound cut-outs, &c. See "Official Notices" to-day.

Taunton.—Electricity Department. One 500-kw. steam turbine generator, travelling crane, cables and meters. See "Official Notices" to-day.

Tuamgraney, Scariff (Co. Clare).—February 15th. Messrs. Lysaghts. One hydraulic turbine, dynamo, pipe line, electric motors and wiring. Specifications from Mr. L. J. Lawless, Rathmines, Dublin. See "Official Notices" January 31st.

CLOSED.

Batley.—T.C. Three electric motors and fittings at the sewage works. Messrs. Ward & Co.

Bradford.—Electricity Committee. Accepted:—

Five-ton hand-operated travelling crane.—Herbert Morris, Ltd.

Tramway Committee:—

One 9½-in. centre lathe, £310.—Ward, Haggas & Smith.
Emery wheels, £52 10s.—Robson & Co., Ltd.
Point fittings, £40.—Hadfields, Ltd.
Point springs, £6 15s.—Edgar Allen & Co., Ltd.

Sheffield.—Tramways Committee. Recommended:—

50 double-decked top-covered vestibuled tramcar bodies and trucks, £102,500, plus 5 per cent. for contingencies.—Brush Electrical Engineering Co., Ltd.

Walsall.—Electricity Committee. Accepted:—

New traction rotary, £3,439.—British Thomson-Houston Co., Ltd.

FORTHCOMING EVENTS.

Electro-Harmonic Society.—Friday, February 14th. At 7.30 p.m. At the Holborn Restaurant (Venetian Chamber). Ladies' night.

Physical Society of London. Friday, February 14th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Annual general meeting.

Royal Society of Arts.—Monday, February 17th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture "Scientific Problems of Electric Wave Telegraphy," by Dr. J. A. Fleming, F.R.S.

Wednesday, February 19th. At 4.30 p.m. At John Street, Adelphi. Paper on "The Use of Electricity in Agriculture in Germany," by Dr. J. F. Crowley.

Junior Institution of Engineers (N.E. Section).—Tuesday, February 18th. At the Mining Institute, Newcastle. At 7.15 p.m. Paper on "High-tension Transmission Lines, Overhead and Underground," by Mr. G. S. Lisle.

Industrial and Reconstruction Council.—Wednesday, February 19th. At the Saddlers' Hall, Cheapside, E.C. At 4.30 p.m. Lecture on "The Responsibility of Trade Unions in Relation to Industry," by the Rt. Hon. J. R. Clynes, M.P.

Liverpool Engineering Society.—Wednesday, February 19th. At the Royal Institution, Colquitt Street. At 8 p.m. Paper on "Boiler Mountings," by Mr. J. Purves.

Chemical Society.—Thursday, February 20th. At 8 p.m. At Burlington House, Piccadilly, W. Ordinary Scientific meeting.

Institution of Electrical Engineers.—Thursday, February 20th. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Lecture on "Dielectrics in Electric Fields," by Mr. G. L. Addenbrooke.

Belfast Association of Engineers.—Thursday, February 20th. At 7.45 p.m. At the Municipal Institute. Paper on "Strength and Stiffness of Flat Plates," by Prof. F. H. Hummel.

Institution of Mechanical Engineers.—Friday, February 21st. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting. Adjourned discussion on "Electric and Oxy-Acetylene Welding."

Manchester Association of Engineers.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Paper on "Hardness Determination of Metals," by Prof. C. A. Edwards.

Birmingham and District Electric Club.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Annual dinner and concert.

Greenock Association of Electrical Engineers.—Saturday, February 22nd, Visit to Brown & Polson's Corn Flour Works, Paisley.

NOTES.

Ministry of Commerce.—The *Daily News* Lobby correspondent states that the Ministry of Commerce will be the name given to the Board of Trade after the Railway Department has been transferred to the new Ministry of Ways and Communications (Transport). The Commerce Ministry, after this change, will be concentrated on commerce and industry, and steps will be taken to link it up with bodies representative of commercial interests.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following is the official programme of papers for the second half of the session 1918-19 :—

February 13th.—Lieut.-Colonel W. A. J. O'Meara, "The Functions of the Engineer: his Education and Training."
February 20th.—G. L. Addenbrooke, lecture on "Dielectrics in Electric Fields."
February 27th.—Paper or papers on "The Co-ordination of Research in Works and Laboratories."
March 6th and 13th.—G. L. Addenbrooke, lectures on "Dielectrics in Electric Fields."
March 20th. Discussion on Mr. Addenbrooke's Lectures.
March 21st.—At 8 p.m. Joint meeting and discussion with the Royal Society of Medicine (Electrical Section), at 1, Wimpole Street, W. Papers by Mr. R. S. Whipple on "Some Notes on Electrical Methods of Measuring Body Temperatures," and "Some Notes on the Electro-Cardiograph."
March 27th. Dr. S. F. Barclay and Dr. S. P. Smith, "The Determination of the Efficiency of the Turbo-Alternator."

Other arrangements for the remainder of the session (details of which will be announced later) include the following :—

Lecture by Dr. C. Chree on "Magnetic Storms."
Joint meeting and discussion with the Iron and Steel Institute; papers on "Electric Furnaces."
Mr. S. Chapman, "Electrical Phenomena Occurring in High Atmospheric Levels."

On February 20th and March 6th and 13th, Mr. G. L. Addenbrooke will give a series of lectures on "Dielectrics in Electric Fields," in the course of which he will show that there is not much probability of our obtaining insulating materials of lower capacity; the important influence exerted by moisture on the losses in dielectrics, and on the effects of temperature changes, will be dealt with in considerable detail.

Society of Arts. Dr. J. A. Fleming delivered the first of three Cantor Lectures on "Scientific Problems of Electric Wave Telegraphy," in the theatre of the Society, on Monday. After calling attention to the great advance in Hertzian wave telegraphy, he described the characteristics and rate of travel of waves in various mediums. Among the pictures illustrating wireless telegraphy shown on the screen were some of the station at Nauen, near Potsdam. At Tuckerton, in America, the station had been in German hands, and some of the best German operators had been employed there to carry out a cunning fraud by which messages were handed in of so apparently harmless a nature that they passed the censor, their significance being imparted to the enemy by the ingenuity of the operator in superimposing a code word. But the trick was detected, and the station was taken under American control.

Volunteer Notes.—Royal Engineers Volunteers, London Army Troops Companies.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 7, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Wednesday, February 19th.—Drill and Military Engineering, 1830, for the whole Corps.
Friday, February 21st.—Range, 1830.

C. Higgins, Captain, R.E., *Adjutant.*

County of London Royal Engineers (V.) Signal Units.—On Saturday evening last, at the Dean Hotel, Oxford Street, a Corps dinner was held, followed by a concert. Major H. C. Gunton, Officer Commanding, presided, and there was a large attendance, including many officers and friends of the Corps. After the toast of "The King," proposed from the chair, Regimental Sergeant-Major Stone, R.E., proposed "The Visitors" in a neat speech, and Mr. W. Noble (Assistant Engineer-in-Chief, G.P.O.), responded, recalling the days when he was himself a sub-commandant of the Corps. The toast of "The Corps" was proposed by Major Preston, who referred to the excellent work that the Corps had done in training members of other Volunteer Corps, and to the important duties which had been assigned to it on the lines of communication. Responding, Major Gunton reviewed the history of the Corps since its formation on the outbreak of war, when Major Preston was the first adjutant, and made special mention of the valuable assistance afforded by Mr. Brown as technical adviser, Mr. Parsons as transport officer, and Major Purvis, as well as many other former officers and friends. An excellent programme was provided, including an amusing topical song by Capt. Wells, R.E. (V.), and the function was thoroughly enjoyed.

Concert.—The Bradford tramway men's annual concert took place last week in the St. George's Hall.

Breaking Lamp Globes.—Two boys were fined 20s. and 30s. respectively at Wallasey, last week, for breaking electric globes on the promenade.

Fatalities.—Mr. James Patterson, of Blackpool, aged 23, in the employ of Messrs. Jones Bros., electrical engineers, Blackpool, has died as the result of a fall whilst engaged in erecting electrical machinery at the Calder and Mersey Extract Works, Ditton.

Industrial Training.—The Minister of Labour has issued a statement to the effect that in view of the importance of providing industrial training such as is required by large numbers of the demobilised members of H.M. Forces and civilian war workers who are being set free from their war occupations, the Government has decided to set up a special Department of the Ministry of Labour to deal entirely with questions of industrial training. The Minister has appointed Mr. James Currie, C.M.G. formerly Director of the Munitions Training Section of the Labour Supply Department of the Ministry of Munitions, Controller of the new Department.

This Department will not only administer various schemes for the vocational training of discharged soldiers and sailors, of civil war workers of either sex, and of women who are being discharged from the various auxiliary corps, but will, in due course, take over from the Ministry of Pensions the training of disabled men, with the exception of those who require medical supervision or training of a curative nature.

Further, the new Department will lay down the general lines upon which the training of serving soldiers and of men in hospital will be carried on.

Representatives of the Trade Unions and employers will be consulted in regard to the proposed systems of training, so as to receive their advice and co-operation in the work of the Department. Arrangements are also being made to ensure the interest of local authorities in all training work.

Welcome Home! in the United States.—The Society for Electrical Development and other American organisations are co-operating to give an electrifying welcome to all who have been with the Colours; electricity has become the generally accepted and employed medium for expressing the welcome that all feel in their hearts, and the flooding of streets and shop windows with light without stint is having a salutary effect upon the spirits of all. Many of the signs and devices which are being employed are of a character to ensure their permanency for a long time to come. On the front of the Rivoli Theatre in New York City, for instance, there is a cluster of myriad lamps so grouped as to flash out the Allied emblems in all their glorious colours, over which is the American eagle guarding a shield. On the Union League Club there is a great electric sign which blazes forth this message :—"Welcome Home to the Boys from Over There."

Some idea of the scale on which the plan of welcoming the boys home electrically is being carried out, can be had from these facts regarding the equipment that is being installed for the *New York Times* building, which consists of over 5,000 10-watt lamps, distributed as follows :—The entire building will be outlined with 300 2-ft. stars, each star containing 11 lamps, alternating red, white, and blue on a flasher. On the 43rd Street side, facing Times Square, will be a cluster of Allied flags, surmounted by a spread-eagle holding the American shield. This display utilises 1,000 lamps, and will measure 40 ft. wide by 24 ft. high. The flags will have a waving effect, and over this will be an electric sign reading "VICTORY." in 6-ft. letters. At each of the four entrances of the building will be a pair of crossed American flags waving; these will contain 250 lights each. On the roof will be four flash-lights illuminating the American flag flying from the flag staff.

Individual dealers who have neither the facilities nor the means to make a big display, have utilised their windows as the basis for their share in the generally expressed welcome.

Appointments Vacant.—Lecturer in electrical engineering (£300) for the University College, Nottingham; foreman jointer for the Mexborough U.D.C. electricity department. See our advertisement pages to-day.

Strikes in London.—In our last issue we carried the history of the strikes up to Wednesday; the Government had issued a regulation making interference with the public supply of electricity a penal offence, and on Wednesday the executive of the E.T.U. met to consider the position, but refused to make any public statement. Transport of some 40,000 persons was provided by means of motor cars and lorries, and preparations had been made to keep trains running on the main-line railways in the event of a national strike being declared.

On Thursday, goods drivers on the Brighton system were called out by the secretary of the Locomotive Engineers' and Firemen's Union, after he had obtained interviews with Sir Albert Stanley and Sir Robert Horne by threatening to call a national strike. On Thursday night the tube strike was settled, so far as this union was concerned, but the resumption of traffic was delayed, and on Friday afternoon the National Union of Railwaymen, which had originally denounced the strike, recognised it as official; as many of the employés at Lot's Road power station belonged to the N.U.R., the result was that the tube service was not resumed.

On Thursday evening the electrical strike should have commenced, but, while a number of men ceased work, those connected with the supply of electricity remained at their posts, with few exceptions. The E.T.U. leaders announced that the real strike would begin at Friday midnight, but on Friday the strike was declared "off," pending consideration by the national executive at Manchester on Sunday.

On Friday evening a lengthy meeting was held at the offices of the Electrical Trades Union, and the following statement was subsequently issued :—

That owing to a special extraordinary meeting of the Executive Council having been convened to sit on Sunday next to consider the question of national action to secure a 40-hour week, and, further, owing to the extraordinary change in the attitude of the Government in first refusing to intervene, and then intervening to safeguard the interests of the capitalists by suspending the civil rights of trade union members, we order an immediate resumption of work pending national action.

We further state that this instruction in no way affects the position of the men on strike in the Port of London.

In the small hours of Saturday morning an agreement was reached between the N.U.R. and the railway management, and the railway strike closed; but for some reason which was not disclosed, though a variety of obviously inadequate explanations was issued, the Lot's Road station was unable to give an adequate supply of electricity for the service of the tube railways until Sunday afternoon. On Wednesday this week the conference between the railway unions and the Government was to take place.

It is interesting to record, in addition to the resolution of the Electrical Power Engineers' Association to maintain the public supply of electricity with the aid of voluntary labour, that the National Association of Supervising Electricians offered its services to the Government. On Thursday afternoon the offer was accepted, and on Friday, at two hours' notice, a large number of the members assembled in readiness to take duty in the power stations. Fortunately, the strike did not mature. The Association of Engineers-in-Charge on Saturday passed the following resolution unanimously: "That this meeting of skilled plant engineers place their services at the disposal of the Government to further secure the continuity of the electrical supply of London, and, further, that they condemn the unlawful action of a section of a trade union in inciting the honest members of the union to break the law, and to cause discomfort to the population of the Metropolis by attempting arrogantly to dictate to the Government."

Electricians employed by private firms, who went on strike on Thursday evening, presented themselves for work on Saturday morning, but in many cases found the shops closed till Monday.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Burton-on-Trent Electricity Committee has increased the engineers' wages at the Corporation electricity works as follows:—Mr. C. J. Melbourne, £19 per annum, making total salary and wages £330; Mr. S. Mellor, £16, total £246; Mr. G. A. Vowles, £18, total £246, and Mr. A. Wakefield, £18, total £246.

Tho salary of Mr. S. D. Jones, electrical engineer to the Batley Corporation is to be advanced by £25 per annum.

Dewsbury Corporation has deferred for a month consideration of the applications for increases of salary to Mr. R. H. Campion, the Corporation electrical engineer, and Mr. R. W. Grubb, the assistant engineer.

Walsall Electricity Committee recommends that the salary of the engineer and manager of the electric supply department be increased from £500 per annum to £650 per annum.

Mr. E. G. Baker, chief assistant engineer to the Morecambe Corporation, is now sufficiently recovered from his wounds received at Ypres in 1917, to enabel him to recommence his duties at Morecambe, and hopes to be back there in a few days.

Canterbury Town Council has advanced the salary of the city electrical engineer, Mr. Blascheck, by £67 a year.

On February 6th, Mr. E. W. Bailey, of the Poplar electricity department staff, was presented with a clock and bronze set by the staff and workmen of the Council on the occasion of his marriage. The Town Clerk presided, and the presentation was made by Mr. J. Horace Bowden, the borough electrical engineer. Among those present were Messrs. Tait, Cruickshank, Ingram, and the available staff and workmen of the electricity works.

Wolverhampton Corporation has fixed the salary of Mr. O. Thomas Silvers, the tramways manager, at £600 a year.

Wolverhampton Corporation Electricity Committee proposes to appoint Mr. T. A. G. Margary distribution superintendent at the electricity works, at £300 per annum (without bonus) to fill the vacancy caused by the resignation of Mr. T. Smith.

Dublin Corporation Electricity Supply Committee has appointed Mr. J. L. Kettle, deputy city electrical engineer, to the chief engineership, in place of Mr. Mark Ruddle, resigned, for a term of six months, at £750 a year and war bonuses about £250.

There was strong opposition at Salford Town Council last week, when it was proposed to increase the salary of the tramway manager from £700 to £750 a year. Cr. Steele said that when only two-thirds of the service was running it was not the time to advance salaries. Ald. Linsley, Chairman of the Tramways Committee, said they had every confidence in the general manager, who was one of the most capable managers in the United Kingdom. The amendment was defeated by 30 votes to 14.

Mr. R. W. L. Phillips has resumed the duties of borough electrical engineer at Bedford after 14 months' service in the Royal Air Force, and all communications for the electricity department should be addressed to him.

Mr. J. E. Edmundson, A.M.I.E.E., who for the last 13 years has acted as engineer and manager to the Urban Electric Supply Co., Grantham and Stamford, has been appointed engineer and manager at the Hawick branch of the same company. He is to be succeeded by Capt. F. H. Brandreth, A.M.I.E.E., who for the last seven years has been resident engineer to the same company at Stamford.

Mr. W. F. Andrews, on his release from the Army, has resumed his duties as draughtsman and mains assistant to the Stepney Borough Council. He joined the London Electrical Engineers, R.E. (T.) at the commencement of the war, and later was appointed staff sergeant to a R.G.A. anti-aircraft company on the London barrage.

Mr. W. Sanderson, who has been appointed superintendent at the Fochabers generating station, was the recipient of an illuminated address recording the high esteem in which he was held in the district, where he has successfully carried through the new scheme of public lighting, and a cheque for £26, from the residents of Uphall, West Lothian, on the occasion of his resignation of his position as engineer to the Uphall special lighting district.

Mr. F. Smith, chief electrician to the Pinxton Colliery Co., has been presented with an eight-day marble and bronze timepiece, with bronzes to match, from the officials and workmen of the company, on the occasion of his recent marriage. Mrs. Smith was also presented with a case containing a solid silver sugar basin, cream jug, and tongs.

Leek T.C. has increased the salary of Mr. F. Swarbrick, engineer and manager of the electricity department, to £350 per annum.

General.—After three years' service at Woolwich as the inspector of empty fuses, controlling a staff of 50 officers and over 12,000 examiners, Mr. Francis R. Wade, O.B.E., has returned to his practice as consulting engineer at Birmingham and the Inner Temple, London.

Mr. S. Evans, who has been demobilised after serving with the London Electrical Engineers since 1916, has returned to Messrs. D. Hulett & Co., Ltd., of High Holborn, W.C. 1, as assistant manager to the company, and as manager of the electrical department.

The many friends of Mr. W. R. Rawlings will be glad to learn that having safely undergone a serious operation, he is now recuperating at Bournemouth.

Mr. C. J. Margerison, manager of the electrical department of Messrs. W. Geipel & Co. for the past ten years, has resigned his position, and joined Messrs. F. J. Shenton and Co., Ltd., electrical engineers, of New Cross, S.E.

Mr. C. F. Spencer, Director-General of the National Kitchens Division of the Ministry of Food, is resigning his position, in order to be able to devote closer attention to his own business.

Mr. H. A. McGuffie (of Messrs. Stevenson & McGuffie, Glasgow), who has been seriously ill since the end of December, expects to return to business about the end of this month.

Mr. A. Blondel has been appointed an Officer of the Legion of Honour.

Mr. G. H. Nash, C.B.E., M.I.E.E., has terminated his war appointment of hon. technical adviser to the Admiralty experimental station, Portland, and has resumed his position as chief engineer of the Western Electric Co., Ltd.

Congratulations to Sir William Slingo, engineer-in-chief to the G.P.O., who has been created a Chevalier of the Order of Leopold by the King of the Belgians.

The King of the Belgians has conferred the Order of Leopold II. upon Mr. F. W. Emett, head of Reuter's intelligence branch in London, in recognition of help given to Belgium during the war.

Mr. L. B. Beale has been appointed H.M. Trade Commissioner at Winnipeg. He is at the Department of Overseas Trade in London until towards the end of February.

The *Times* states that Mr. W. Noble, assistant engineer-in-chief, G.P.O., has received from the King of the Belgians the decoration of Chevalier de l'Ordre de la Couronne.

Belfast Electricity Committee has appointed Sir James Johnston chairman and Councillor Reddell vice-chairman

Mr. H. G. W. Haslett, late of Messrs. Haylock & Haslett, has now returned from active service in France. His temporary address is 93-94, Chancery Lane, W.C.

Mr. G. Duncan Dewar, B.Sc., A.R.T.C., has accepted an appointment as manager of the electrical department of Messrs. James Pitkin & Co., Ltd., engineers and instrument makers, of 28, Hatton Garden, and Willesden, N.W. During the past three years Mr. Dewar has been an officer on H.M.S. *Vernon* and in H.M. Signal School, R.N. Barracks, Portsmouth, being engaged during his service with the Admiralty in the design and development of wireless telegraph apparatus for use in the naval service. Previously Mr. Dewar was a designer with the Lancashire Dynamo and Motor Co., Ltd. He will now devote particular attention to the development of Messrs. Pitkin's electrical branch.

Amongst the many employés of Messrs. C. A. Vandervell and Co. who have now returned to the firm to take up their old jobs is Lieut. Ernest Leighton, of the Royal Air Force, who joined the Army in 1914. Lieut. Leighton takes up his old position as manager of the installation department.

Mr. C. Jones, M.I.E.E., &c., chief electrical engineer, Cannock Chase Collieries, and consulting engineer to other concerns, has recently been appointed chief mechanical and electrical engineer to the Cannock Chase Colliery Co., Ltd.

Roll of Honour.—The Meritorious Service Medal has been awarded to First-Class Air-Mechanic H. Holmes, who already holds the Military Medal and the Mons Star. He was formerly employed at the Warrington Corporation electricity works.

The following is an extract from the *London Gazette* for November 18th, 1918:—

"Reward for service in the field in connection with military operations in East Africa, to be dated June 3rd, 1918. To be a Member of the Most Excellent Order of the British Empire, Fuge, Capt. W. V. G., R.G.A. (Wireless Signal Service)."

Private P. Coleman, 1/8th Manchester Regt., who died of pneumonia on February 3rd, was employed by Messrs. Charles Macintosh & Co., Ltd.

Private H. Taylor, 37th Labour Battalion, who has died in hospital at Valenciennes from influenza, was employed by the St. Helens Cable & Rubber Co., Warrington.

Lance-Corporal J. A. Barlow, M.G. Corps, previously an employé of the Stepney Borough Council electricity undertaking, has been awarded a bar to the Military Medal.

Second Lieutenant W. R. Baird, R.F.A. (Glasgow), who has been mentioned in dispatches, was engaged with the Clyde Valley Electrical Power Co.

Corporal R. Wylie Farr, 1/5th Argyle and Sutherland Highlanders, who was wounded at Menin October 28th, 1918, has been awarded the Croix de Guerre with bronze star from the French Government, also the Military Medal. He is an employé of the Clyde Valley Electrical Power Co. (meter survey department).

The death is reported of Major D. F. Colson, D.S.O., R.E., son of the late Mr. Alfred Colson (for many years head of the gas and electric department of the Leicester Corporation). He volunteered for service in the Boar War, in which he served as an electrical engineer, and was taken prisoner. On returning home he took a great interest in the Electrical Engineers' Volunteer Corps, and it was in connection with this body that he joined up when war broke out in 1914. For the past two and a half years Major Colson has seen service in Palestine, where he was in charge of the water supply. He was afterwards engaged in work in Alexandria. He was expected home on leave a few days ago. While on his way home he received orders to proceed with the building of a railway to Constantinople. He contracted pneumonia, and died on 3rd inst. Major Colson was about 40 years of age.

Obituary.—Mr. W. Cordrey.—We regret to announce the death of Mr. William Cordrey, of 5, St. Mildred's Road, Lee, Kent, on January 28th, at the age of 58 years. Mr. Cordrey was a governing director of Messrs. W. H. Willcox and Co., Ltd., and a partner with Mr. W. H. Willcox in the original business. The funeral took place on February 3rd, at Lee Cemetery.

Prof. G. Carey Foster, F.R.S.—We regret to record the death, which occurred at Rickmansworth, on Sunday last, of Professor George Carey Foster, F.R.S., J.P., in his 84th year. Prof. Foster became Professor of Physics at University College, London, in 1865, and he held that appointment until 1898, when he became Principal. He retired from that position in 1904. He was one of the founders and presidents of the Physical Society of London, and for several years was general treasurer of the British Association for the Advancement of Science.

NEW COMPANIES REGISTERED.

William Beal & Co. (1919), Ltd. (152,855).—Private company. Registered January 29th. Capital, £6,000 in £1 shares. To acquire the business of dealers in gas and electrical fittings carried on at 2, Hill Street, Birmingham, by Wm. Beal & Co., Ltd. The subscribers (each with one share) are:—A Pritchett, Eagle House, King's Norton, Birmingham, managing director; W. B. Pritchett, Eagle House, King's Norton, Birmingham, bank clerk. The first directors are: A. Pritchett (chairman), W. B. Pritchett, and A. B. Pritchett. Registered office: 2, Hill Street, Birmingham.

W. J. Furze & Co. (Manchester), Ltd. (152,958).—Private company. Registered February 4th. Capital, £10,000 in £1 shares (9,900 ord. and 100 founders). Electrical engineers and contractors, suppliers of electricity, carriers, manufacturers of electric railway, tramway, and other apparatus, &c. The subscribers (each with one share) are:—W. J. Furze & Co., Ltd., Traffic Street, Nottingham; W. F. Furze, Holm View, Victoria Embankment, Nottingham, electrical engineer; C. J. Fox, Elmsthorpe, Maple Grove, Prestwich, near Manchester, electrical engineer. First directors: W. F. Furze and C. J. Fox.

Arthur Maxwell, Ltd. (152,903).—Private company. Registered February 1st. Capital, £100 in £1 shares. Electrical contractors and engineers, fitters, motor-car dealers and makers, &c. The subscribers (each with 50 shares) are:—J. Leitch, 6, Exeter Mansions, N.W. 2; Mrs. S. M. Maxwell, 2, Fairhazel Gardens, Hampstead, N.W. First directors: Mrs. S. M. Maxwell and J. Leitch. Registered office: 2, Fairhazel Gardens, Hampstead, N.W.

British Electron, Ltd. (158,030).—Private company. Registered February 5th. Capital £60,000 in £1 shares. To take over the business of the British Electron Co., Ltd., and to carry on the business of manufacturers of hydraulically compressed iron and steel billets and tin ingots, metal refiners, de-tinners, smelters, engineers, importers and exporters of and dealers in metals, metal scrap, ores, and ferrous or non-ferrous substances, metallurgists, &c. The subscribers (each with one share) are:—H. D. Ashworth, Old Alley, Ellesmere Park, Eccles, metal refiner, D. Davies, Avondale, Ellesmere Park, Eccles, colliery director; A. Keating, 51, Stockport Road, Manchester, metal merchant; C. S. Adams, 127, Queen's Road, Cheetham, Manchester, metal refiner. The first directors are:—H. D. Ashworth, D. Davies, A. Keating, C. R. Adams, J. W. Binns, G. A. Bower, and E. Brierley. Solicitor: F. E. Osborne, 30, St. Ann Street, Manchester.

Northern Electric Wire Co., Ltd. (152,976).—Private company. Registered February 5th. Capital, £15,000 in £1 shares. To take over the business carried on at Sedburgh Mills, Halifax, as the Northern Electric Wire Co. The subscribers (each with one share) are:—J. Tetlow, The Royas, Cleckheaton, card manufacturer; J. P. Horley, The Hollies, Cleckheaton, card maker; E. Ellison Braemar, Cleckheaton, tar distiller; F. Walker Wynngrove, Cleckheaton, wire manufacturer. Subscribers appoint the directors. Registered office: Sedburgh Mills, Halifax.

Radi-Arc Electric Welding Co., Ltd. (152,977).—Private company. Registered February 5th. Capital, £200 in 1s. shares. To carry on oxy-acetylene, electrical, or other welding and re-welding in connection with machinery, apparatus, railway, motor, shipping, aircraft, and other appliances, or otherwise, &c. The subscribers (each with one share) are:—S. Miles, 30, Craven Park, N.W. 10, clerk; Vera M. Huthwaite, 270, Southampton Street, S.E. 15, shorthand typist; Caroline Miles, 30, Craven Park, N.W. 10, clerk. First directors not named. Registered office: Regency Huuse, 1, Warwick Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Commercial Telephone & Electrical Co., Ltd. (152,988).—Private company. Registered February 6th. Capital, £2,000 in £1 shares. As title. First directors: F. Gardner, 176, Hyderthorpe Road, Clapham Park, S.W.; A. H. Marshall, 43, Courtland Avenue, Ilford, Essex. Registered office: 16, Fenchurch Street, E.C.

Harry W. Cox & Co., Ltd.—Issue on January 22nd, 1919, of £500 debentures, part of a series already registered.

Bourne Valley Manufacturing Co., Ltd.—Debenture dated January 20th, 1919, to secure £1,395, charged subject to prior mortgage on property at Boscombe and the company's general assets. Holders: Cox & Co., 16, Charing Cross

Burmah Electric Tramways & Lighting Co., Ltd. (75,090).—Capital, £200,000 in £5 shares (20,000 pref. and 20,000 ord.). Return dated January 14th, 1919. All shares taken up. £10,000 paid on the pref.; £100,000 considered as paid on the ord. Mortgages and charges: Nil.

Caerphilly Electric Supply Co., Ltd. (139,086).—Capital, £6,000 in 400 cum. pref. shares of £5 each, 1,500 pref. ord. shares of £1 each, and 2,500 ord. shares of £1 each. Return dated December 31st, 1918. 100 ord. shares taken up. Mortgages and charges: Nil. (To date of return, company had not commenced trading.)

CITY NOTES.

London Electric Railway Dividends.

Metropolitan District Railway Co.—Dividends on the 4 per cent. guaranteed stock for the last half-year 2 per cent., making 4 per cent. for the year; on the 4½ per cent. first preference 2¼ per cent., making 4½ per cent.; on the 5 per cent. second preference stock 3½ per cent., making 5 per cent. for the year, carrying forward £21,331.

Underground Electric Railway Co.—The full interest to December 31st on the 6 per cent. first cumulative income debenture stock is to be paid, and the full interest of 3 per cent., free of tax, on the 6 per cent. income bonds of 1948 for the half-year ended December 31st, carrying forward £36,700.

City and South London Railway Co.—Dividend on the Consolidated ordinary stock for the past half-year 1¼ per cent., making 2 per cent. for the year, carrying forward £24,367.

London Electric Railway Co.—Dividend 2 per cent. for the past half-year on the preference stock, making 4 per cent. for the year; 1¼ per cent. on the ordinary, making 2 per cent. for the year, carrying forward £23,604.

Central London Railway Co.—Dividend on the undivided ordinary stock for the past half-year 2¼ per cent., making 4 per cent. for the year on the preferred ordinary; 2 per cent., making 4 per cent.; and on the deferred ordinary 4 per cent. for the year; carrying forward £17,485.

Crompton & Co., Ltd.

The report for the three years ended March 31st, 1918, states that the accounts for the year ended March 31st, 1916, have already been before the shareholders, and the figures now presented include adjustments in regard to capital expenditure for war purposes, depreciation, &c., for that year. The balance of profit and loss with the amount brought forward amounts to £121,959; after deducting allocations to reserve and dividends paid there is a balance of £86,605, subject to excess profits duty and munitions levy. From the above balance dividends for the year to March 31st, 1918, passed at the annual meeting in July must be deducted, leaving £76,550. The directors recommend placing £15,000 to reserve, carrying forward £61,560, subject to excess profits duty and munitions levy. In view of the rise in cost of material and of labour, which necessitates for a given output an increased amount of working capital, and of the demand for goods of the company's manufacture, the directors consider it necessary to increase forthwith the capital of the company, and are further desirous of giving an opportunity to their employés of investing in the company's shares, such shares to have some preferential rights. A resolution is to be submitted to the shareholders to increase the registered capital from £221,007 to £500,000, of which 24,000 shares of £1 each will be preference shares, ranking *pari passu* with the existing preference shares of the company, and the balance will be ordinary shares. Subject to this resolution being approved by the shareholders, the directors propose to reserve the preference shares so created for issue to the employés of the company on the terms that the number of shares to be held by any one employé be limited, and that the holder of such shares, while in the company's employment, be entitled, in addition to such dividend as may be declared on the preference shares from time to time, to a bonus to be paid out of the profits of the company equivalent to 3 per cent. per annum upon the amounts paid up on such shares.

Dublin United (Electric) Tramways Co. (1896), Ltd.—The half-yearly report shows £117,492 available for division. Interim dividends in August absorbed £22,620, and a final dividend is now recommended at the rate of 6 per cent. per annum, making 5 per cent. for the year, with a bonus of 1s. for £10 unit of ordinary stock. The preference dividend is 6 per cent. for the half-year. £35,000 is put to deferred renewal of rails and cars, and £15,000 to general reserve, and £1,850 is written off investments, bringing them to present market values. Dividend, bonus, and sums set aside amount to £104,230, leaving £13,262 to carry forward. During the year 71,008,655 passengers were carried, the revenue being £443,401, as against 66,624,326 passengers and £383,838 in 1917.

Edison Swan Electric Co., Ltd.—Following upon the references to the required new capital for expansion purposes, the *Financial Times* says that the directors have now definitely decided to ask holders of the "A" shares to forego their cumulative preferential rights and, in addition, to permit the cancellation of their arrears. Under the scheme put forward the first preference will remain as at present, but the "A" and "B" shares will be converted into ordinary capital, and an emission of 150,000 such shares will then be made.

Vera Cruz Electric Light Power Co.—The report for the year to December 31st, 1917, states that the net profits in Mexico amount to £50,611. After meeting all expenses, debenture interest, and sinking fund charges there is an available balance of £38,266, plus £13,314 brought forward, making £61,581. The directors recommend a dividend of 7½ per cent. for the year, of which 5 per cent. has already been paid, to transfer £10,000 to depreciation and reserve, and to carry forward £15,331.

Metropolitan Railway Co.—Results for 1918:—Gross railway receipts £1,336,247, expenditure £906,565, miscellaneous receipts £194,261, total net income £623,943, plus £16,100 brought forward. Interest, rentals, and other fixed charges, and appropriations to renewals, absorb £308,910, dividends on preference stock £239,107. Dividend on the ordinary stock £1 5s. per cent. for the year, leaving £19,211 to be carried forward. £20,000 has been transferred to the general renewals fund.

City of Buenos Aires Tramways Co. (1904), Ltd.—The report to December, 1918, states that the annuity payable by the Anglo-Argentine Tramways Co., Ltd., has been received, and the net revenue for the year amounted to £67,839. Three interim dividends have been paid, and a final dividend of 1s. 3d per share, making 5 per cent. for the year, less tax, is recommended, leaving £5,750 to put to general amortisation fund, and £89 to be carried forward.

Llandudno & Colwyn Bay Electric Railway, Ltd.—For the year ended November, 1918, the profit, after providing for expenses and debenture and loan interest, is £7,938, making with the balance brought forward £8,134. Of this £1,775 has been placed to sinking fund, £1,500 to renewals, leaving £4,859. A dividend at the rate of 4½ per cent. per annum, less tax, is to be paid, and £386 carried forward.

St. James & Pall Mall Electric Light Co., Ltd.—Balance dividend on the 7 per cent. preference shares for the half-year ending December 31st, 1918, of 3s. 6d. per share, and 6s. 6d. on the ordinary shares, making with the interim dividend paid thereon a total distribution of 10 per cent. for the year.

Cambridge Electric Supply Co., Ltd.—The total profit for 1918 was £7,312, plus £2.947 brought forward. After deducting debenture and other interest £1,748, and placing £1,500 to depreciation fund account, a dividend of 5 per cent. for the year absorbs £4,460, leaving £2,552 to be carried forward.

Parsons Marine Turbine Co., Ltd.—Interim dividend of 10 per cent., free of tax.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended December 27th, 1918, amounted to 2,000,352, compared with 1,946,348 units in the corresponding four weeks of 1917.

Central Electric Supply Co.—After transferring £22,253 to depreciation fund, £400 is written off for discount on issue of debenture stock, leaving a loss for 1918 of £7, which is deducted from the credit balance of £16 brought forward, leaving £9 to be carried forward.

Tottenham District Light & Power Co.—Dividends for the past half-year at the following rates:—5 per cent. on the preference stock, 4½ per cent. on the "A" stock, and 3 per cent. on the "B" stock, all less income-tax.

Telegraph Construction and Maintenance Co., Ltd.—In addition to the interim dividend of 5 per cent. paid in July last, a further dividend of 10 per cent., together with a bonus of 12s. per share.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Crompton & Co., Ltd.—Ordinary shares of £1 each, fully paid; preference shares of £1 each, fully paid; and £150,000 6 per cent. first mortgage registered debentures (£100 and £50).

International Light and Power Co.—Dividend of 16½ per cent., less British income-tax, on the preference shares for a period of 33 months in full payment of accrued arrears of dividend to December 31st, 1918.

National Gas Engine Co., Ltd.—Final dividend 3¾ per cent. on ordinary shares, making 7½ per cent. for the year, and a bonus of 1s. per share, free of tax.

National Electric Supply Co., Ltd.—Net profits for 1918 £13,080, plus £160 brought forward; total, £13,240. Dividend 2s. 6d. per share, making 5s. for the year, carrying forward £242.

Marconi Wireless Telegraph Co. of America.—The financial Press announces a dividend of 5 per cent., less tax, on the capital stock.

Crossley Bros., Ltd.—Final dividend 4½ per cent. actual on the ordinary shares, making 7½ per cent. for the year.

STOCKS AND SHARES.

Tuesday Evening.

Some degree of normality having been established in the world of Tube railways, it is again possible for London to go about its business as before, and the Stock Exchange, like the rest of us, is able to resume work within ordinary hours. But the strikes made little difference to share prices in the railway lists. These are dividend markets to-day, and the unexpected declaration of a full 3 per cent. on the Income bonds of the Underground Electric Railways had a smart effect upon the price, sending it up with a rush to 97 before a point reaction took place. The dividend makes 5 per cent. for the year, but the 3 per cent. just announced is held to be a return to the 6 per cent. per annum rate, and at 96, cum div., the return works out to 6¼ per cent. on the money. As it is free of tax, this is equal to 9 per cent., less tax at 6s. in the £. We work out the dividend, in our tables overleaf, on the strictly correct basis of 5 per cent. for the year.

For the full year 1918, Central London deferred stock gets 4 per cent., as against 3 per cent. in 1917, and the London General Omnibus dividend is raised from 7 per cent. to 8 per cent. The City & South London, with the London Electric, pay 2 per cent. for 1918, a rise in each case of ½ per cent. on the year. District second preference will have 5 per cent. for 1918, a gain of 2 per cent. over 1917; the District carry forward of £21,300 is about £7,700 less than that in the previous twelvemonth, but the London General Omnibus carries forward £60,900, or £22,000 more than in 1917. Quotations for the Tube stocks have mostly moved up since a year ago, Districts, for instance, at 28½ going against 15½ in December, 1917, and Underground Incomes at 96 showing a rise of 14½ in as many months.

The St. James' & Pall Mall Co. has declared its dividend and the prices of the shares remains unaltered at 7¼. The declaration was received with a certain amount of relief, because it is certainly better than was expected. Lively dealings have sprung up in Westminster Electric new shares. The old issue is quoted 6⅞ ex rights, and the new are being dealt in on the basis of ⅛-¼ premium. City of London ordinary reacted to 12¾, but otherwise the list of electric lighting shares is steady. Edison & Swan "A" shares have eased off to 18s. 6d. A good deal of curiosity is expressed as to what the definite proposals are likely to be for re-arrangement of the capital. Nothing further is known than was announced some weeks ago. It is thought in the market that the arrangements to be made may be a little less what some people call drastic in regard to the dividend on the "A" shares, but it is impossibie to say yet precisely what scheme will be formulated. Meanwhile, it will be as well to accept unofficial statements with considerable reserve. General Electric ordinary lost 5s., but otherwise the manufacturing group is firm. Newcastle-on-Tyne Electric ordinary receded to 22s. 6d.

Few changes have occurred in the list of telegraphs and telephones. Globe ordinary fell 2s. 6d.; Eastern ordinary is a point higher; Telegraph Constructions are 10s. up, while Callenders went back to 10¼, a reaction of 5s. Marconis are quiet. American Marconis at 30s. have rallied a little from the weakness that occurred as a result of the dividend disappointment.

The foreign group continues irregular, Mexican Light and Power preferred advancing to 50, although the company's first mortgage bonds are another 2 points lower at 65¼ Canadian General Electrics have risen 3 to 118½, and San Paulo Electric first mortgage bonds at 86 are higher. On the other hand, Vera Cruz debenture stock fell 4 points to 84.

There is not much doing in rubber shares, speculative interest in them having been diverted into the popular oil group. Armaments, with iron and steel shares, are better, probably on the settlement of some of the minor strikes that have occurred recently. Base-metal shares are steady, showing little movement one way or the other. The Government is expected to come to the aid of the tin mining companies in Cornwall, and, in consequence, a few of the leading shares have strengthened during the past few days.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Feb. 11, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	9	10	7⅜	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	3½	—	6 8 7
Chelsea	8	6	4	—	6 5 4
City of London	8	8	12¾	— ⅛	6 5 6
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	8	4	3	—	6 13 4
do. 4½ per cent. Pref.	4½	4½	3¼	—	6 18 6
St. James' and Pall Mall	8	9	7½	—	6 4 2
South London	5	5	3	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6⅞xd	—	6 11 0
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	98½	—	6 1 10
do. Def.	1½	1½	22	—	7 12 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10¾	—	*6 10 4
Eastern Extension	8	8	15½	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	+1	*5 1 0
Globe Tel. and T. Ord.	7	7	14½	— ⅛	*4 19 1
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	4⅝	—	4 6 7
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7¾	—	*5 1 7
West India and Panama	6d.	1/3	1⅝	—	*3 17 6
Western Telegraph	8	8	16⅝	—	*4 16 3
HOME RAILS.					
Central London Ord. Assented	4	4	65½	—	6 2 2
Metropolitan		1	30	+ ½	4 3 4
do. District	Nil	Nil	27¼	—	Nil
Underground Electric Ordinary	Nil	Nil	3½	—	Nil
do. do. "A"	Nil	Nil	10/6	+9d.	Nil
do. do. Income	6	4	96	+4½	*5 4 2
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3 11/16	—	—
do. do. 2nd Pref.	5½	—	3½	—	—
do. do. 5 Deb.	5	5	71½	—	6 19 10
Brazil Tractions	—	—	55½	—	—
Bombay Electric Pref.	6	6	10¾xd	+ ½	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	65½	—	7 12 8
do. do. Preferred	Nil	Nil	47	—1	Nil
do. do. Deferred	Nil	Nil	43½	— ½	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 6 per cent. Bonds	Nil	Nil	63½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	61	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	50	+1	Nil
do. 1st Bonds	Nil	Nil	65¼	—2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	9⅞	—	3 17 5
British Aluminium Ord.	10	10	1 13/16	—	6 10 5
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref.	7½	7½	2⅜	— 1/16	6 0 0
Callenders	20	25	10¾	—	5 16 3
do. 6½ Pref.	5	5	5⅜	—	5 2 4
Castner-Kellner	22	20	3 7/16	—	6 16 3
Edison-Swan, "A"	—	—	18/6	—1/6	—
do. do. 4 per cent. Deb.	4	4	74½	—	5 6 0
Electric Construction	7½	10	1 5/16	—	8 8 5
Gen. Elec. Pref.	6	6	10¼	—	6 6 10
do. Ord.	10	10	17½	— ½	*5 14 3
Henley	25	25	2 5/16	—	6 8 2
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	10	—	6⅛	—	*8 3 4
Telegraph Con.	20	20	48½	+ ½	*4 17 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 12th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/5	..
a	Ammoniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	"	£78	..
a	Bisulphide of Carbon	"	..	..
a	Borax	"	£48	..
a	Copper Sulphate	"	£50	£10 dec.
a	Potash, Chlorate	per lb.	1/9	3d. dec.
a	" Perchlorate	"	1/9	..
a	Shellac	per cwt.	£13 10s.	16s. dec.
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers	"	£83	..
a	" Lump	"	£25	..
a	Soda, Chlorate	per lb.	11d.	¼d. inc.
a	" Crystals	per ton	170/	..
a	Sodium Bichromate, casks	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	1/1⅜	..
c	" Tubes (solid drawn)	"	1/3½ to 1/3¾	¼d. dec.
c	" Wire, basis	"	1/2	..
c	Copper Tubes (solid drawn)	"	1/5¾ to 1/6¼	½d. dec.
g	" Bars (best selected)	per ton	£132	..
g	" Sheet	"	£132	..
g	" Rod	"	£132	..
d	" (Electrolytic) Bars	"	£100	£5 dec.
d	" " Sheets	"	£161	..
d	" " Wire Rods	"	£110	£5 dec.
d	" " H.C. Wire	per lb.	1/1⅝	½d. dec.
f	Ebonite Rod	"	8/-	..
f	" Sheet	"	2/6	..
n	German Silver Wire	"	2/6	..
h	Gutta-percha, fine	"	11/-	..
h	India-rubber, Para fine	"	2/5¾	¼d. dec.
i	Iron Pig (Cleveland warrants)	per ton	Nom.	..
l	" Wire, galv. No. 8, P.O. qual.	"	£40	..
g	Lead, English Pig	"	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small	per lb.	9d. to 4/6	..
e	" " " medium	"	5/- to 10/-	..
e	" " " large	"	12/6 to 25-/& up.	..
d	Silicium Bronze Wire	per lb.	1/7	..
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	"	£224	£19 dec.
n	" Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

New Belgian Companies.—Among the new companies recently formed in Belgium in connection with the generation and distribution of electricity are the Société de la Centrale Electrique de Leignon, formed at Leignon, and the Société Co-operative Centrale Hydro-electrique des Grands Etangs, of Cierreux-Rovigny.

Safety First. — As evidence of the necessity which exists for immediate action, the latest published returns show, says the British Industrial "Safety First" Association, that in 1914 969 persons were killed and 147,045 were injured by accidents in workshops and factories alone, a large proportion of which would, undoubtedly, have been prevented had those who became casualties been educated in matters pertaining to their own safety. Millions of pounds paid in compensation, and huge sums of money lost to workers as wages, might have been saved and utilised to better advantage, and untold suffering have been obviated. The aim of the Association is to render the industrial community "Wreckless, not Reckless."

Electrically Illuminated Christmas Tree in War Zone.—Coblenz saw its first electric Christmas tree on Christmas Eve. It was set up in the plaza along the Rhine, directly in front of the headquarters of the Third Army. The tree, which was 40 ft. high, was decorated with red, white, and blue ribbons and was trimmed by Army nurses. It was placed in position by members of the Thirty-Seventh Engineers. Red, white, and blue incandescent lights covered the tree, at the base of which, in letters 3 ft. high, were the insignia of the Third Army. The electricity was furnished by a portable plant taken to the spot by American troops. The Seventy-Third Field Artillery gave a concert when darkness fell and the tree was lighted up. The large building housing the headquarters of the Third Army, as well as smaller structures erected by American troops, all bore crosses, which were lighted the evening before Christmas and on Christmas evening.—*American Electrical Review.*

L.C.C. Elections.—In an address to members of the Constitutional Club, last Friday, Lord Downham said that there was very little divergence of policy, programme, or feeling between the Municipal Reform Party and the Progressives. He said that they both aimed at raising the general standard of life and happiness of London citizens. Both had a forward policy with regard to housing, health, tramways, and electricity in bulk, and they desired the L.C.C. to be a model employer of labour.

PARALLEL CONNECTION AND VOLTAGE REGULATION OF LARGE MERCURY RECTIFIERS.

Where transformers, motors, and generators are concerned there must be a whole series of designs and sizes to suit various output requirements, and different supply voltages and frequencies, but this is not the case when mercury rectifiers are concerned. The range of conditions which necessitates 20 or 30 patterns of transformers may be covered by two or even by a single type of rectifier. The modern high-power mercury rectifier consists essentially of a cylindrical steel vessel with six anodes passing through the cover and a cathode at the bottom. The only gradation which could be arranged on the basis of power and voltage would be to increase the dimensions of the electrodes with increasing current, and to increase the distance between electrodes with increasing voltage. Experience shows, however, that any saving of material effected in this manner is more than offset by increased cost of manufacture. As a matter of fact, the same spacing of electrodes will serve such a wide voltage range as 65 to 650 volts, and there is little practical advantage in adapting the electrodes to a number of current values. The frequency of the primary A.C. supply has no influence on the rectifier. For these reasons, says Bela Schafer (*Elekt. Zeitschrift*) the Glarus Rectifier Co. has standardised only two sizes of steel-clad rectifier, for 250 and 500 amperes respectively; the D.C. voltage can be arranged to have any value between 110 and 800 volts. Higher current output is obtained by paralleling several rectifiers, and the relative merits of various systems of connection and regulation are discussed in this article.

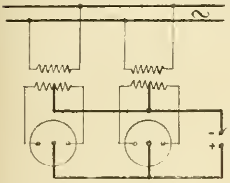


Fig. 1

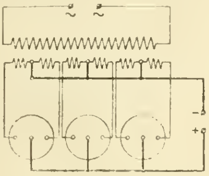


Fig. 2.

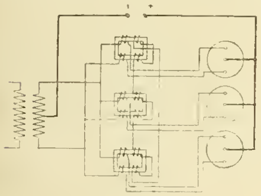


Fig. 3.

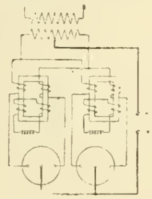


Fig. 4.

Parallel operation of several rectifiers offers no particular difficulties. Once the vacuum has been reduced to a permanently low value, the pressure drop in the arc is practically constant at 16 to 18 volts down to the lowest current value. The negative characteristic of the rectifier arc is only slightly in evidence, the voltage drop in the arc increasing by only a volt or two as the current decreases. Hence the requisite ballast may be provided by a small choke coil. There are a number of alternative connections which secure satisfactory current distribution without sacrifice of efficiency or power factor, and the choking coil may be utilised for voltage regulation. If each rectifier be provided with its own transformer, as in fig. 1, the voltage drop of the transformer secures uniform division of load, without the use of a choking coil. Also, this arrangement yields the lowest voltage drop between light load and full load (leaving out of consideration for the present certain special connections which are considered later). The provision of a number of small transformers instead of one large one of the same total capacity involves higher capital outlay, but provides greater security of operation.

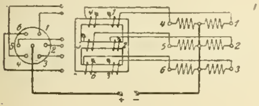


Fig. 5.

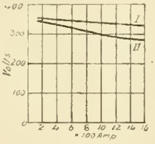


Fig. 6.

Another arrangement which yields satisfactory parallel operation without the use of choke coils is shown in fig. 2, where a number of secondary windings are used in conjunction with a single primary. The stray reactance is a minimum when the load is the same in each current branch, hence there is a tendency for this condition to be maintained automatically. In both cases represented by figs. 1 and 2, a single rectifier or any desired part of the group may be placed in commission. An arrangement which is electrically equivalent to those of figs. 1 and 2 is shown in fig. 3, where uniform current distribution is obtained by choking coils with special auxiliary windings which are not connected in series but short circuited in series; here again, unequal distribution of load between the several rectifiers sets up voltages in the choking coils which re-establish balance. An equally good result is obtained by the arrangement shown in fig. 4, where the auxiliary windings are not connected in series but short circuited directly on to each choking coil. In all the arrangements so far illustrated, the busbar voltage varies very little if the number of rectifiers in service be proportional to the load. With all the rectifiers in parallel, the total voltage variation from light load to full load is 6 to 10 per cent.

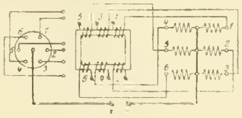


Fig. 7

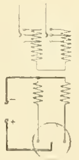


Fig. 8

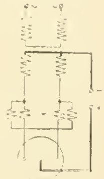


Fig. 9

The connections in figs. 1 to 4 are equally applicable to single-phase or polyphase rectifiers, but where six-phase rectifiers are operated in parallel one would (in the interests of economy) wind all six phases on the three limbs of a single core (fig. 5), rather than use six single-phase choke coils. Of the various possible arrangements of six-phase choke coils, that in fig. 5 gives the lowest pressure drop. The characteristic feature of this arrangement is that the iron core is magnetised in the same sense by the three successive phase currents, *i.e.*, the magnetisation is nearly sinusoidal. Ballast choke coils without short-circuit windings cause, however, considerable voltage drop, which varies according to the selected choke voltage and the load voltage, between 14 and 20 per cent. The importance of the connections chosen, as regards the parallel operation of several rectifiers, is shown in fig. 6, which refers to a group of three rectifiers for currents up to 1,500 amp. (total) at 320 volts. Curve I shows the voltage-current characteristic with connections as in fig. 2; and curve II relates to fig. 5, with equal transformer voltage and the use of choking coils which absorb 40 volts when traversed by the normal anode current at 50 cycles per second. Higher voltage drop may be desirable if the rectifier is to be operated in parallel with old-fashioned motor generators, but the connections in figs. 1 to 4 are suitable for use where new machines are employed, having small voltage drop between no load and full load. By using a suitable inductive resistance instead of short circuiting the auxiliary windings, the voltage drop of the regulator may be given any desired value between 6 per cent. and 20 per cent., and thus adapted accurately to parallel operation with D.C. dynamos.

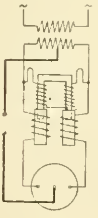


Fig. 10.

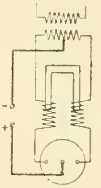


Fig. 11.

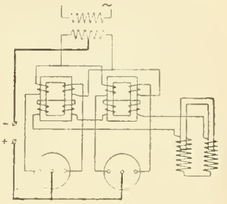


Fig. 12.

Fig. 7 shows an arrangement of anode choking coils for a six-phase rectifier, using only two cores instead of three, as in fig. 5. All six-phase coils magnetise the core in the same direction, so that there is good interlinking and overlapping of effects. The small magnetic leakage between the individual coils ensures good parallel operation with medium voltage drop on the D.C. side.

The parallel connection of choking coils reduces the efficiency by less than 1 per cent., and the same applies to power factor, except in the case represented by fig. 4, when the power factor is reduced by from 3 to 5 per cent., according to the size of the choking coil Normally the power factor of the rectifier is from 0.9 to 0.95

Connections for Voltage Control.—The rigid ratio between the A.C. and D.C. voltage of the rectifier necessitates an alteration in the applied A.C. voltage if the rectified voltage is to be varied. The A.C. voltage may be varied either by altering the number of effective primary or secondary turns in the transformer (fig. 8), or by an auxiliary transformer of variable number of turns or coupling In the latter case an induction regulator (fig. 9) or a transformer with plunger core (fig. 10) may be used.

In the larger rectifier installations, induction regulators have hitherto been used almost invariably for voltage control. If suitably arranged, the regulator is not affected by the operation of the rectifier, even if it be connected on the low-voltage side and carries only pulsating rectified current in its windings. In smaller installations, the arrangement shown in fig. 11 may be used, in which voltage regulation is effected by choking coils with plunger cores. This is suitable for charging stations of from 10 to 20 KW., where it is less a matter of maintaining a definite voltage than of limiting the charging current.

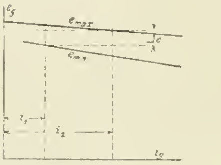


FIG. 13.

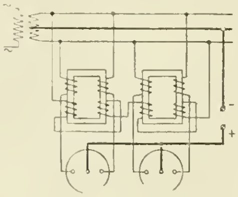


FIG. 14.

Where several rectifiers are to be connected in parallel, it is advantageous to provide the existing anode choke coils with additional windings, and to short circuit the latter through the regulating choking coils, as in fig. 12. This arrangement results in considerable improvement in power factor and in better regulation. The trend of the rectified voltage is shown in fig. 13. Connections as in fig. 11 yield slightly divergent voltage lines; whereas the connections shown in fig. 12 yield curves which are practically parallel (making possible better utilisation of the regulating coil). Fig. 13 shows also that any desired voltage within the range Δe is obtainable between the loads i_1, i_2 corresponding approximately to full load and half-load. The good regulation, small loss, and simplicity of the regulable choking coil make it very suitable for small and medium-sized installations.

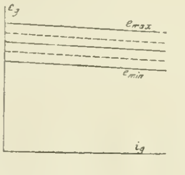


FIG. 15.

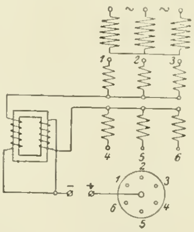


FIG. 16.

The anode choking coils used for the parallel connection of several rectifiers can be used advantageously for voltage regulation by using them in the form of auxiliary transformers (fig. 14), the secondaries of which are in series with the anodes, whilst the primaries are connected to aid or oppose the main transformer. Three voltage steps are thus obtained as shown in fig. 15. The middle step is obtained by short circuiting the primary windings on themselves; the main transformer generally makes possible two voltages in the ratio 1 : 2 which yield another two pressure stages, as shown by the dotted lines in fig. 15. Finally, if desired, a small regulator of the type already described may be used to provide voltages intermediate between the five steps. The efficacy of the anode choking coils as regards parallel working is not reduced by using them as auxiliary transformers.

The connections shown in fig. 16 (due to J. Kubler, of Brown, Boveri & Co.) are interesting in connection with voltage regulation. The two low-voltage windings form two star-connected, three-phase systems displaced 60 deg. in phase. When the rectifier is in action, there flow through the two neutral conductors, undulating currents the direct-current components of which do not magnetise the solenoid choking coil owing to the opposing connections; on the other hand, the ampere-turns of the alternating-current components add together and produce powerful throttling effect. The rectified voltage is almost constant between light load and full load, with a maximum drop of 2 to 3 per cent. The requisite power rating of the choking coil is about 10 per cent. that of the main transformer power.

The system of compounding illustrated by fig 17 permits the voltage drop to be made zero or, if required, yields a rectified voltage which *increases* with load The connections employed are an elaboration of those used in fig. 14, a choking coil being connected in series with the winding of the auxiliary transformer and provided with a coil excited by rectified current (see heavy lines, fig. 17). As the load on the rectifier increases, so does the unidirectional saturation of the core of the choking coil, hence there is less throttling effect, and therefore a rise in voltage on the field winding of the auxiliary transformer. The auxiliary voltage (positive or negative, according to the connections adopted) is thus increased, and the curve of rectified voltage lies within the limits shown in fig. 18. The compounding action may be explained in greater detail by reference to fig. 19, in which the choke-voltage e is shown as a function of the total ampere-turns. If the main current coil carries no current (rectifier on light load) a relatively small alternating current $i\,a$ in the A.C. windings develops a considerable voltage drop, say, a. If, however, the rectifier be loaded, so as to produce a steady saturation of the iron core of the choke coil corresponding to point c (fig. 19), then the same alternating current as before can now produce only a small field variation, say, b. The decrease in choke voltage is therefore in the ratio $a : b$, and the voltage of the auxiliary transformer is correspondingly increased.

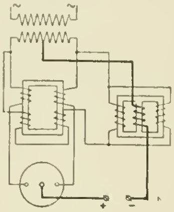


FIG. 17.

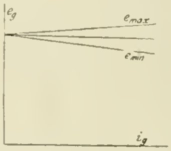


FIG. 18.

It is merely a question of dimensions in order to obtain 10 to 15 per cent. increase in voltage from no load to full load, so as to compensate, for instance, for pressure drop in a long feeder. Provided that the primary voltage is constant or nearly so, the connections shown in fig. 17 replace a high-speed voltage regulator. In tramway and similar service where there are rapid and considerable changes in load, inertia effects are apt to give trouble in mechanical regulators, and the arrangement shown in fig. 9 offers considerable advantages.

As regards the lower limit of voltage regulation, this may be continued to zero without interrupting the rectifier action, provided that the cathode then be excited permanently by an auxiliary arc.

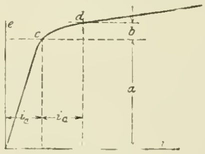


FIG. 19.

In the municipal electricity works at Hirschberg, there are three mercury rectifiers (one in reserve), each rated at 540 amp., 465 volts. At full load of 500 KW., two rectifiers are in circuit, and these (alone or in conjunction with a storage battery) feed the lighting and power network. Voltage regulation within a range of about 10 per cent. is obtained by an induction regulator connected in series with the six-phase main transformer on the low-voltage side.

Mercury rectifier installations recently completed are said to be capable of yielding 16,000 amps. at 250 volts, and 550 amps. at 1,100 volts.

An Indian Society of Engineers.—The question of the formation of a single engineering association for India, under the auspices of the Home Institutions of Mechanical and Electrical Engineers, has been under consideration at Bombay and Calcutta. An attempt was recently made by Major G. H. Willis, R.E., of H.M. Mint, Bombay, through a letter to the Indian technical Press, to elicit views on the matter. According to a letter in the *Times of India*, it was resolved, at a meeting held on January 3rd, to call the Society the Indian Society of Engineers. An Organising Committee was appointed. The inaugural meeting was to take place in November, at Delhi. An organising guarantee fund of Rs. 20,000 was raised.

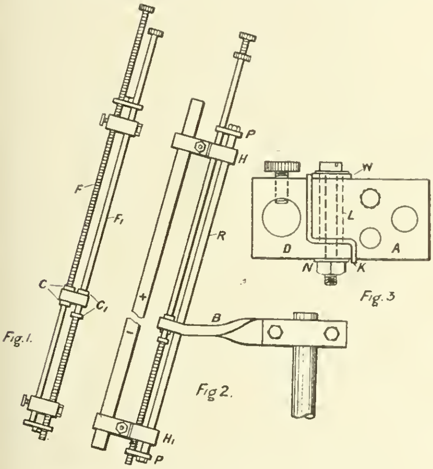
NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Hand-Feed Arc Lamp.

A simple lamp, suitable for lantern work, which can be made up by the aid of ordinary screw-cutting dies, is illustrated by the accompanying drawings (figs. 1, 2, and 3). Besides dispensing with the need of gear-cutting machinery, or the use of left-hand thread, it has the advantages of quick striking, and the ease with which the arc may be centred, by adjusting the carbons independently. The lamp was designed by N. D. Blagdon Phillips, Lieut., R.E., who made one "in the Field" and used it for blue printing.

Fig. 1 is a front view (without the carbons), while fig. 2 is a view in elevation of the complete lamp, in which a rod R, supported by the bracket B, has a bearing plate P at each end. These plates act as bearings for the positive feed rod F and the negative feed rod F_1. Each of these latter has a right-hand thread cut on a portion of its length, and collars C and C_1 pinned on them respectively. F is screwed in the positive carbon holder H and passes through a clearance hole in the negative carbon holder H_1, and *vice-versa* in the case of the rod F_1. F and F_1 are turned for feeding purposes by means of the milled disks at the top. The space between the collars C_1 is to allow the negative carbon to be pulled upward about ⅜ in., and pushed down as soon as the arc is struck. Fig. 3 is a larger scale view of the positive carbon holder, in which the two brass pieces A and D are insulated from each other by the fibre strip K, the bush L, and the washer W. The flex may be connected under the washer and nut N.

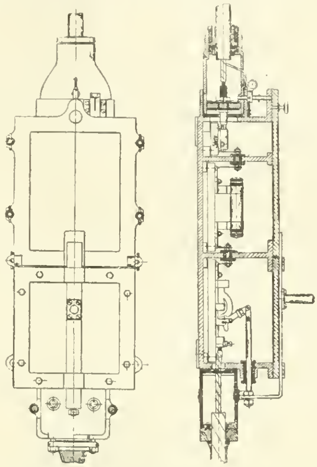


Figs. 1, 2 & 3.—Hand-feed Arc Lamp.

A New Mining Switch.

The patent gate-end mining switch, of which figs. 4 and 5 show the details, is the joint invention of Messrs. W. Creswick, general manager, and J. Bentham, electrical engineer, of the New Sharlston Collieries, Ltd., near Normanton. This switch was designed for use with all portable machinery underground; it can be used either on D.C. or A.C. circuits, providing these particulars are given at the time of ordering. In designing the switch, it was endeavoured to make it fool-proof, durable, and safe; a large number of these boxes are now in use at the SharlstonCollieries, where, we understand, they have given every satisfaction. The initial cost may be great in the first instance, but taking safety as the first consideration, durability, and low cost of maintenance, they are claimed to be the best in the long run.

The body of the box is formed of a three-compartment casing, housing respectively the switches, fuses, and plug box. The box cover is formed in two parts, which close respectively-the switch chamber and the fuse and plug-box hambers. The switches are of the usual quick-make-and-break type, operated by a crank-arm connected to a rod projecting through a gland in the box, the rod being, in its urn, connected to and operated by a bolt which slides in guides on the outside face of the box. If desired, there can e fitted a mitre bolt lock, permitting the switches to be pened, but not closed again without the application of a pecial key. The fuse bodies are of cartridge form, provided t both ends with metal sockets permanently secured in position, so that the terminals are always in alignment. It is only necessary to remove the two caps to renew the wire, whilst, as the parts are metal, they may be screwed tight without the possibility of stripping. The box itself as well as the compartments within are flame proof.



Figs. 4 and 5.—Gate-end Mining Switch.

The action is as follows, presuming the switch is closed:—Upon the main bolt being drawn the switch will be opened, and when the bolt has moved clear of the lower half of the cover, by easing the thumbscrews the latter can be thrown back on its pivots, thus opening up the fuse and plug chambers. It is impossible to get at a terminal compartment without first opening the fuse compartment and impossible to open the latter without withdrawing the bolt which opens the switches. Further, as the plug is secured in position by a through bolt, the outward movement of which is controlled by the cover, it is impossible to put in or remove the plug till the switches have been opened. The bayonet contacts are carried in a mica-insulated aluminium plate, which slides into a groove at the front end of the box, so that all joints can be made and examined without dismantling the box.

Further particulars can be had from the inventors.

Electric Warehouse Truck.

A new one-ton electric truck, which is specially adapted for use in warehouses and factories owing to the fact that it can turn in a circle of 4 ft., has been brought out by British Electric Vehicles, Ltd., of Churchtown Works, Southport. The truck, illustrated overleaf (fig. 6), has a loading space

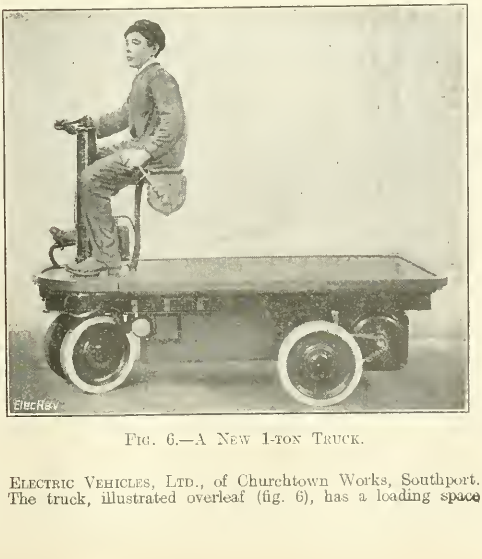


Fig. 6.—A New 1-ton Truck.

6 ft. by 3 ft. 1 in., the platform being 1 ft. 8¼ in. from the ground. The speed on the level is 6 to 7 miles per hour, and the rated mileage per battery charge is 20 to 25 miles on the level. The battery consists of fourteen 25-volt cells of the chloride "Ironclad" pattern, with a capacity of 193 ampere hours. The charging rate is 25 to 40 volts, 10 amperes, and boosting charges can be given up to 50 amperes when necessary. The vehicle is fitted with three speeds in either direction, and a bell push is attached to the controller handle. The transmission is by chains from both motors to the rear wheels. The brake, which is of the external expanding pattern to both rear wheels, is operated by a foot pedal, and is normally in the "on" position. A switch is interlocked with the brake, cutting off the current when the brake is on, and *vice versa.*

A New Rotary Transformer.

Our illustration (fig. 7) shows a new patent variable-voltage rotary transformer designed for use in all cases where the voltage of a direct-current supply is required to be transformed in the most efficient possible way. This machine is made by the Crypto Electrical Co., Ltd., Acton Lane, Willesden, N.W. 10, where we recently had an opportunity of seeing the machine on the test bed. The machine, we understand from the makers, is intended to take the place of the standard motor generator, and among the various advantages claimed in favour of the rotary are a saving in first cost, weight, space, and efficiency. The single machine has fewer bearings and less parts to get out of order, and it does not require lining up on a level foundation, since it is a self-contained unit.

These machines can be made for various requirements, as, for instance, variable voltage by shunt control for accumulator charging, &c.; constant voltage secondary as a compound motor generator for lighting, &c.; and reverse compounded (drooping characteristic) for arc lighting, kinemas, searchlights, &c., or for electric welding.

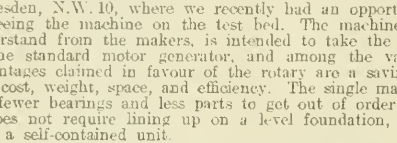


Fig. 7.—A New Variable-Voltage Rotary Transformer.

Readings taken for the machine that we saw on test indicated the following results for the three cases when compounded, reversely compounded, or for variable voltage respectively. The secondary voltage in each case if of particular interest.

	Prim.		Sec.			
	V.	A.	V.	A.	Revs.	Load.
Compounding	198	33·5	64	80	1,475	Full
	199	4	64	0	1,300	Light
Reverse compounding	200	4·1	63·1	0	1,250	Light
	200	28	51	80	1,220	Full
Variable voltage	200	29	51·2	80	1,180	Low
	200	29	56·5	80	1,275	Normal
	200	33·2	62	80	1,365	Full

Electric Snow-melters for Railway Tracks.—An electric heater has been devised for use on the New York Central Railroad for keeping switches and special work at points free from snow and ice, says the *Electric Railway Journal.* The heater consists of resistance wire wound about a porcelain tube, the whole being enclosed in 3½-in. wrought-iron pipe 20 in. long. The heating units are laid under the points to be protected, and the current is switched on as soon as snow begins to fall. Very satisfactory results have been obtained in a three-years' trial, only one case having occurred in which the snow was not melted as fast as it fell. Each unit takes 11 amp. at 36.7 volts, and for turn-outs with 5-ft. switch points 18 heaters were used, thus taking 7.26 kw. for each turn-out. The heaters have also been employed under pipe runs, signal mechanisms, turn-table pits, and the like.

NATIONAL ELECTRICITY SUPPLY.

The report of the Law Committee of the Association of Municipal Corporations, on electric power supply, which was adopted by the council on January 23rd, 1919, deals with the reports which have been made by the Electrical Trades Committee, the Coal Conservation Sub-committee, and the Electric Power Supply Committee.

After giving an admirable summary of the various recommendations, and particularly the proposals relating to District Electricity Boards, the report proceeds:—

In our opinion, the general principle that the generation of electricity should be subject to the control of a body having authority over a sufficiently large area, where there will be a large and varied demand for energy, is one that should commend itself to the municipalities. The selection of the areas and the determination of the type of board to be established will, no doubt, give rise to some difficulties, but we are glad to note that in the report the view is expressed that it would be a mistake to attempt to tie the hands of the Commissioners, and that it is sufficient to give certain general indications as to the broad lines to be worked along by them, and then to leave them a free hand to deal with the variety and complexity of the situation which they would undoubtedly meet in each district.

As regards the constitution of the boards, we desire to reiterate the view which we expressed a short time ago, and which was accepted by the council, that it would be a mistake to depart from the principle upon which Parliament has acted with very few exceptions for many years past, that undertakings of this description, which involve a monopoly and upon which the prosperity of the people is so largely dependent, should be in the hands of public authorities. We are convinced that in most cases it would be preferable to have boards which are financed locally, and upon which local authorities should have a preponderating voice, due regard being had to the financial responsibility undertaken by the several constituent members.

The report suggests, in paragraphs 58 to 63, that whilst the District Electricity Boards should remain the owners of the undertaking, the operation might be transferred to a commercial company as lessees. We are of opinion that this would be wrong and contrary to the principle referred to in the last paragraph, and that both the ownership of the undertaking and the operation thereof should remain in the hands of the publicly constituted authority. In the report the opinion is expressed (para. 47) that it is essential that the District Electricity Boards should make no divisible profit, and this view, with which we are prepared to acquiesce, appears to us to be inconsistent with the suggestion that the undertakings might be carried on by companies whose primary object would necessarily be to make a profit for their shareholders.

Although the control of the generation of electricity would, according to the proposals, be in the hands of the District Boards, it would not, of course, be proposed to discontinue the use of all the present stations, many of which are well placed and suitably equipped for the generation of energy on a large scale and at a low cost. As regards many stations, it would, no doubt, be true economy that their use should be wholly or partly discontinued, and in those cases the owners should be adequately compensated, so that their financial interests are not prejudiced.

We are of opinion that there are stations which comply with modern requirements and which already serve a wide area and have a large and diversified load, and which consequently might be retained by their present owners and in suitable cases used for affording a supply to larger areas. We are also of opinion that where the undertaking is so situated as not to lend itself to a general scheme of generation and supply, the Electricity Commissioners should exercise a dispensing power either temporary or permanent, and on such conditions as they think fit. The precise course to be adopted in each case is rightly intended by the report to be considered by the Electricity Commissioners and decided by them. We would urge that:—

1. The greatest opportunity should be afforded to local authorities owning generating stations to make representations, and if they think fit to present schemes to the Electricity Commissioners for the constitution of an area and a District Electricity Board.

2. The Act of Parliament to be based upon the report should clearly provide that a municipal corporation already supplying power on a large scale and over a large area, and able and willing to develop that supply at its own risk, should be empowered to do so at its own option, and that its existing area of supply should be extended to such an extent as may be deemed desirable by the corporation and the Commissioners, having due regard to the local requirements of the district.

The basis on which generating stations should be taken over by the district board is generally to be "payment of the actual amount expended on lands, buildings and plant for generating purposes, less depreciation, reserve funds and renewal funds and sinking funds which have been provided and which are properly applicable to the generating stations. Exceptional cases may require special treatment."

We are strongly of opinion that these terms are inequitable and could not be accepted by local authorities. In some cases where a district board is formed to take over the undertakings of local authorities only, the basis of outstanding debt might not be inappropriate, but in view of the want of uniformity in the practice of local authorities with respect to depreciation, reserve and renewal funds, we think that all such funds, other than statutory sinking funds, should be retained by the individual authorities. The case of those authorities which have carried sums from revenue account to capital account or have written down their capital at a rate in excess of statutory requirement or have met losses out of the rates should receive special consideration. In cases where both local authorities and companies have to be dealt with, the inequality of the proposed basis is greatly accentuated owing to the fact that companies are under no obligation to provide sinking funds.

We suggest that the fundamental consideration is that the transaction contemplated is not a purchase and sale, but the formation of a partnership. The essentials of a basis are therefore:—

1. Fairness between the partners.
2. Avoidance of inflaton of the capital of the partnership.

If these requirements are fulfilled it is not necessary that the basis should be the same in every case. It is suggested accordingly that no attempt should be made to lay down a uniform basis, but that the two essentials already mentioned should be adopted as instructions subject to which the Commissioners should deal with each case. This would leave room for agreements between the parties to whom considerable freedom of action should be left, subject always to the approval of the Commissioners.

We have not criticised the report of the Coal Conservation Sub-committee, because we assume that that report is now superseded by the Electric Power Supply Committee's report. We ought, however, to state clearly that we must not be taken as accepting the conclusions expressed in the former report, and particularly the suggestions that appear in it that company management should take the place of municipal management. On the contrary, in our opinion, the public interests would better be served by precisely the converse process.

Nor must we be taken as accepting the figures contained in the sub-committee's report. Amongst other things, a comparison is made between the average price charged by municipal electricity undertakings in Lancashire and by company undertakings in the north-east coast district of England. As far as we are aware, no evidence was given before this committee, and the figures and the circumstances under which the supplies are given would require careful investigation before they could be accepted as affording a basis for comparison.

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

At Edinburgh, on January 14th; Prof. Miles Walker's paper (an abstract of which appeared in our issue of December 13th, 1918) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers.

Mr. Mitchell said that in a reference to the "effect of single-phase load on a three-phase generator" it was stated that if the single-phase load did not exceed 20 per cent. of the normal three-phase load the disturbance to the voltage would be inconsiderable. If that was done regularly up to the full 20 per cent., would there not be considerable heating in the generator due to pulsating fluctuation? In Glasgow single-phase loads were thrown in and off three-phase mains without unbalancing the voltage. This was done in connection with welding transformers, and the same thing was done in an even smaller way for glass annealing. The speaker thought that as systems grew larger the objections against the three-phase furnace would not weigh so heavily. Also, as furnaces grew larger the provision of the rotating balancer would be a very costly item. The right policy was to dissipate energy directly in the furnace as three-phase power rather than by complicating the position by first converting to single phase by rotating machinery. There was undoubtedly a demand for a single-phase supply for electric traction, and that demand would be greatly enhanced if anticipated developments were fulfilled.

Mr. W. B. Hird said that in the balancer described the windings were described as having the single-phase winding locally congregated with two or three phases. He suggested splitting the single-phase slots so that, instead of being integrated with two of the three phases, they would overlap one of the phases. It would look as if such an arrangement would be more easily dealt with. The need for the suggested conversion would be limited to supplies to furnaces or traction loads, and it appeared to him that if that was the only combination requiring such a change, the proportion of the total load on the system thus represented would be small. If a large number of furnaces or cars were run, it was easy to balance them and still keep a fairly efficient balance on a three-phase system. If, on the other hand, the system of supply was large, it could stand a great many furnaces and cars without being put seriously out of balance. With the schemes now in hand for large stations there was little hope that such a scheme of conversion would ever be largely practicable. None of the schemes of conversion described in the paper were really automatic; they required skilful watching in order to make a successful combination. While he much admired the paper from the theoretical point of view, he hoped they would never have to resort to any of the devices described.

Mr. Anslow suggested that they ought to improve the multi-phase furnace rather than devise means of phase conversion.

Prof. Baily described the machine as exceedingly ingenious, and simpler than others evolved in America. He thought the machine would be of considerable use for smaller tramway systems, as it would not want much power, and a convenient tapping from the three-phase main would be necessary and much required. Three phase did not lend itself to conversion into single phase. Would it not be better to convert the three phase to two phase, and on the two phases they had the two actual phases separately pulsating, but they could separate their two phases quite independently. If they made double use of these phases, such as supplying two dynamos, then the out-of-balance load might be taken up by quite a small balancer, working the balancer very much in the way of the ordinary three-wire system. This out-of-balance was taken up by a rotary machine, and not the whole current, as in Prof. Walker's machine. Not only was the balancer taking care of the out-of-balance, but only half of the out-of-balance current. The motor took up half the balance, and the generator the other half, so that a small balancer would take one half of the total load with a very obvious efficiency, as well as a moderate first cost.

Mr. E. Seddon regretted that the author had found it necessary to introduce a rotary balancer. This not only increased the cost of the furnace, but introduced undesirable features from the consumer's point of view. The electric furnace was essentially the class of load for a large station, and most supply engineers who had not yet handled the business would have to provide for it in the near future.

Prof. Miles Walker, in reply, said that where they could divide the single-phase load into two parts that was the best thing to do. The difficulty with furnaces was that they were not all out of or in use at the same time, and they got a load with a variable characteristic. For single-phase furnace work the extra expense in balancing was very small if they had decided to correct their power factor and reduce their voltage. For ordinary three-phase supply it was preferable to divide the system into two phases, and convert the two phases. One reason for using a big distance between single-phase and three-phase windings was to get the necessary reactance. That enabled them also to introduce the compensation winding. They wanted the machine to operate only as a rotating generator. It tended also to operate as a transformer, but if it operated only as a transformer it would not act as a balancer at all. He was sure all small tramway systems would want a balancer of this kind, though he believed it would be better to have a two-phase system, and try to split up the load between the two phases. Stationary machines were admittedly preferable to rotary ones, but to those who used a balancer and got a steady three-phase load, instead of a jerky load on short-circuit, it was worth while to have a rotary machine. So far as consumption was concerned, he did not think the single-phase furnace showed a great saving. The main point was the saving in carbon consumption, and the fact that if they used that method of control they saved lining. In Norway there was a project on foot by which they calculated that they would save £1 per ton by using single-phase furnaces. Single-phase generators driven by water-wheels would be used, and each generator would feed one furnace. On consumption results the operator at Darlington told him that his results showed 600 units per ton, *i.e.*, melting without refining. That figure was perhaps too good. More power was lost through bad management of the furnace than through the characteristics of the system. If preparations were properly made, and there was a switch-off as soon as the metal was melted, the consumption need not exceed, say, 670 units per ton. The motor-generator had two rotating fields instead of one, so that if the rotating field system cost one-third of the machine they might take it they saved about a third more. Then they had two windings for the same cost in the motor-generator. They had a certain amount of saving in iron, so that the balancer was only about 55 per cent. of the cost of the motor-generator, and the efficiency would be about 5 to 6 per cent. higher. They could do everything with the motor-generator that they could do with the balancer.

Priority of Work Order, 1917.—The Ministry of Munitions has suspended the operation of the above Order as from February 1st, 1919, except that from that date priority shall be given to work and materials in accordance with any special directions or regulations issued by the Minister of Munitions.

All priority certificates and permits issued before February 1st, 1919, continue to be operative until March 1st, 1919, but shall cease to be operative on that date.

THE RÖNTGEN SOCIETY.

At a meeting of the Röntgen Society, on February 4th, Dr. F. Hernaman-Johnson read a paper on protection in X-ray work, more especially with regard to the effects of scattered and secondary rays. He said that the tube should be entirely enclosed in a box opaque to the rays; the diaphragm leaves and lead glass in front of the screen must also be opaque, and the body of the observer must be protected when using the diascope by making the whole front opaque, and when using the couch, by means of a moving panel and extensive flaps of lead rubber attached to the screen.

An interesting discussion took place as to whether metal articles worn by the X-ray worker, such as watches or rings, or even coins in his pocket, could set up injurious secondary radiations. Dr. J. Metcalfe, who has had personal experience on this point, said that he had worn a silver wristwatch within his lead-rubber glove while using X-rays, and an ulcer was set up on the wrist corresponding in size and position to the watch. The remarkable thing was that a thickness of 2 or 3 mm. of leather, comprising the watch band, intervened between the metal and the skin, but even this had not been sufficient to absorb the secondary radiations which were set up in the silver. He had found the same action with nickel sock-suspenders. Dr. Hernaman-Johnson said that the danger of such articles worn on the person only arose when the protective material surrounding the tube was ineffective. Given proper protective devices for tube and screen, the only personal "armour" which the diagnostician needed when doing X-ray work was a rubber glove for making digital examinations.

At the same meeting Lieut. W. Makower, M.A., D.Sc., described and exhibited a Langmuir exhaust pump, which is used for exhausting some of the modern X-ray tubes. He said that the point about the Langmuir pump was that the walls of the vessel were cooled in the neighbourhood of the nozzle by water circulation, so that the molecules of mercury or other gas which came through on to the surface condensed there by virtue of the fact that the temperature was low, and there remained. In the case of the ejector pump, the temperature had a tendency to rise, so that the molecules got away again in the form of vapour, and thus introduced a contrary action or double blast of mercury, one stream passing downwards and the other upwards, so that long-continued action was not possible. In the case of Langmuir's device there was only a stream in one direction, and the gas, escaping down into the jet by diffusion, was carried away.

A very beautiful experiment was carried out at the meeting whereby in the course of five or ten minutes a small tube was completely exhausted, the glow with which it was suffused at first appearing no longer, and the spark preferring to jump the gap. The pump was described in the Electrical Review of January 12th, 1917.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

1,861. "Process for recovery of iron from scrap tinned steel." S. O. Cowper-Coles. January 25th.

1,862. "Electro-deposition of iron alloys." S. O. Cowper-Coles. January 25th.

1,873. "Electric cable-carrying or supporting means." A. H. Lessells. January 25th.

1,897. "Electrical apparatus for movement duplication or remote control." F. M. Denton & E. T. Painton. January 25th.

1,905. "Guard chambers for holding electric elements." J. Nolan. January 25th.

1,912. "Electric bell switches." H. M. Black. January 25th.

2,109. "Sparking plugs." J. K. White and Baynes & Partners. January 28th.

2,121. "Ignition and load control for internal-combustion engines." W. W. Bucher. January 28th.

2,130. "Electrical discharge-gap apparatus." British Westinghouse Electric & Manufacturing Co. January 28th. (U.S.A., February 8th, 1918.)

2,134. "Electric heating element for raising temperature of solution in electroplating vats." A. Bolton. January 29th.

2,145. "Variable resistances for electric welding, &c." Quasi-Arc Co. and A. P. Strohmenger. January 29th.

2,164. "Electric lamp." M. F. Marshall (T. Marshall). January 29th.

2,188. "Sparking plugs." W. Skam. January 29th.

2,194. "Charging boards for electric accumulators." H. Leitner & W. H. Exley. January 29th.

2,195. "Heating by electricity." R. H. Forman & C. O. Bastian. January 29th.

2,197. "Electric signalling systems." Western Electric Co. (Western Electric Co., U.S.A.) January 29th.

2,203. "Dry batteries." J. G. Hossack. January 29th.

2,216. "Dynamo battery ignition system." F. H. Hocking & A. W. Pearson. January 29th.

2,235. "Fuse and circuit testers." L. D. Johnson. January 29th. (U.S.A., April 7th, 1916.)

2,236. "Ignition devices for internal-combustion engines." Splitdorf Electrical Co. January 29th. (U.S.A., June 8th, 1918.)

2,243. "Signalling apparatus." S. Oulianine. January 29th.

2,244. "Automatic control apparatus." S. Oulianine. January 29th.

2,253. "Electric switches." T. W. A. Attwater & Southern Transport Co. January 29th.

2,254. "Magnetic chucks, &c." A. C. Norman & Southern Transport Co. January 29th.

2,262. "Electric boiling plates, hot plates, stoves, and ovens." A. I. Rich & A. H. Bundy. January 29th.

2,269. "Telephonic transmitters." B. S. Cohen. January 29th.

2,270. "Signalling apparatus." B. S. Cohen. January 29th.

2,289. "Apparatus for discovering and determining electrically location of veins of ore or mineral." H. T. F. Lundberg & H. J. H. Nathorst. January 30th. (Sweden, July 8th, 1918.)

2,295. "Contact breakers for magnetos." D. C. Dingley & G. Mayor. January 30th.

2,322. "Obtaining single-phase alternating electric currents from three-phase or *vice versa*. A. M. Taylor. January 30th.

2,326. "Rotary interrupters for electrical circuits." H. A. Eastman. January 30th.

2,329. "Dynamo construction." H. Leitner. January 30th.

2,361. "Electric lamp sockets." G. Frankel. January 30th.

2,366. "Electrical amusement apparatus." S. J. Levi. January 30th.

2,369. "Electrolytic processes." H. Derauge. January 30th. (France, January 30th, 1918.)

2,370. "Electrolytic apparatus." H. Derauge. January 30th. (France, January 30th, 1918.)

2,377. "Radiotelegraphy." V. Bajenoff. January 30th.

2,384. "Incandescent electric lamps." T. W. Hancock & T. W. Harrington-Mountjoy. January 30th.

2,392. "Electric fuses." A. H. Morse. January 30th.

2,393. "Electrical condensers and mountings therefor." Bosch Magneto Co. January 30th. (U.S.A., February 11th, 1918.)

2,395/6. "Ignition devices for internal-combustion engines." F. A. Smith. January 30th.

2,423. "Electrical fuses." Midland Electrical Manufacturing Co. and W. L. Barber. January 31st.

2,448. "Anti-vibration electric light fittings." F. A. Ross. January 31st.

2,458. "Electric switch fuses, &c." V. E. Joyce & Park Royal Engineering Works. January 31st.

2,471. "Motor starters, &c." E. N. Bray, and Bray, Markham & Reiss. January 31st.

2,481. "Ignition generating devices." E. C. R. Marks (Splitdorf Electrical Co., U.S.A.). January 29th.

2,485. "Ignition systems." Splitdorf Electrical Co. January 31st. (U.S.A., December 28th, 1916.)

2,486. "Generating ignition current." Splitdorf Electrical Co. January 31st. (U.S.A., November 9th, 1917.)

2,487. "Generating electric currents." Splitdorf Electrical Co. January 31st. (U.S.A., June 8th, 1918.)

2,492. "Switch contacts." F. J. Gill. January 31st.

2,500. "Device for tapping and making temporary connection with insulated electric cables or wires." T. A. Atkinson, J. Meredith & J. M. Peterson. January 31st.

2,507. "Manufacture of electric accumulators." H. Leitner & W. H. Exley. January 31st.

2,516. "Electric switches." D. B. Jones. January 31st.

2,517. "Apparatus for grinding, &c., commutators for electric motors, &c." J. Phillips. January 31st.

2,522. "Wireless telegraph valves, &c." B. S. Gossling & F. Horton. January 31st.

2,528. "Ignition devices." C. E. Palmer-Bott. February 1st.

2,536. "Ignition devices of internal-combustion engines." A. W. Wall and J. White. February 1st.

2,542. "Supporting means for light diffusing shades on electric, gas, &c., lamps." C. H. Kitching. February 1st.

2,569. "Ignition of internal-combustion engines." C. H. T. Alston. February 1st.

2,585. "Electric wave transmission." C. D. Ehret. February 1st. (U.S.A., February 1st, 1918.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

11,031. Electric motor-control systems. British Thomson-Houston Co. (General Electric Co., U.S.A.) July 31st, 1917. (121,753.)

16,517. Electrical alternating-current relays. Electric Control, Ltd., and O. Ellefsen. May 10th, 1918. (121,766.)

18,048. Ventilation or cooling of dynamo-electric machines. H. Chitty. December 5th, 1917. (121,774.)

18,778. Electric arc lamps. H. S. A. Rydberg. November 11th, 1916. (112,269.)

19,195. Safety devices for interlocking the operating parts of enclosed electric switchgear with the door or doors of the enclosed casing. J. A. Hirst & P. S. Brook. December 29th, 1917. (121,939.)

19,239. Interrupters or contact-breakers for magneto-electric machines. R. B. North & A. M. Allen. December 29th, 1917. (121,787.)

19,280. Party-line ringing systems for telephone exchanges. Western Electric Co. (Western Electric Co., U.S.A.) December 31st, 1917. (121,790.)

19,304. Sparking plugs for internal-combustion engines. L. Lavoisier. December 31st, 1917. (122,000.)

1918.

56. Excess-demand electric meters. A. W. Burke. January 2nd, 1918. (121,805.)

183. Electric lampholders. B. J. Grigsby. January 3rd, 1918. (121,818.)

354. Railway signalling. Mackenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) January 7th, 1918. (122,009.)

436. Electrical wall plugs and the like fittings. J. R. Craig. January 8th, 1918. (122,010.)

537. Electric anti-overheating devices for electric irons. J. H. Hickey. January 9th, 1918. (122,022.)

729. Electrode holders for electric furnaces. C. W. Kayser & J. E. Robinson. January 12th, 1918. (122,034.)

748. Metal receptacles for the accumulators of electric battery lamps. W. P. Wrightson. January 12th, 1918. (122,035.)

379. Telegraphic receiving apparatus. E. A. Willson. January 7th, 1918. (121,824.)

901. Sparking plugs. H. G. Longford, W. W. Longford & W. A. Clark. January 16th, 1918. (121,835.)

1,093. Machine switching telephone systems. Western Electric Co., G. Deakin & L. Polinkowsky. January 19th, 1918 (122,047.)

1,795. Protecting devices for alternating-current apparatus. J. A. Kuyser. January 31st, 1918. (122,057.)

2,757. Fire-prevention device for electric cables. Simplex Conduits, Ltd., & J. H. Collie. February 15th, 1918. (122,064.)

2,790. Form of mouthpiece for use with the standard forms of telephone transmitters. P. Whysall. February 16th, 1918. (121,852.)

2,878. Carbonisation and distillation of coal and other carbonaceous matter by electricity. C. W. Simpson & L. Moorhouse. February 19th, 1918. (121,854.)

3,963. Telephone receiver earpieces. A. C. Brown. March 6th, 1918. (121,866.)

4,131. Electromechanical power transmission system. Leyland Motors, Ltd., & J. G. P. Thomas. March 8th, 1918. (121,870.)

4,939. Electric motor controllers. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) March 20th, 1918. (122,085.)

4,933. Vacuum tubes. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 20th, 1918. (121,878.)

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. FEBRUARY 21, 1919. No. 2,152.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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NEW YORK: D. Van Nostrand, 25, Park Place
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PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch, 132, Bay Street
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving his copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

STRIKES.

ALTHOUGH the strikes which disturbed the London public a fortnight ago are now happily over, they are not "done with": that similar crises will return can hardly be doubted—the millennium has not arrived—and it will be wise on the one hand to endeavour to remove the causes of such occurrences, and on the other to provide against them as far as possible. We do not question for a moment the right of men to withdraw their labour on due occasion; that is as indisputable as the corresponding right of men to continue at work should they think fit to do so, without interference. But we do protest against the tendency to strike without warning, without authority, and without adequate reason, which has been markedly observable in connection with recent disturbances, and against the cruelty of strikes of which the hardships are felt mainly by people who are entirely unconcerned with the questions at issue.

We therefore cordially welcome the step which has been taken by the Ministry of Labour, in inviting representatives of employers and employed, in many branches of industry, to a Joint Industrial Conference next week, for the purpose of discussing the situation and ascertaining by what means the feeling of unrest which prevails in various parts of the country can be allayed. It is interesting to note that the invitation is being addressed to Joint Industrial Councils and Reconstruction Committees, where they exist, and thus we see the principles of the Whitley Report bearing fruit in the organisation of this National Conference—which some day may take the shape of a Standing Council of representatives of employers and workers. The proposal to confer has met with general approval: while in some industries local organisations already exist which have proved their ability to settle all such questions amicably, it is, nevertheless, felt that much benefit may be derived from the national gathering, and that, at any rate, no harm is likely to be done by it. Of course, the conclusions arrived at can only be of a general nature, as the conditions of working vary so widely in different industries, that each case must be finally settled on its own merits by those most directly concerned.

Turning to the subject of the threatened attempt of the E.T.U. to plunge the Metropolitan district into darkness, several interesting points arise for notice. As we indicated in our last issue, a weaker case for a strike could hardly have been imagined: not only did it make no appeal whatever to popular sympathy—the first condition to be fulfilled before success can be hoped for—but it offered no inducement even to the members of the Union to leave their posts, a fatal error indeed, for the men whose services were concerned would have been loath to do so even for their own purposes; and, as the event proved, they flatly declined to do so for the sake of a political will-o'-the-wisp. The leaders of the London Branch, therefore, committed a colossal mistake when they embarked upon this foolish policy, and not only brought the Electrical Trades Union into bad odour with the public, but also called down upon themselves the censure of their own members—not to mention the National Executive, which did not appear to cut much ice in the recent frost.

Now, what is the matter with the Electrical Trades Union? We think the answer has been most ably expressed in a letter from a Trade Unionist which appears in our "Correspondence" columns to-day. The facts are notorious. During the war the E.T.U. admitted to membership every Dick, Tom, and Harry that it could induce to enter, no matter how nebulous or remote his claims to electrical qualifications might be; it went further—it advertised itself as an efficient umbrella for those who wished to evade military service, and thus it became—what it is; we will not characterise it more closely, for the sake of the good men who also belong to it.

It is about those good men—by which we mean trained, highly-skilled electricians, men who take pride in their work and uphold the dignity of their calling—that we wish to speak. Are they content to remain lumped together with the war-shy, the alien, and the nondescript? to exercise the same voting power as the boys who belong to the same Union, and to further the political aims of a clique of Bolsheviks? We cannot think that that is their wish. But if they desire reform, it is for them to act—no one else can do it for them. We commend to their notice the proposal put forward by our correspondent—to form a branch of the E.T.U. as a Craftsman's Union, to which none shall be admitted but those who can prove their just right to that privilege. Why should not the Electrical Trades Union possess a standing and reputation on a par with those of other Unions that we could name? It is a matter for the members, and, if they care to take it up, we shall be pleased to provide space in our "Correspondence" columns for its discussion—but *short* letters, please!

Before leaving this subject we feel bound to refer to the letter of Mr. John Vincent, which appeared in our last issue, regarding the shorter working week. We wish to enter an emphatic protest against the fallacious doctrine that unemployment can be lessened by shortening the working hours in order to secure the employment of more workers. It is based upon the idea which for so long has obsessed the British worker, but which has been so often disproved by facts—that there is a fixed amount of work to be done. The effect of increasing the cost of production, however brought about, is inevitably to diminish the demand, the output, and the amount of employment; and unless the rate of production per man is increased sufficiently to counteract the reduction of the working hours, that result will surely follow. Hence the Unions which are out for a short working week are helping to bring about an increase of unemployment, either under an honest misunderstanding of the facts, or, as in the recent example, for purely political and anti-national motives. This is no time to increase the cost of production; what is urgently necessary is increased output at the lowest possible cost—failing that, ruin and misery, which invariably bear hardest on those least able to endure them.

Fuel Economy.

Elsewhere in this issue will be found an article dealing with the coal consumption of power stations, which we specially commend to the attention of central station-engineers; the author (Mr. R. H. Parsons), an engineer of exceptional ability and resource, has himself employed the system which he describes in the working of a large power station, with results nothing short of remarkable.

In these days fuel economy is a matter of the first importance, and the station engineer cannot afford to ignore any device which is likely to facilitate the accurate determination of the true conditions under which his plant is working, or to reveal the nature and cause of losses known or unsuspected. In up-to-date undertakings a variety of instruments is provided, and numerous records are kept, with those ends in view, as we showed, for instance, in our recent article on the Sheffield Electricity Works; but observations and records, however voluminous and accurate, are of little value unless their meanings can readily be interpreted.

It is here that the value of the method outlined by Mr. Parsons makes itself felt. The simple law, closely analogous to the famous Willans law to which he draws attention, is the key by which the problems of the boiler house and engine room can be solved. With the aid of graphic methods, which appeal to the eye at once, a *constant check* is maintained on the rates of consumption of coal and water, and on the efficiency with which the plant is operated, and, at the same time, the invaluable incentive to improvement that is afforded by the cultivation of the spirit of emulation between the various shifts is fully utilised. As we have said, the method has been tried and found extremely effective, and it is in the hope that our readers will likewise profit by its adoption that we invite them to give it a serious trial.

The Battle of the Systems.

The question whether the battle of the systems, which has been dormant for many years abroad, is about to be resumed, has been raised by Dr. von Dolivo-Dobrowolsky, in a paper read recently before the Electrotechnical Association in Berlin, in the course of which he predicts a return to the direct-current system for the electrical transmission of power over long distances. The author points out that the substitution of alternating current for the then customary direct current gave rise to the transmission of power approximately three decades ago; but, in his opinion, transmission by three-phase current has now reached the limit of its possibility of development. With overhead conductors the economic limit for alternating currents lies at about 240 miles and a pressure of 200,000 volts, but with cables the limit is 60 miles. It is necessary, however, to think of the future, when engineers will have to deal with distances of from 300 miles even up to 600 miles. Great reliability can only be obtained by the removal of the conductors from the air—that is, by the substitution of underground cables; and the author, therefore, recommended the reversion to high-pressure direct current for this purpose. This is considerably more favourable for cables, and the further development rests with the future. The author invited all German engineers to co-operate in the matter, so that the prospective great revolution in practice should have its origin in Germany, and be of advantage to the whole world.

In this country the conditions are different; we have no long transmission lines, and unless and until we seriously contemplate generation on the coal-field and transmission to the centres of consumption, we shall not even approach the 60-mile limit for underground cables suggested by the author. As a matter of fact, recent investigations arising out of the national electricity supply proposals indicate that it is not profitable to transmit electrical energy in this country more than 30 miles. Hence the three-phase system, which has secured almost a monopoly of what we call "long-distance" transmission here, will serve our purpose for a long time to come, and it is rapidly growing in favour for distribution also.

We said "almost a monopoly," having in view the high-pressure direct-current system put down for the Metropolitan Electric Supply Co. some years ago by Mr. J. S. Highfield, which, we believe, is the only example of its kind of any consequence in this country. For Mr. Highfield's purpose the system offered certain advantages, and it would be interesting to know what progress has been made in its development and working.

We would, however, emphasise the fact that while this "tight little island" offers few opportunities for long-distance work, the British Empire abounds with them. The case of the Victoria Falls at once comes to mind, as one which aroused intense interest some 15 years ago; that problem still awaits a solution, but is only one of many similar ones on which the British engineer will soon, we hope, be engaged. The report of the Committee on Water Powers of the British Empire, which we summarised some months ago, contains particulars of numerous water powers of vast potentialities in remote localities—and the question relates almost wholly to water-power development. The subject, therefore, although of no immediate importance to us at home, has a very real interest to us in its bearing on the development of the natural resources of the Empire, as well as those of foreign countries: and while we do not attach much weight to Dr. Dolivo-Dobrowolsky's prediction, it behoves us to keep a close watch on progress in the technology of long-distance transmission in every school of engineering thought.

National Electricity Supply.

From the correspondence which has appeared in our pages, and the Memorandum of the Association of Consulting Engineers which we publish to-day, it will be seen that the report of the Committee appointed by the Institution of Electrical Engineers on the subject of electric power supply, to which we took exception in our issue of February 7th, is meeting with criticism in other quarters also. The Consulting Engineers fix upon the same point as ourselves—namely, that the Electricity Commissioners should be armed with wide and effective powers to act in an executive capacity, whereas the I.E.E. Committee proposes to limit them to advisory functions—a mere mockery of reform. It will be observed also that the Electrical Section of the Newcastle Chamber of Commerce, after discussing the subject, endorsed this view, and indeed it appears to be the general opinion; we shall not be surprised if the Provincial Centres of the Institution take the matter up.

We gladly seize upon the excuse put forward by Mr. C. H. Marshall, a member of Council of the I.E.E.—that the Committee, though appointed by the Council of the Institution, was not in fact, and was not meant to be, representative of the Institution of Electrical Engineers. It was a joint Committee representing some 14 engineering Associations, of which the I.E.E. was only one, and, as the Memorandum above-mentioned shows, the report of the Committee did not necessarily convey the views of any one Society correctly. This affords a loophole for the Institution, like the Association of Consulting Engineers, to escape through, and we hope that the matter will not be allowed to rest where it is. It would be most unfortunate if the report were to go forth as the verdict of the Institution as a whole.

The Trade Situation in Germany.

Herr Karl Friedrich von Siemens, chairman of the Siemens-Schuckert Works Co., is reported to have stated that it was necessary for the company to change over to peace work; but this operation was rendered difficult owing to the absence of willingness to work, and the lack of raw materials. Orders were not coming satisfactorily to hand; and foreign countries were withdrawing their orders, as they had no confidence that German works would be able to effect delivery under the prevailing labour disturbances. It was not possible for sale prices to keep pace with the increase in wages and in the cost of raw materials. The constant interruption in working through strikes, political demonstrations, and works' meetings had caused the average efficiency of the men to fall far below half the normal; whilst, on the other hand, higher wages per hour were being paid. The exclusion of the district on the left bank of the Rhine had had the result of causing it to be impossible to obtain supplies of many partly-finished materials.

The chairman of the Elektrizitäts A.G. (late Schuckert and Co.), of Nuremberg, addressing the shareholders at the recent annual meeting, stated that the year 1917-18 was comparatively favourable. On the other hand, the present situation was so unfavourable that the immediate future was looked to with anxiety. The hard terms of the Armistice had a paralysing effect on all undertakings, whilst the internal political and economic conditions were developing in a way injurious to industry. Operations in most departments at the Nuremberg works had had to be reduced to 34 hours per week, owing to the decrease in the working hours through the scarcity of coal, and the cancellation of war contracts which could be only partly replaced by peace orders and the very few orders received from the State. The strikes in Berlin, &c., had led to a fall in the output of the works by more than two-thirds of the normal, and wages and salaries and the prices of materials had considerably advanced. As a consequence of these circumstances and the internal conditions, the chairman remarked, the hope of regaining the export markets was vanishing.

Distributing Powers in London.

In the Report of the Municipalities of Greater London owning electricity undertakings, London has, for the first time, come under review in connection with the reorganisation of the Electricity Supply Industry. This Report, it will be remembered, dealt very largely with the political side of the question, the bias, needless to say, being in the direction of a thorough-going municipalisation. The chief point advocated was the establishment of an Electricity Board for Greater London, from which every company interest would be jealously excluded. In view of such a sweeping judgment, it might not be out of place to glance at the facts of the case from the point of view of the comparative interests of companies and municipalities respectively as they stand at the present moment. Thus, as regards areas over which municipalities and companies respectively have distributing powers, taking the area of Greater London as, say, 970 sq. miles, the municipalities hold distributing powers over 216 sq. miles and the companies over 402 sq. miles. It will be seen, therefore, that so far as Greater London is concerned, the company interests predominate very largely indeed. Further (and this is important, since the new schemes deal largely with the future), by far the greater part of the industrial area as yet undeveloped lies in the hands of the companies, this undeveloped area being situated in that outer belt of Greater London usually termed Extra-London. In this Extra-London area the municipal interests cover only 161 sq. miles, as compared with the company area of 338 sq. miles. The fact that the companies have almost a monopoly here has come about, apparently, through local authorities in the Home Counties having fought shy of municipal enterprise.

In the County of London itself, the difference is, of course, not nearly so great, but the preponderance is still on the companies' side, the respective areas being—municipal, 55½ sq. miles; company, 64½ sq. miles.

A review of these figures will show that, despite political convictions, when the question comes to be dealt with as a practical issue, consideration must necessarily be given to such obvious facts, and any scheme which ignores them cannot expect to be taken seriously.

A moral incidental to the London situation as given above is that each of the various big districts in England must be treated individually, and that conclusions drawn from a survey of England as a whole are often flagrantly misleading when applied to a particular district considered as a unit. Some districts are almost exclusively company, some municipal, and some—like London—hybrid.

THE COAL CONSUMPTION OF STEAM POWER PLANT.

By ROBERT H. PARSONS, M. Can. Soc. C.E.

As the cost of fuel is by far the largest single item of expense in the operation of a steam power station, the greatest factor in determining the cost of power production in any given station is the number of pounds of coal burnt per KW.-hour generated. This figure will depend, of course, very largely upon the nature and magnitude of the load upon the station, and upon the type of machinery installed, and to this extent it is beyond the immediate control of the engineer responsible for the management of the plant. But with any given load and equipment the coal consumption may vary between wide limits, according to the care taken in the operation and maintenance of the generating machinery. It is this "controllable margin" that deserves the most unremitting attention of the power plant manager, because the dominating influence of the coal bill on the generating costs makes the saving of even a small percentage of the fuel a matter of more practical importance than a corresponding saving on any other item of expenditure.

It is not the purpose of this article to discuss the various directions in which a saving of fuel may be brought about, but rather to direct the attention of engineers to a practical methob of keeping a check upon the efficient use of fuel shift dy shift, whatever may be the output during the shift. Incidentally, also, the method advocated gives the engineer a far more comprehensive view of the working of his station considered as an organised unit than he can acquire from a study of the log sheets and other periodical returns of the working of the plant. But it is the feature of independence of output which gives the method its peculiar value. The bare figure of coal consumed per KW.-hour is apt to be misleading. It depends very much upon the output during the period in question, and with a good load a low operating efficiency may show an apparently better coal-consumption figure than a really higher operating efficiency under less favourable conditions of load. For example, a coal consumption of 2·75 lb. per KW.-hour for a shift output of 40,000 KW.-hours might be really a distinctly worse performance than a consumption of 3·0 lb. per KW.-hour for a shift output of 20,000 KW.-hours in the same station. Yet the average station engineer, if satisfied with the second of these figures, might possibly be as well, or better, satisfied with the first figure, because he would not know what consumption might reasonably be expected from his plant at various loads. What appears to be required is a system of criteria for the behaviour of individual plants under varying loads. The nature and equipment of every power station affect the coal consumption to such an extent that a direct comparison between the coal consumed per KW.-hour in different stations is misleading as a test of efficiency of operation. Such comparisons could be made with great advantage by comparing the criteria of individual plants here suggested; but they would bring out the relative merits of the different equipments rather than the relative efficiency of the operation of the stations. The primary object of the criterion of a station is to serve as a standard against which the results of that particular station may be judged, and thus to form a continual check upon the efficiency of operation. Having such a criterion for his station, the engineer would have no difficulty in determining at a glance which of the two coal-consumption figures in the example given above really constituted the better operating performance.

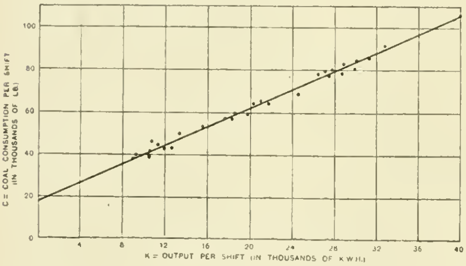

FIG. 1.—COAL-CONSUMPTION CHART.

It was shown by the writer some years ago[*] that both the coal consumption and the steam consumption of a power station apparently followed straight-line laws. These figures represented the operating results of a large Canadian power station under his management, and the conclusions deduced from them have been found equally applicable to data obtained over considerable periods from central-station practice in this country. Having once determined the law of coal and steam consumption for a given power station, we have a criterion by which the efficient working of the station may be judged at the end of every shift, and any departure from the standard will not only be definitely brought under notice, but the cause, whether it is to be found in the boiler-room or the engine-room, will also be suggested with reasonable certainty. Thus any change in operating conditions, whether inadvertent or intentional, will be reflected at once, so far as it affects the economy of the station, and adverse conditions can be discovered and rectified with the least possible delay.

To determine the standard coal and steam consumption for a particular station is a matter of great simplicity. Referring, first, to coal consumption, a chart is prepared on squared paper, the vertical scale being figured in total pounds of coal burnt per shift, and the horizontal scale in total KW.-hours produced by the main generators. For the steam consumption per KW.-hour a similar chart is prepared, the vertical scale in this case representing pounds of feed-water pumped into the boilers per shift, and the horizontal scale total KW.-hours per shift as before. Having prepared these two charts, at the end of every shift the total coal and the total water consumed are plotted respectively over the figure representing the output on that shift. When a fair number of results have been plotted, it will be seen that the dots lie about a straight line on each chart, and the line which lies most evenly among them must be drawn in. The easiest way to do this is to rule a line on a piece of tracing paper, and move it over the chart, when the best position of the line among the dots will readily appear. The appearance of the charts will be somewhat as shown in figs. 1 and 2. The greater the variation between the outputs of the shifts the more extended will be the series of plottings, and the more definitely, therefore, can the slope of the line be established. It will be found, however, that in the average station the difference in the outputs of the lightest and heaviest shifts of the day is quite enough to extend the plottings sufficiently, and the light Sunday load also provides points which assist in the location of the line.

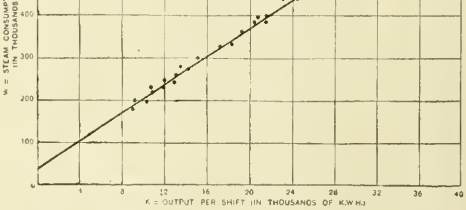

FIG. 2.—STEAM-CONSUMPTION CHART.

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[*] *Engineering*, November 14th, 1914.

Assuming the positions of the lines representing the total steam and coal consumption to have been determined in the manner described, the question arises as to what practical use can be made of them. The most obvious thing to do is to prepare a couple of new charts with the lines drawn upon them, and instruct the shift engineer to plot down on the chart so prepared the results of the working of each shift as soon as the figures are known. If any of the plottings come materially above the lines representing the standard figures, there is reason for inquiry, and the cause of the inefficiency may be investigated while the facts are fresh. The results of employing the charts in this way effected such a noticeable improvement in the efficiency of operation of one power station under the author's notice, that after a month it was found advisable to revise the standards and establish new and lower positions for the lines. Such a result would of itself justify the very small amount of trouble the method involves; but, apart from the check on overall efficiency of operation, the lines, when properly understood, throw a most valuable light upon the conditions obtaining in the plant.

Each line, of course, may be represented by a simple equation, which may be determined as follows:—Referring to fig. 1, let the coal consumption per shift be represented by C, and the output per shift by K. The value of C for any point on the line is obviously equal to the height at which the line cuts the vertical through 0, plus the additional height due to the slope of the line. The first of these quantities is read directly from the scale on the diagram—namely, 18,000 for this particular case. We also see from the diagram that when, for example, $K = 40,000$, the corresponding value for C is 106,000. Subtracting from this latter figure the constant of 18,000, we see that C increases in value by 88,000 for an increase of 40,000 in the value of K, or by 2·2 for every unit increase of K. The total value of C at any point is, therefore—

$$C = 18,000 + 2{\cdot}2\,K \quad \ldots \quad \ldots \quad (1)$$

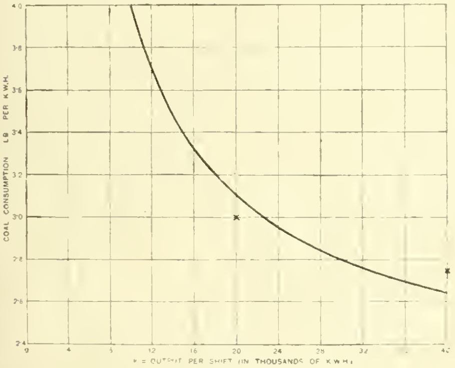

Fig. 3.—Coal-Efficiency Chart.

This is the equation to the line in fig. 1, and gives the total coal consumption corresponding to any value of K, that is, to any output per shift. By treating fig. 2 in an exactly similar manner, we get another equation, namely—

$$W = 40,000 + 16{\cdot}5\,K \quad \ldots \quad \ldots \quad (2)$$

where W represents the total water consumption per shift, and K the total output as before.

These equations bring out certain very instructive facts relative to the operation of the station whose working they represent. In the first place, we see from equation 1 that 18,000 lb. of coal are burnt per shift without any corresponding production of energy, and that an extra 2·2 lb. are burned for every KW.-hour generated. The constant loss of 18,000 lb. represents the fuel used to supply all radiation, condensation, and other losses, and is substantially the same whatever the load on the station. It is, in fact, the "stand-by" coal necessary to maintain the station in working order at no load. Similarly, we see from equation 2 that 40,000 lb. of steam are used per shift without any corresponding output of energy, and that 16·5 lb. are used in addition for every KW.-hour produced. As before, the constant of 40,000 lb. represents stand-by losses, leakages, &c., and remains substantially the same whatever the output of the station. These substantially constant losses of coal and steam must, of course, in the nature of things, increase to some extent with the load; but what the plotted results indicate is that such increase is negligible in practice, and that no practical error arises from treating them as substantially constant.

Referring, again, to the two equations, namely—

$$C = 18,000 + 2{\cdot}2\,K, \quad \ldots \quad \ldots \quad (1)$$

and

$$W = 40,000 + 16{\cdot}5\,K, \quad \ldots \quad \ldots \quad (2)$$

if we multiply the first throughout by 16·5, and the second by 2·2 we have—

$$16{\cdot}5\,C = 297,000 + 36{\cdot}3\,K,$$

and

$$2{\cdot}2\,W = 88,000 + 36{\cdot}3\,K.$$

Subtracting the second of these from the first, we have—

$$16{\cdot}5\,C - 2{\cdot}2\,W = 209,000,$$

which may be written either as—

$$C = 12,666 + {\cdot}133\,W. \quad \ldots \quad \ldots \quad (3)$$

or as

$$W = 7{\cdot}5\,C - 95,000. \quad \ldots \quad \ldots \quad (4)$$

These two equations might also have been obtained directly from the coal and water consumption figures in a manner similar to that by which the former equations were derived.

From equation 3 we see that if no steam at all were to be used during a shift, 12,666 lb. of coal would, nevertheless, be required to maintain the boiler house conditions and to keep up steam. If this figure is compared with the quantity of 18,000 lb. of coal per shift found necessary to run the plant at no load, it will be seen that the difference between these quantities—namely, 5,334 lb. of coal per shift—is consumed in generating steam which is condensed through radiation, &c., and recovered as water.

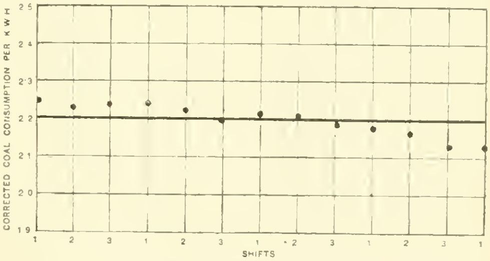

Fig. 4.—Water-Efficiency Chart.

Besides indicating the magnitude of the constant, or stand-by losses of the station in terms of coal and water consumed for the individual plant per shift, the equations further show that with the same type of station, and, therefore, for any other with equivalent efficiency of equipment and operation, any load which may be carried by the station can be generated for 2·2 lb. of coal, 16·5 lb. of steam per KW.-hour, and 7·5 lb. of water per lb. of coal, apart from the substantially constant stand-by consumption of coal and water.

From the same data, coal-efficiency and water-efficiency curves can be constructed (fig. 3), showing the consumption of coal and water per KW.-hour for any given output. These curves are obtained by dividing the total coal or water consumption per shift, as shown on the straight lines in figs. 1 and 2, by the corresponding output in KW.-hours, and plotting the points so determined. These curves show at a glance what coal and water consumptions are to be expected for any given output, and in addition enable performances at different outputs to be compared for their real, as contrasted with their apparent, efficiency. Take, for example, the question suggested at the beginning of this article, whether the consumption of 2·75 lb. of coal per KW.-hour for an output of 40,000 KW.-hours per shift was a better performance than a consumption of 3·0 lb. per KW.-hour for an output of 20,000 KW.-hours on the same station. If the normal coal performance of the station in question has been found to be represented by equation 1, it will be seen from fig. 3 that the efficiency of operation was less at the higher load, and a consumption of only 2·65 lb. might have been expected. The assumed consumption figures are plotted in fig. 3 for comparison with the curve.

Charts prepared as described above enable a continuous check to be kept upon the gross coal and water consumptions of the station, but do not show directly any variations in the efficiency with which coal and water are used. This comparison can be made readily by a slight modification of the charts. Referring to the coal-consumption equation, it will be seen that for the plant in question the consumption per KW.-hour would be a constant quantity of 2·2 lb. per KW.-hour if there were no constant losses. The relative efficiency with which the plant is being operated at various times, can therefore be seen by comparing the variations in coal consumption per KW.-hour in excess of the constant quantity required for stand-by. To make this comparison, the constant loss, when once it has been determined for the station, is deducted from the total coal consumption per shift, and the resulting figure is divided by the output per shift, a constant figure of normal or standard coal consumption per KW.-hour being thus obtained. The chart on which the coal-consumption efficiency of the station is recorded will appear similar to fig. 4. The base line is divided to correspond with the successive shifts, and a horizontal line is drawn at a height corresponding to the normal or standard coal consumption of the station per KW.-hour; in the instance here assumed, 2·2 lb. per KW.-hour. As soon as the coal return for the shift is handed in, the constant quantity representing the stand-by losses is deducted, the result is divided by the output for that shift, and a point corresponding to the quotient is plotted on the chart. If the point lies above the horizontal line the operating efficiency is shown to have been below the standard for that shift, and vice versa; and the general trend of the line obtained by joining the plotted points will indicate the progressive efficiency of the station. An exactly similar method may, of course, be followed in respect of the steam consumption of the station; and by means of a comparison of the two charts a very good idea may be obtained of the respective improvements in the operation of the boiler house and engine room.

THE CHINESE MARKET FOR MACHINERY.

THE following is a summary of a report recently issued by the Far-Eastern Division of the Bureau of Commerce of the United States Government:—

The present situation in China as regards machinery is more a question of supply than of demand. China, emerging from internal dissensions, economically rejuvenated compared with the destruction of wealth going on in Europe, has found the usual sources of supply practically closed by the war. With silver worth more than ever known, the people would be anxious and willing to buy were not the same low exchange price in gold for their exports a deterrent. Everywhere abroad the home markets are being considered first; and if ships are found for what is left, it is carefully parcelled out.

New Lines of Manufacture.

The result of these conditions has been the industrial awakening of China and a determined effort to supply some needs at home, with the consequent expansion of Chinese domestic industries. The necessity that has driven the Chinese to look to home manufactures to replace imports no longer available has been the mother of invention in more lines than one, and hardly any field of manufacture has been left untouched or untried. Among the new ventures noted during 1917 are pumping, mining, and printing concerns, flour and rice mills, cotton weaving and silk filatures, oil and paper mills, brick and cement works, candle and soap factories, glassware and porcelain industries, electric lighting and water works, chemical manufactories, sugar refineries, and factories for making surgical instruments, heating apparatus, electric lamp bulbs, bicycles, imitation Panama hats, motors, printing presses, needles and nails, clocks, tiles, carpets, canvas, and leather ware. Many other factories have been started in a small way, and in every case there is the primary need of machinery.

Supplies Must be Financed.

Due to the lack of capital, the large majority of Chinese enterprises are of a joint nature, the Chinese supplying the working capital, and foreign interests supplying the fixed capital, in the form of machinery and supplies. It must be pointed out that in a great many instances original installations have been made at a loss with a view to getting the profits out of the venture from accessories, repairs, and renewals, as well as from an advertising standpoint, with the advantage of subsequent business elsewhere. As a rule, the Chinese wish to pay for a new installation out of the profits, and the dominant position of German machinery in China before the war was largely due to the fact that they always took part payment and extended the balance over a few years. Moreover, German firms carried small boilers, steam engines, ice-making plant, hand flour and rice mills, oil engines, dynamos, and machine tools in stock, which were installed and payment arranged later.

The sale of machinery is largely dependent upon the [illegible] of financing such private enterprises, for, as has been pointed out, the lack of ready capital to cover initial purchases often leads to the machinery supplier being invited to participate in the enterprise. To those desiring to do business in this way the field is practically unlimited, just as the opportunities are very narrow for anyone expecting to do business on these lines as it is commonly transacted in the United States. Happily, the extension of adequate American industrial banking facilities is becoming more and more an established fact, and will serve as a valuable intermediary to those not desiring actual participation in the enterprises on the machinery for which they wish to bid.

Two Methods of Securing Contracts.

There have been two well-recognised methods of securing machinery contracts in China in the past. The first method is that of appointing one of the large mercantile houses having branches at all the important Chinese trade centres as general agents on a fixed agreement for a term of years. This was the system employed by almost all the large German manufacturers, and its principal advantage lies in the benefits accruing from an old-established connection on the ground with valuable Chinese connections. In addition to such agency, it has been found advisable to send one or more qualified engineers, trained at the home factory, who could use the offices and staff of the agents' branches in China on their trips of inspection, and co-operate with the agents' salesmen in obtaining business. The other and less desirable method for those just entering the Chinese field is to conduct the business direct with the Chinese and open offices at four or five of the trade centres with qualified engineers attached, who are competent not only to draw up specifications and quotations on the spot, but to carry on negotiations with Chinese officials and purchasers. There are, of course, any number of variations from these two general methods, but as a rule the first method is by far the more desirable for those new to the field, as the peculiar conditions of Chinese trade have nothing in common with conditions in this country, or in other foreign countries.

Shortage of Textile and Power Machinery.

In the course of analysis of the trend of the trade in China in various classes of machinery during recent years, the report points out that the decrease in the imports of textile machinery in no way denotes a backwardness in that industry. Owing to the fact that supplying countries were busy on war work, entries of this class of material showed a distinct drop in value in 1917 compared with 1915, and a still greater drop in quantity or weight. It is noteworthy, however, that Canada figured in 1917 as a furnisher of textile machinery to the value of about £40,000, whereas in 1915 her trade with China in that line was negligible. Judging by the unimportant influence on the importation of textile manufactures which has yet been exercised by the local industry, there is very great scope for the sale of spinning and weaving machines, and of the electric plant for driving them.

Inability to procure supplies accounts also for the drop in the sales of boilers, turbines, and other propelling machinery in the Chinese market, the total value entered in 1917 being less than half that in 1915, although Japan nearly doubled her sales in that line. Canada, too, sold such plant to the value of about £10,000, as compared with a mere £200 worth in 1915.

Larger Demand for Sundry Machinery and Machine Tools.

Imports of machinery for brewing, distilling, sugar refining, &c., are small, but increasing, whilst other new industries which have sprung up have involved an increase also in the value of the imports of machinery and parts "unclassified."

The total trade in machine tools has jumped almost 200 per cent. since 1916, and Japan's share has risen 300 per cent., that country taking not only its own share of the total increase, but practically all of the trade of Great Britain and France.

Demand for Electrical Materials and Fittings.

Under the heading electrical materials and fittings are included all accessories and appliances of an electrical nature. The use of these appliances is naturally limited to those cities and districts where electric power is obtainable, and the constant growth of this trade in these circumstances is promising. A great many electric power plants have been unable to get machinery during past years to take care of natural increases in consumption, and new contracts for electricity have been subsequently refused. With an increased import of appliances under such circumstances we can only infer to what size the business would have grown under normal conditions. The import figures for electrical materials and fittings appeared in the ELECTRICAL REVIEW for January 17th, p. 78.

Japan Dominates Chinese Machinery Market. Japan has taken a more and more dominant position in China's machinery trade each year. This is more readily seen from the totals of all classes of machinery imported, including machine tools, sewing machines, and electrical equipment, by countries, as given in the following table:—

Imports from—	1915. Haikwan taels.	1916. Haikwan taels.	1917. Haikwan taels.
Japan	1,720,189	3,721,456	5,043,924
United States	1,042,134	1,656,567	2,236,313
Great Britain	2,451,056	3,175,198	2,056,756
Hong-Kong	810,126	1,211,708	674,384
Canada	56,605	299,511	427,025
All other countries ...	977,988	159,730	190,097
Total gross imports ...	7.068,098	10,224,170	10,918,499
Re-exports	210,107	408,396	1,019,571
Net imports	6,857,991	9,815,774	9,898,928

N.B.—The Haikwan tael = 2s. 8d. in 1915, 3s. 2d. in 1916, 4s. 2d. in 1917.

Canadian Competition. These figures show a consistent demand for industrial machinery and equipment in China which has been unaffected by scarcity of goods abroad, high prices, or lack of shipping, but, even taking into consideration the increased price of goods as affecting total values, has at least held its own in a time of considerable disturbance. Although Japan has increased its sales to a greater degree than America, this increase has been mainly in electrical fittings and equipment, supplies which China is rapidly making at home. The growth of Canada's trade in other classes has offset the losses of Great Britain, and Canada bids fair to become a serious competitor in the heavier lines. The report says that there should be nothing to prevent the United States not only from holding the advantage obtained, but, with increased supplies at home after the war, to gain an even greater share of China's machinery business.

New Antung Plant. The electricity department of the South Manchuria Railway Co. expected to start up early this year the new plant, which has been under construction since July at Antung. This makes the third lighting and power plant operated by the South Manchuria Co. in the Antung district. While the new plant will remedy an insufficiency of electricity for lighting purposes it is intended primarily to furnish motive power for several new manufacturing enterprises, which it is expected will grow up in its immediate vicinity. The first of these will be the Anto Yoko Silk Mill. In addition a box factory and several smaller enterprises are being considered.

NATIONAL ELECTRICITY SUPPLY.

THE Special Committee, representing 14 engineering associations, which was appointed by the Institution of Electrical Engineers to consider the Board of Trade Report on Electric Power Supply, sent a letter to the President of the Board of Trade purporting to represent hose points on which the memoranda of the Associations were unanimous, but ignoring others on which they differed.' (See ELEC. REV., January 24th, 1919.)

The Association of Consulting Engineers has therefore sent its memorandum to the Board of Trade, and doubtless other associations which do not find that their views have been fairly represented will take a similar course.

The Association of Consulting Engineers finds that the letter to the President of the Board of Trade directly conflicts with its support of conclusion 88a of the Board of Trade Report—that large additional powers should be given to the Commissioners; the Association recommended that the Commissioners should have as wide powers and discretion as possible. The Association also agrees with conclusion 88f of the Board of Trade Report, that the District Boards should be free to operate in any of the methods indicated. The following are extracts from the memorandum:

The Association welcomes the recommendations that qualified Commissioners should be appointed for long terms, and be independent of the political forces which have played such havoc with the industry in the past. They should take over from all Government Departments the work of framing rules and regulations, and it should be their duty to advise Parliament on all matters relating to the electrical industry. They should when necessary initiate legislation, and, in a word, their functions should be creative and not merely restrictive. Wide discretion should be left to the Commissioners, and they should not be too much tied by specific directions of detail.

The power companies need special consideration; their licences are not, as with lighting companies, for a term only, and if and when their generating stations and main transmission lines are taken away, their business will be extinguished, and the suggested purchase terms provide no compensation or allowance for goodwill. In the cases of local authorities and lighting companies, the business is not to be extinguished, and the goodwill, therefore, has not to be purchased. There should be included compensation to the extent needed if the business is damaged.

The Commissioners should be placed in a position to enable them to meet the Postmaster-General on equal terms in the matter of wayleaves. In the past serious obstruction has been caused by the power of the Post Office to obstruct other users of the highways.

The way of arriving at the price to be paid is apparently intended to get rid of the difficulty of valuing either on tramway terms or on the value of the business by simply taking the concern as it stands. The consequence of this will be that those concerns which have not put away depreciation, reserve funds, renewal funds, or sinking funds will be better treated than those which have made due provision, because the purchase price is to be what they have actually spent less what has, in fact, been provided. But the necessity for a valuation will still arise, because only part of the plant is to be acquired, namely, the generating stations, and presumably the main transmission lines, and the funds which have been provided (and which are to be deducted from the actual expenditure), are only to be those which can properly be allocated to the generating stations, so that some part of the reserve funds, &c., are to remain in respect of that part of the plant not purchased. There will therefore be the necessity for some kind of a valuation to determine the allocation of the reserve funds.

Although it is intended that the main transmission lines shall be acquired, the purchase clauses contain no recommendation as to the method of valuing these lines. If those recommendations are embodied in an Act, this omission should be remedied. Incidentally, it is doubted whether as a practical measure it will in all cases be feasible to separate the main transmission lines from the rest of the distribution system. In many cases the same series of ducts and the same manholes will be used for both main transmission and for distribution.

It is doubted whether Clause 57 would give the Commissioners sufficient power to deal quickly with a contumacious District Board. It would appear desirable that they should have some summary power, such as power to suspend or terminate a licence and take over the working of an undertaking if necessary.

Clause 70 does not provide adequate safeguards for the officials. Any official displaced by the operation of the scheme should have his claim for compensation adjudicated by the Electricity Commissioners, and if hardship be proved should have the right to equitable compensation.

At a meeting of the Electrical Section of Newcastle-upon-Tyne Chamber of Commerce on the 11th inst., Mr. H. W. CLOTHIER presiding, the subject of national electric power supply was discussed. It was resolved to disagree with the conclusions in paragraphs (G) and (H) of the letter addressed to the President of the Board of Trade on behalf of the Committee convened by the Institution of Electrical Engineers. The Section felt that the Electricity Commissioners should have executive powers as recommended in the report of the Committee appointed by the Board of Trade

Mr. ELLIS reported upon the conference regarding the proposal to form an electrical federation in the district regarding the wages question, and it was resolved to call another conference at an early date.

The following resolution was passed by the Council of the I.M.E.A. at its meeting in London on Friday last week:—

"The I.M.E.A. view with great concern the suggestion which has been reported in the Press that the future control of electricity supply is to be taken out of the department of the Board of Trade, and to be placed under the proposed Ministry of Ways and Communications.

"Electricity supplies to collieries, factories, commercial users generally, and other consumers, preponderate largely over supplies to railways and to other undertakings coming under the control of the suggested Ministry of Ways and Communications, and it is feared that such control would be exercised in the interests of transportation, to the detriment of the larger interests involved in the general supply of electrical energy."

The secretary of the Association states that it has for some time been apparent that the report of the Board of Trade Electric Power Supply Committee, which has in its main principles been heartily supported by the I.M.E.A. and other progressive bodies, has not fully met the anticipations and desires of a section of the community particularly interested in electricity supply undertakings operated by companies, and it is very greatly feared that the proposal to take the matter out of the hands of the B.O.T. would result in making electricity supply subservient to other interests such as those of railways, and other forms of transport, and would further delay the putting into practice of the progressive movement in the national interests.

It is common knowledge that the B.O.T. has already proceeded with the preliminary arrangements to give effect to the recommendations contained in its committee's report, and the Bill has been looked for for some little time past.

The Prime Minister has on several occasions referred to the reorganisation of electricity supply, and placed the same upon his Parliamentary programme for the earliest attention.

It is considered exceedingly regrettable, and it is feared significant, that the matter was not referred to in the King's Speech, unless it is deemed to be included under the reference to "a Bill to establish a Ministry of Ways and Communications, with a view to increasing and developing the industrial and agricultural resources of the country by improved means of transport."

In sending a copy of the resolution to members of the I.M.E.A., Mr. Proctor impresses upon them the view of the Council that the matter is most urgent and important, and asks them to immediately lay the same before their Electricity Supply Committees, and, if they deem it necessary, before their Councils, and to have resolutions passed in support of the same, and to take up the matter with their Members of Parliament, desiring them to take action in accordance with the resolution when the question comes before the House.

Mr. Bridgeman, for the B.O.T., said on Monday in the House of Commons that a Bill for the establishment of national super-power stations would bé introduced at an early date. Consideration is being given to the question of ownership, but the question of coal prices could not be included in such a measure.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Re-employment of Engineers.

I have read with great interest your leading article in the ELECTRICAL REVIEW for January 24th, entitled "The Resettlement of Officers" But why officers alone, Mr. Editor? All the qualified electrical engineers, many of whom have, with "the long record of their brilliant and self-sacrificing achievements," covered themselves with glory, do not hold commissions in the Army, and, again, "As in the case of a private, so in the case of the officer—perhaps more so." (Why "more so"?) However, this is by the way. What I desire to state is that your remarks to the effect that the men who have served their country well, in her direst hour of need, now that the strife is over and the cause is won, ask not for sympathy, but for a practical manifestation of gratitude, represent exactly the true sentiments of the men for whom you are kindly appealing. They call out across the sea for a job, not simply because they have served, but because they have served *and are qualified.* There are, of course, a few who apparently think, judging by some advertisements in the "Situations Wanted" columns, that by revealing the fact that they have been in the trenches, or have been wounded, &c., they will secure comfortable positions; but broad-minded men, who constitute the majority, do not maintain that the fact alone of having fought, and perhaps bled, qualifies a man for a position which he hitherto was incapable of holding.

Well, then, how can these overseas men obtain the jobs they seek? How will their cries be heard? The great difficulty confronting both officers and men overseas having demobilisation in view, with regard to their re-entry to civil employment is that, unlike the ordinary run of occupations, only few vacancies occur from time to time in the electrical profession, particularly in the central-station line. These are advertised each week in the columns of the ELECTRICAL REVIEW. But what prospects of success has a man "out here" who is desirous of obtaining one of these positions, and who cannot secure his release from the Forces unless he first obtains employment? If he makes application, the vacancies are probably filled before his application reaches England.

Therefore, Sir, I desire to appeal, through your paper, on behalf of the Engineer officers and men serving abroad to the principals of the various electricity undertakings at home, when vacancies are about to occur in their respective stations to glance down the "Situations Wanted" columns of the ELECTRICAL REVIEW each week to ascertain if there should happen to be a soldier electrical engineer with the necessary qualifications for the particular job vacant, and, if so, to give him the job, for this is the gratitude he desires.

Sapper Black, R.E.

B.E.F., France.

The Export Vision.

I was very much interested in reading your leading article of last week under the above heading. You say, "Where is the manager or director who will call the employés together and tell them the story of the World as it is to-day, in relation to the class of goods that they are daily making?"

Whilst claiming no particular virtue, nor any degree of honour and glory, other than a desire to improve the relationship between employers and employed in the sphere of my own particular business, I would just say that I have, for some time past, acted in accordance with the above suggestion of yours, and also in the spirit of other suggestions contained in your admirable article. I heartily endorse what you say, as I have found it to be most beneficial to all concerned, and I strongly recommend it to the attention of other employers.

Sentiment plays a large part in all business matters, and especially in regard to the promotion of good feeling, or the reverse, in any works. When a man knows not only what he is making, and what the machine is for, but also *where* it is going to, it makes a great difference to his mental attitude, and to the degree of interest which he takes in his work.

As a nation, we are woefully ignorant in the subject of geography, to say nothing of history, and when a man neither knows the position of himself, nor his own country, in relation to the rest of the world, either as regards "space" or "time," *i.e.*, geographically or historically, he has no vision whatever, except of himself and his own immediate surroundings. He becomes a self-centred and short-sighted individual, with very little power of judgment or perspective, and this disease (for it is nothing less) of "shortsightedness," is one of the principal complaints in the country at the present time, and especially so amongst what are spoken of as "the working classes."

We are principally an industrial or manufacturing nation, as is well known, and our prosperity depends chiefly upon our export of various commodities, but our ignorance regarding even the geography of the British Empire, to say nothing of foreign countries, is appalling, and there must be something radically wrong with our educational system in this respect.

If I might make a suggestion, I would recommend that a large-sized map of the world be placed in a conspicuous position in every workshop in the country. This map could be ornamented with flags, something like a war map, showing the various countries and places of the world to which the products of the workshop were sent. This might perhaps do something, if only a little, to cultivate or produce that "Vision of Export" for which you plead, and if this were amplified occasionally by "talks" from the manager, it would help to remedy that short-sighted mental condition, from which, at the present time especially, our nation is suffering.

Workmen will get their education somewhere, and their employers are the people best fitted for the purpose, and if some effort were made by them to educate their own employés and workmen in the simplest rudiments of political economy, and in particular as regards the export trade of this country, there would be far fewer strikes for a 30 or 40-hour week, such as have been exhibiting themselves recently. Everyone would realise that there never was a time, in the history of England, when there was so much work to do for all (at a reasonable price), and such great prosperity in store for us, if we could only "open our eyes" and "take the tide at its flood," which is, or should be, *now*.

J. E. Lea.

Manchester, *February 12th*, 1919.

The Future of the E.T.U.

Permit me to thank you for your admirable article in the current issue of the ELECTRICAL REVIEW on the abortive strike of the London District members of the trade on the 6th inst., and to express my agreement with the sentiments of your correspondent, my fellow "Member, E.T.U."

To my mind, it is high time that the great number of members of the E.T.U., who, like myself, are patriotic, and have a sense of responsibility to our fellow countrymen, should take action, and

(*a*) Exert pressure and purge the irresponsibles and extremists from the ranks of our union, or

(*b*) Secede from the E.T.U., and form a society where violent politics are excluded, and where we can exercise our energies in the legitimate aims and purposes of a trade union.

May I suggest to you, Sir, that you allow the columns of the REVIEW to be open for a reasonable period for further correspondence on this subject, so that something practical may ensue; you will not only earn the gratitude of the moderate men in the trade, but also "do the State some service."

Constitutional.

February 15th, 1919.

As an E.T.U. member on the negotiating committee for wages, &c., I must write and deprecate the action of certain E.T. Unionists writing to your paper on matters which should have primary discussion in their branches; but, lest the public be still further misled, an answer is certainly desirable to some of your correspondents.

Evidently, by his letter, "Member E.T.U." is not a member of a station branch, or he would be aware through that branch of the steps we took to secure the lighting and power supply of London until such time as our Society required the adoption of a drastic policy. Certainly at no station branch meeting held on the Friday were station men told they should have come out; instead, discussion ensued as to how and why certain men had stopped work on the Thursday, especially as the notice in the Press referred to by your correspondent distinctly stated that station men were not to stop work that night. During our discussion it was found that certain men in outlying districts had stopped work, due to the fact that telephonic communication between us and our members had been stopped, and further, the powers that be had also seen fit to hold up nearly all the telegrams we sent off, and those which were delivered had in some cases had the wording altered so that a totally different impression was conveyed.

However, the reference to the sale of *Heralds* at meetings is a different matter. I think No. 3 Branch is the only station branch which has a policy of selling *Heralds* at its meetings, and as I am the individual responsible for their sale, I can assure your correspondent that there is no relationship between their sale and the propagation of Mr. Lansbury's particular views. Personally, I am quite aware that current events are just as much distorted to suit his point of view as they are also distorted by the Northcliffe Press, &c., for their particular objects—and here, let me say that the Press reports of the contemplated strike were only a series of distortions supplemented by some most extraordinary guesswork. But the one and only object for selling *Heralds* is to stimulate discussion and interest in current Labour topics at the branch meeting. The distribution of these *Heralds* has always caused me a certain amount of inconvenience, to avoid which on two occasions I gave up supplying them, and I have only re-started the sale at the urgent request of my fellow branch members, who are evidently convinced that, allowing for the biased opinions expressed in some articles, the paper is still a very interesting and instructive pennyworth from the trade unionist point of view.

With reference to "Shift Engineer's" concluding remarks, he had better not take that loyalty too much to heart, for I think the E.P.E.A., the N.A.S.E., also the A.E.C., claim to have the monopoly of that not much sought after spirit; all that we E.T.U. members insist on is loyalty—brotherhood we term it—to one another, but, Mr. Editor, should a drastic policy ever be decided on, rest assured that the station man will have his say and his vote on that policy, and, once decided on it, he will go ahead without any qualms of loyalty as suggested. and Mr. Farrar may then be lectured on the other side of the object-lesson he has so ably explained. But this policy, I hope, will only be adopted when all reasonable methods have failed to remove a genuine grievance, and I have too much faith in the intelligence of my fellow members to think they will be stampeded into any hopeless policy by what some of your contributors quote as the Bolshevik element. Let "E.T.U. Member" attend his branch and help to shape the future policy of his Society, and see to it that the appointed officials carry out that policy; then we shall have seen the last of the days when the daily Press can portray to a very gullible public how English trade unionists are being exploited through the agency of Russian and German gold.

J. J. M.

February 17*th*, 1919.

Recent events have placed the E.T.U., as far as the London Branch is concerned, in a very unfavourable light. Both the general public and the technical Press rightly denounced as dastardly its action in trying to put London in darkness, and looked upon it with contempt when it was found out that it was unable to do so, and that the whole thing was a bluff.

To come to the point: Are the members of the E.T.U. Bolsheviks? Emphatically no! The majority of the saner minded men were dead against coming out, and in a good many instances flatly refused. A number of the leading contracting firms tell me that some of their best workmen are members of the E.T.U., and my own experience confirms this. These men and others of the same class are highly indignant now that they find the strike was not called for their benefit, but that they have been made the tools of irresponsible sedition-mongers and led astray by a few undesirable aliens seeking power at their expense. The members realise that they have been badly let down by their "leaders," and at one branch meeting at least a resolution was passed calling upon the Executive to resign. The E.T.U., to put it very mildly, is out of favour both with the general public and with the trade. What is the cause, and what the remedy? The cause is not far to seek.. It is that the E.T.U. does not represent any section of the electrical trade. It has a membership, I believe, of about 22,000, composed of wiremen, electricians, armature winders, mates, boys, and labourers. As everybody has a vote, and as the skilled men are in a minority, they do not get the representation they deserve. In a nutshell, they have gone in for quantity, and not quality. It has been said time and time again by men of experience that it is very galling and distasteful to have to work with men getting the same rate of wages and equal rights with perhaps two years in the trade. The remedy is in the hands of the members themselves, and they will never advance until they apply it. It is, to make their union a craftsman's union. Let the men who are good at their work and have served their time at it band themselves together, and let ability be the test of membership. Let them form a branch of their union *as* electrical workers—first-class men who know their job and take a pride in it. A greater self-respect and the good opinion of all concerned would be a foregone conclusion. This would lead to a desire for better conditions, and a willingness to deserve and earn them. Instead of holding meetings at public-houses and drinking thin beer they would have a place of their own with a useful library, where they could hold their meetings in comfort, and be better in body and mind for so doing. This is no figure of imagination; more than one set of men have been working on these lines for some time with highly successful results. From information which reaches me from various sources, I know that a number of the best men of the E.T.U. are in sympathy with these ideas, and would gladly see them put into practice. There is room for an independent man of good standing in the electrical world to give them a lead.

An Electrical Trade Union Worker.

[We refer to this matter in our leader to-day.—Eds. Elec. Rev.]

A Protective Association for Non-Technical Officials.

It is gratifying to see the interest manifested by such a large number of clerks in the question of organisation.

I regret that I gave the impression that all the clerks, including those in the electrical departments, engaged by the undertakings specified in my last letter, were members of the N.U.C. I sincerely hope that ere this they have become members. It appears to me that the correspondents are all agreed as to the need of a protective organisation, but not as to the type of organisation that will best serve their purpose. As an old trade unionist, I am strongly of the opinion that clerks, including non-technical officials, can only secure improved conditions by joining the National Union of Clerks, which caters for them.

The strength of the National Union of Clerks lies in the fact that it not only has Guilds for the special needs of a particular section, but that it unites all these sections into one cohesive body.

It must be obvious to every clerk that the conditions prevailing in one place must reflect upon the conditions in other offices. All clerks have a common aim, and must adopt an organisation which embraces all clerks if it is to perform its real functions.

In concluding, I appeal to all non-technical officials to let me know, through the columns of your valuable paper, whether they are prepared to attend a special conference if one is convened.

Power Company Clerk.

February 10*th*, 1919.

I have read with much interest the correspondence you have permitted on the subject of the organisation of the clerical and so-called non-technical staffs of electric supply undertakings.

It is perfectly clear that there is at present too much division in the camp; for example, take the position of a sales engineer who wishes to join an association: he has at present three different associations appealing to him, and none of these large enough to wield any real power. I confidently suggest *the only remedy is for each of these smaller Associations to become affiliated to the E.P.E.A.*, which has now obtained a large membership, and includes many chief engineers. *The E.P.E.A. can then hold a mandate for the whole of the salaried staffs of the electric supply undertakings*, and the beneficial results of this are easily foreseen.

It is to be hoped that the secretaries of the various associations referred to will immediately take steps to obtain the consent of the E.P.E.A. to affiliation. If this is done, and made generally known, I feel quite confident that the organisations will meet with unanimous support.

Accountant.

With further reference to my letter of February 7th last on the above subject, the following supplementary information may interest your readers:—

The Executive Committee of this Association, and that of the Chief Commercial Officers' Association, have for some time past given careful consideration to the question of closer affiliation between both Associations, and at a joint meeting of representatives of the two Executive Committees held on Monday last it was resolved to combine the two Associations into one organisation, which will in future be known as the Electricity Supply Commercial Association.

It is not possible to state the details of the amalgamation at this early stage, except that the Association is to form separate internal sections, in order to allow opportunity for independent discussion on matters relevant to a particular section only. Any further arrangements will be subject to the decision of an early meeting of a provisional national council representing members throughout Great Britain. This information will answer the many letters of inquiry that have already been received on the subject.

Your correspondents will also be pleased to know that, as a result of the information given in your issue of February 7th, applications for membership are pouring in wholesale from all parts of the country. Furthermore, the correspondence which now reaches me shows an earnest desire on behalf of the clerical staffs of electricity supply undertakings to help us to the utmost in our aim. I am sure that the closing up of the ranks as indicated above will result in a further increase in membership in the near future.

Will all members, correspondents, and intending members please note that future correspondence should be addressed in the first instance to the Acting Hon. General Secretary, Electricity Supply Commercial Association, 39, Leghorn Road, Plumstead, London, S.E. 18.

G. R. Smith,
Acting Hon. General Sec.,
Electricity Supply Commercial Association.
London, S.E., *February 18th*, 1919.

I am very glad to see that things are beginning to move at last, and quite agree with "Supporter" when he suggests a Union to combine with the E.P.E.A. We do not want to read in the papers any more: "Owing to bad treatment on the part of the management, the switchboard engineers at the electricity works ceased work, but, thanks to the assistance of the clerical staff, their action was abortive, &c." To join forces with the E.P.E.A. would strengthen them, and make a strong combination; in fact, I am rather surprised the suggestion has not been made before officially by the E.P.E.A.

The interests of the clerical staff are absolutely wrapped up with those of the engineers, and on the success of the industry they both stand or fall together. It is obvious that the power-house clerical staff, many of whom have 10 to 20 years' specialised experience, are highly technical, and have not much in common with a clerk in, say, a grocer's shop (who, presumably, should join a grocers' union). I would also like to point to the Railway Clerks' Association, who prefer to work with the Railwaymen's Unions rather than the N.U.C., which is quite consistent, as their interests are bound up with those of the railwaymen. The N.U.C. is an excellent body, but not quite appropriate in this case.

Another Supporter.
February 17th, 1919.

The I.E.E. and National Electricity Supply.

The letters in your issue of February 7th from Mr. C. H. Marshall and Mr. Napier Prentice, apart from their bearing on the above important matter, touch upon another vital point, viz., the recently-acquired habit of Committees who, instead of reporting to those who appointed them, take important steps without sanction or discussion by the body of members of the Institutions or Associations in question, and by this means disenfranchise the main body of members.

In these days, when momentous decisions are being taken by the Government, we cannot allow even the Council of the I.E.E. (to say nothing of a sub-committee) to speak in the name of the electrical industry or profession until and unless the intended pronouncement is submitted to members for discussion. I hope steps will be taken by members of the Institution, and also of other Associations with which I am connected, to ensure democratic control of the actions of their committees.

In the meantime some influential action should be taken to acquaint the President of the Board of Trade with the situation, otherwise the effect of the Committee's letter to him may be to discourage the Board, and so deprive the country of a national electric power supply scheme approximating to that which the Board of Trade Committee recommended, and which the public expects.

W. Fennell, M.I.E.E.
Northwich, *February 11th*, 1919.

The Great Northern Telegraph Route.

My attention has been drawn to a note in your issue of February 14th about cable delays, in which this company's lines to the Far East are mentioned as passing Germany, and having been interrupted at the beginning of the war. This is not so. Our lines do not pass Germany—nor have we ever had any cable landed on German or other enemy territory—and they were working right up to the spring of last year, although with difficulties owing to the revolution in Russia. I should feel much obliged if you would cause this letter to be inserted in your next issue.

Paul Westergaard,
Great Northern Telegraph Co., Ltd.
London, E.C., *February 17th*, 1919.

[The statement referred to was published by the *Daily Telegraph* on the authority of the Eastern Telegraph Co.—Eds. Elec. Rev.]

Electrical Contracting.

Under this heading in this week's Review I see letters written by two men styling themselves "Amused" and "Live and Let Live" respectively. Methinks that behind those letters, which are, of course, not signed (my letters always are, and are open to honest criticism), there lies a motive other than the one of electrical advancement in the contracting line. Both these gentlemen, I fancy, have found the cap fitted them, apropos of the style of electrical work I mentioned in my first letter to the Review some weeks ago. I am sincerely sorry that they have taken the attitude adopted by them of attacking a man in the dark. I really thought, judging by the warm appreciation extended by you, Mr. Editor, in your first footnote, and which I have constantly received from those of high knowledge and experience mentioned by "Amused," that it would have led to something far better than the personal attacks of your two correspondents.

I alluded in my letters to the fact that rotten jobs had been put up in the past, and would be put up again also, unless some higher standard for electrical work, speaking generally, is adopted throughout the country. As practical contractors, both gentlemen must have come across too much of the class of work which I, for one, would like to see cut out altogether. What is there to prevent a plumber, or a gasfitter, at the present moment from putting in electrical work? I fancy the plumber must have put in some work I saw only last week, for it consisted of ordinary lead tubing with some lovely bends and sets in it, passing through a fairly large laundry; the cables inside the tube must, of course, have been there while the bending process was going on. I also saw a fair amount of lighting wiring carried out in water piping, including elbows, &c. I often wondered how the cables were taken to the different positions without seriously damaging their insulation. These two instances are only given as showing that our "profession" requires a slight lift up. Any electrical man who is knocking about on different jobs will tell you of the rotten work he comes across from time to time.

I am not seeking to cut out poor work as a cheap advertisement for myself personally. Most firms doing general contracting also carry out considerable electrical work, and employ fully qualified electricians at the highest rates of wages to undertake and carry out such work. There is, and will be in the near future, perhaps nearer than some people think, plenty of good-class work for those who want to cater for that class of work. I have heard it mentioned that some day "price-cutting estimating" may be entirely abolished, and instead, the work be given out on specification, a working percentage being allowed to carry out the work. The customer would be the gainer by such a system, and it would stop a lot of the throat-cutting existing at the present time.

I don't agree with "Amused" that the "labour" is to blame always for bad work, and not the material. If a good workman is given, say, tubing to set and bend which was never intended to be used other than in straight lengths, I fail to see how he can make a job of it. Yet I have seen the workmen blamed under these circumstances. On the other hand, I have seen a workman try to bury a conduit sunk box in a lath and plaster wall, and the tubing with it; perhaps his boss wished he had been buried with it! Such work has in many cases resulted in the firm in question losing repeat orders. If "Amused" has been bitten by this class of man I sympathise with him.

In conclusion, I fail to see where the attempt to curry favour in some unknown quarter comes in, as mentioned by "Amused." I took up the matter fully knowing what I wrote to be positive facts, with the hope that someone else more worthy than myself might be able to carry the point a little further than I could, and ultimately something tangible might be set up whereby a higher standard of electrical wiring might be attained. Considering the adverse criticism of the letter I wrote, it would be quite a treat if I could see one written by someone who, like myself, has no ulterior motive, but has his heart and soul in the electrical trade, no matter whether it be contracting or carrying out plant maintenance. Thanking you for the appreciation you showed me, and which I regret no one else so far has shown, I wonder if jealousy has anything to do with it? Personally, I sincerely hope such is not the case.

H. Fowler.
Liverpool, *February 17th*, 1919.

[This correspondence is now closed.—Eds. Elec. Rev.]

Engineer Surveyors' Salaries.

Referring to "Pitman's" letter in your issue of the 14th inst., after quoting a few dividends paid to the shareholders of certain insurance companies, he states that the figures in question were circulated by the Engineer Surveyors' Association a few months ago.

As the statement, to put it mildly, is inaccurate, I am directed by the Executive of the Engineer Surveyors' Association to say that no such figures have ever been issued, or authorised, by themselves, and they know nothing about the calculation referred to. I may add, however, that a private paper read last year by one of our members contained somewhat similar information *re* dividends. On being brought to the notice of the Executive, the figures were considered to be misleading, and consequently were not reproduced.

"Pitman's" further remarks regarding registering the Association as a trade union, &c., do not call for any special comment, as all members are cognisant of the actual position of affairs, and consequently know what value to place on the various statements made.

F. Trapnell,
General Sec., The Engineer Surveyors' Assn.
Manchester, *February 17th*, 1919.

Import Restrictions.

We understand that the policy to be adopted in regard to the continuation of restrictions on imports is receiving the consideration of the War Cabinet. The Federation desires to press most strongly on the Government the absolute necessity of not allowing products which compete with those of any industry in this country to be imported and sold at prices with which existing conditions make it impossible for the home industry to compete, until that industry has had a reasonable opportunity of converting from a war to a peace footing. Unless this course is adopted, the resumption of normal industrial activity in this country will be gravely prejudiced, and the effect upon employment must be most serious in the present condition of industrial unrest.

The Federation realises that pressure may be being brought to bear upon the British Government by foreign Governments who desire to import into this country, but such considerations appear to it to be infinitely less important than those to which reference has been made above.

In any case, it would urge that no relaxation of import restrictions should be made in deference to the representations of a foreign Government without securing from that Government a substantial *quid pro quo*, and that in any such case the relative value of the concession which is being made to the foreign Government and of the benefit to be received in return should be most carefully weighed.

Finally, I am to urge that no decision should be taken on this most important question without the fullest consultation with representatives of the industry of the country, and to say that we shall be most willing to place our organisation at the service of the Government to advise them, should they so desire. I am to point out, further, that the decision of the questions which arise in connection with the raising of restrictions and granting of licences often involves very minute inquiries into the available and potential supplies of small articles. These inquiries can most satisfactorily be made through an organisation such as ours, which comprises manufacturers in every branch of industry, and has collected very full statistics as to the products of the various industries, and we have already been able to render considerable assistance to the Government in dealing with questions of this kind referred to us by the Department of Import Restrictions.

V. Caillard,
President, Federation of British Industries.

London, S.W., *February 17th*, 1919.

"State Salary Expected."

I agree absolutely with "Applicant." Why is it? Because, like the Jew, whom it is so fashionable to despise, those advertisers have an innate dread of stating the amount lest they might be offering a little more than the applicant might have asked. There may be strong disagreement with my remarks, but I say openly that my varied experience has taught me that the average British employer in his own country is *not* straight. He prefers to equivocate rather than to define. Men of our race abroad, whether represented by the American or others, *say* what a job is worth *first*, and then see that they get a man who is worth it. Here they don't, but angle for brains; delude a man, if possible, into their service, then dole out remuneration with an unhealthy satisfaction that they have cheated somebody.

Disgusted.

Hundreds of technical men will surely be in sympathy with your correspondent "Applicant" on that absurd clause which appears in so many advertisements: "state salary." Any man answering such an advertisement is naturally tempted to suggest a higher figure than he would really accept, and consequently the job must often go to an inferior individual, or one who, by underestimating his own value, is really acting against the interests of the profession.

As your correspondent points out, the advertisers know what sort of man they want, and how much they are prepared to pay him, at any rate within a few pounds. If they cannot state a definite figure, I should like to suggest adopting an indefinite statement such as, for example, £250-£280, or, say, £270 approximately. This would clearly indicate to the applicant whether it was worth his while to apply for the post, and would save the advertisers the trouble of reading through numbers of unsuitable applications.

Interested.

February 16th, 1919.

I support "Applicant" on the above subject. How would employers care to tender for contracts on such vague information? Employers ought to know what the situation is worth, also what they are prepared to pay, &c. I believe most applicants apply for situations and accept them with the hope of advancement, but "there's many a slip." If men are caught gambling with pennies the law inflicts a heavy fine, and it is far worse to gamble with one's home, and it is a scandal to encourage it. Unfortunately, this scandal is spreading.

Anti-Cheapness.

February 14th, 1919.

I fully agree with "Applicant" that if employers advertising situations vacant would state the salary they are willing to pay, it would save a number of men from wasting time on applications for unsuitable jobs. If, as is suggested, employers are out for the cheapest man they can get, it would appear to be useless for a man requiring a fair wage to answer those advertisements which say "state salary expected."

I should also like to point out to employers that a considerable number of men applying for situations desire, if possible, to obtain work in a certain district, and it would save these men a lot of time and trouble if advertisers would state *where* the vacancy is situated.

C. A. B.

February 17th, 1919.

[This correspondence is now closed.—Eds. Elec. Rev.]

The Shorter Working Week.

I shall be greatly obliged if you can publish the following solution for the "six eight-hour shift week" in your "Correspondence" Column.

	Weeks.			
	1st.	2nd.	3rd.	4th
Monday	N	E	D	Off
Tuesday	N	E	D	SD
Wednesday	N	E	D	SD
Thursday	N	Off	D	E
Friday	N	E	D	SD
Saturday	N	E	Off	D
Sunday	Off	12 hrs. E	Off	12 hrs. N

N = night shift; E = evening; D = day; S.D. = spare duty (for which I suggest efficiency tests of plant, plant repairs, and meter testing and repairing).

It will be seen that by working 12-hour Sunday shifts, every other week-end can be taken off, or one in four off if eight hours are worked, when the D and relief man could arrange days off to suit the locality.

It will be noticed that two good week-ends are obtained, N finishing on Saturday morning and resuming on Monday afternoon, while D finishes on Friday (four hours earlier if 47-hour week), and becomes S.D. on Tuesday. It also has the advantage that the relief man automatically drops into the night shift for the fifth week.

Shift Engineer.

February 17th, 1919.

Electrified Seed.

Dr. Mercier is too late! I married the sailor's mother who was sceptical about the flying-fish, but who thought it might be true that a wheel of Pharaoh's chariot had been found in the Red Sea. She never told me anything about "mountains of sugar and rivers of rum," and I shall be grateful to Dr. Mercier for a reference to the author of the phrase. As a *quid pro quo* I offer him a slight correction.

I do not believe that the "electrified chickens" (between inverted commas) which I saw were improved by being electrified, as they were treated so much better in many ways than ordinary chickens that a proper test, with the necessary control experiments, proved that electricity was not required; and, unless Dr. Mercier has himself carried out proper trials—not merely causing "great pleasure to Mr. Fry and his friends" by being able to visit several farms and inspect the crops grown from electrified seed on the eve of last harvest"—I shall incline to the belief that Dr. Mercier has been mistaken for once in his life.

Washing seeds in artificial fertilisers—as you, Sir, have already pointed out—may do a lot of good; and, if the effect of washing and drying seeds is to make them lighter, it is evident that by planting *the same weight per acre* of treated and untreated seeds, there is no mystery about the "electrification" which enables somebody "to pocket the money and do it again." Has Dr. Mercier seen the banking accounts to which he alludes?

Wide Awake.

February 15th, 1919.

[Several letters are unavoidably held over.—Eds. Elec. Rev.]

Munitions Plant Sale.—The *Times* states that a five days' sale has been concluded at Birmingham of the engineering plant and machinery at the National Shell Factory. There were 1,564 lots; electric motors realised prices exceeding their original price, and time-recording machines made double their cost.

LEGAL.

Re Armorduct Manufacturing Co., Ltd.

In the Chancery Division, on February 13th, the affairs of the Armorduct Manufacturing Co., manufacturers of electric cables and accessories, were before Mr. Justice Younger, under the Trading with the Enemy Acts, the Controller of the company appointed by the Board of Trade asking for the directions of the Court as to how he was to deal with the assets of the company remaining in his hands, more particularly in respect of claims by the former managing director and secretary of the company.

Mr. J. T. Matthew, K.C., for the Controller, said early in the year 1907 the company entered into an agrement with Mr. Wm. Ratcliffe Small, by which he was to receive as managing director a salary of £500 a year, together with 20 per cent. of the net profits of the company, the agreement being subject to 12 calendar months' notice. In the event of the company giving the notice, they were to pay the £500 immediately, and in the case of Mr. Small giving notice, the company had the right to require him to leave at once on payment of £500 to him. In respect of his salary, Mr. Small was to have a preferential claim over the company's assets. At a meeting of the directors of the company held on December 5th, 1907, Mr. Small's salary was increased to £750 and his share of the profits increased from 20 to 25 per cent. He was to have sole control and management of the business of the company, but he was free to engage in any other business which did not interfere with the business of this company. Subsequently, an agreement was entered into for 10 years, by which Mr. Small was to receive £1,200 per annum salary during the present war, to be increased to £1,500 per annum upon the signing of peace between Great Britain and Germany.

On January 7th, 1917, Mr. Small wrote to the Controller, saying the Board of Trade had notified him that the business was to be wound up immediately. The Controller replied relieving Mr. Small of his position at his own request, and saying that he (the Controller) would be glad to avail himself of Mr. Small's offer of assistance in respect of Government contracts then on the books of the company. At a meeting of the company, at which, it was alleged. there were no independent shareholders present, a special resolution was carried awarding to Mr. Small £3,000 for special services rendered to the company. It was in respect of this amount which had been credited to Mr. Small in his account with the company, together with his claim for £1,200 for one year's salary, that the Controller now asked for directions.

Mr. Schiller, K.C., for the respondent, Mr. Small, read an affidavit by his client, in which he claimed he was entitled to the sum of £3,000, based upon the profits of the company for the past three years.

Mr. Matthew said that was exactly the position. It had been suggested that some compromise might be arrived at, subject to his Lordship's approval.

His Lordship said, on the evidence before him, he conceived Mr. Schiller would say that the meeting at which the £3,000 was voted was a properly-constituted meeting of shareholders. Everything turned upon the validity of the resolutions, which it was said were carried by the votes of the person who was to ultimately benefit.

His Lordship ordered the summons to be amended by raising the point asking that Mr. Small be ordered to pay to the company the sum of £3,000 alleged to have been wrongly credited to him in the account as between him and the company.

British Westinghouse Electric and Manufacturing Co., Ld.

Mr. Justice Astbury, in the Chancery Division, on Feb. 18th, heard a petition by Mr. H. G. Wright on behalf of this company, asking sanction to the alteration of the articles of association.

Mr. Wright, in support of the petition, said the company was an electrical company carrying on a fairly large business. Its present capital was divided into 685,000 preference shares of £2 each, all of which had been issued and fully paid, 75,000 ordinary shares of £1, none of which had been issued, and 500,000 deferred shares of 1s. each, the whole of which had been issued and fully paid. The last class of shares were all held by one person, and were really issued for voting on a certain particular. The object of the company was to carry out an agreement between the Westinghouse Electrical and Manufacturing Co.. a company constituted under the laws of the State of Pennsylvania, on the one part, and the petitioning company of the other part, and to carry on the business of electricians, engineers, makers and suppliers and dealers in electricity works, power. and light. The main object of the company, said counsel, was the promotion of subsidiary companies, and it was proposed to insert a clause in the memorandum of association as follows:—"To promote and reorganise any company, whether British, Indian, Colonial, or foreign, for the purpose of acquiring undertakings of such companies, or for carrying on any business which the petitioning company was authorised to carry on, or in furtherance of any of the objects of the company. Further, to underwrite the shares, debenture stock, or other securities issued by such company, and to guarantee the payment of the capital and interest of any such shares, debentures. or other securities, or the payment of the minimum rate of dividend on such shares, and generally to guarantee the performance of any contract entered into by any such company."

Counsel read evidence which went to show that the desired alteration of the company had been brought about by the present state of electrical business, due in a great measure to the removal of German competition. They asked for extended powers to develop their business in the United Kingdom and in other parts of the world, and. with this object in view, they desired to improve the method of conducting their business, and to subsidise companies. They were not really in a sense extending their business, but improving their methods and subsidising companies, in all of which they were going to hold shares.

Mr. Justice Astbury drew attention to the fact that there was a large debenture issue.

Mr. Wright said the company had issued mortgage debenture stock for £1,241,353 4 per cents., and also prior lien debentures for £250,000, bearing interest at the rate of 6 per cent.

His Lordship asked whether it was usual to act on a petition of this kind when the debenture-holders were not represented?

Mr. Wright said that the debenture-holders had all received due notice of the application, and he took their non-objection as an assent to the proposal.

His Lordship: The debenture-holders are as large as the shareholders?

Mr. Wright admitted that that was so; but he reminded his Lordship that the company was not taking extended powers but merely asking for a change in the methods of carrying on the old business.

His Lordship: Very well; you may take your order.

BUSINESS NOTES.

Our Letters from the Forces.—A demobilised central station official writes:—

"I have just succeeded in getting demobilised, and wish to take this opportunity of once again thanking you very heartily for your continued kindness in sending me the Review. I always eagerly looked out for it, and could be certain of finding plenty to interest and instruct me in the various articles, letters, news items, &c. After I had done with it there was always a crowd waiting to borrow it, and we had many pleasant little discussions regarding the different opinions expressed therein. I almost wonder which my late 'pals' will miss most, the Electrical Review or myself. I might say that during the whole time you have been sending (nearly two years) I have never missed a single number."

A major, well known in the electrical industry, in the course of an interesting letter, refers very gratefully to the Electrical Review for forming a link with home for so long. "The Review has followed me to France, Belgium, India, Mesopotamia, and Persia during the past 4½ years. It has reached me in many remote spots, even travelling by aeroplane post from Mesopotamia to Persia. At times when I have seemed most out of touch with the world in general, it has served to recall many of my visits to Ludgate Hill in the pre-war days, and helped to conjure up many visions of electrical progress during the after-war period."

Two Lead Market Reports.—Messrs. James Forster and Co., London, E.C., report under date February 15th:—

There are no buyers of forward lead, and on the Metal Exchange no offers have been made either of prompt or forward lead during the week. The official price for controlled lead remains at £30 per ton net.

The American market is again lower at 5 cents per lb., which would be about the equivalent of £25 per ton here. American lead (uncontrolled) is offering at about £29 10s. net, and a little business has been done at this for prompt delivery. So long as present conditions continue this market will remain practically dormant.

With round about 100,000 tons in stock here, large stocks in the hands of producers in Australia, America, and Spain, there is no room for any other policy on the part of consumers than that of buying from hand to mouth. A cut in prices of several pounds a ton would not, we think, induce free buying.

The Government will have to take the matter in hand without delay, as the present tactics will leave the stock on their hands indefinitely. Possibly the trade might be induced to take over all the stock at pre-war rates with the necessary credit facilities granted by the Government, but, even so, such an undertaking would be most onerous.

Messrs. G. Cawson & Co., London, E.C., report under the same date:—

There is very little fresh to report with regard to lead; the market during the week has been practically stagnant, and not a single transaction has taken place on the Metal Exchange. Prices are nominally unchanged—the control price is still at £30, with very little doing, except in small lots to cover pressing requirements. February shipment lead is on offer at £28 10s., at which America is willing to sell. Sellers of forward shipment have tried in vain to sell, but without success.

The imports last month are given as 25,150 tons, and as the Government stocks in the same period increased by 23,641 tons it appears that only about 1,500 tons went into consumption here, or were exported. Arrivals so far this month have again been fairly heavy, so that stocks here have probably increased by further 8,000 to 10,000 tons.

The Control make no sign of meeting the position, and doing their best to encourage trade—we wonder how long this position is to continue, and when those in authority will see the necessity of bringing about a more satisfactory state of things. It is perfectly clear to every one with experience in the lead trade that no consumer will buy at present prices unless compelled to do so from actual necessity.

While there is a stock of 120,000 to 130,000 tons overhanging the market, we can only look for a dull sagging trade, unless steps are taken to bring down the price to a more satisfactory level.

The English Electric Co., Ltd.—This company, which has now gone to allotment, has been formed to consolidate under one direction and management the various interests of the following companies, in all of which a predominating control exists: Coventry Ordnance Works, Ltd.; Dick, Kerr & Co., Ltd.; Phœnix Dynamo Manufacturing Co., Ltd.; United Electric Car Co., Ltd.; Willans and Robinson, Ltd. It is the intention to interfere as little as possible with the internal organisation of the respective works, but the English Electric Co. will take over the whole of the external business management, and with certain exceptions, such as the civil engineering and contracting department of Dick, Kerr and certain special products of the Coventry works, will conduct all selling and other negotiations with the public. It will be remembered that the company, having arranged to acquire the whole holding of preference and ordinary shares in the Coventry Ordnance Works, Ltd., and the Phœnix Dynamo Manufacturing Co., Ltd., made an offer to Dick, Kerr shareholders to exchange shares on certain terms. It is now announced that about 90 per cent. of the Dick, Kerr shareholders have accepted the offer. The English Electric Co., Ltd., will control directly or through Dick, Kerr & Co., Ltd., the following powerful group of manufacturing interests, viz.: the Coventry Ordnance Works, Ltd.; Dick, Kerr & Co., Ltd.; Phœnix Dynamo Manufacturing Co., Ltd.; the United Electric Car Co., Ltd., and Willans & Robinson, Ltd. The company is registered with a capital of £5,000,000 in 1,500,000 £1 preference and 3,500,000 £1 ordinary shares, and the issued capital on allotment is just under £2,000,000.

Tour of Brazilian Delegates in Great Britain.—With the object of strengthening the business and personal relations between Great Britain and Brazil, the Federation of British Industries has invited to this country a delegation of representative Brazilian business men. It will be remembered that the Federation was responsible for the visit of a body of Greek commercial men to the United Kingdom in the autumn of last year.

Various reasons have influenced the Federation to select Brazil in the first instance from among the Latin-American republics. Brazil's area alone, covering more than half South America, entitles her to this preference, apart from the moral influence exercised in that continent by her whole-hearted challenge to Germany at an early and critical stage of the war. The time is propitious for inaugurating a business tour.

With a view to considering the representative industries of both countries which will best profit by the tour, it has been decided that Mr. W. S. Barclay, who was loaned by the Federation to Sir Maurice de Bunsen's Mission to South America during last summer, shall proceed to Brazil and spend a few weeks there before conducting the delegates to this country. It has also been arranged, by courtesy of the Department of Overseas Trade, that Mr. Hambloch, H.M. Commercial Attaché in Brazil, shall accompany the party to this country and throughout their tour, a fact which will be of very great advantage to the delegates. Mr. Barclay will sail for Brazil on April 5th, and will arrange for the tour to begin in this country not later than June 15th.

Electricity Supply Undertakings and Priority Certificates.—In order that electrical undertakings with plant and machinery, &c., in course of manufacture under orders placed with Priority Certificates may understand the Priority of Work (Partial Suspension) Order, 1919, issued by the Minister of Munitions on February 7th, 1919, the following explanation has been issued:—

Outstanding Priority Certificates and Permits will continue to be effective until February 28th, 1919, but from March 1st onwards they will be inoperative unless special directions or regulations are issued in writing by the Ministry of Munitions.

Electrical undertakings with orders still awaiting completion, for which they hold Priority Certificates at the moment, should, therefore, take steps to ascertain from the manufacturers whether the withdrawal of the certificates on February 28th, 1919, will result in delay in the completion of urgently needed plant, machinery, &c. Should such delay be serious and prejudicial to urgently needed supplies of current by consumers, application may be made to the Priority Department of the Ministry of Munitions for the issue of a new Priority Certificate.

Orders placed from March 1st, 1919, onwards can be placed without Priority Certificates, but if deliveries cannot be secured in time, application may be made to the Priority Department for a Certificate, which will be issued if after inquiry it is deemed to be essential in the national interest that priority be given. All communications should be addressed to the Controller, Priority Department, Ministry of Munitions, 10, Great Stanhope Street, London, W.

A Manufacturers' Directory.—The National Union of Manufacturers (Inc.) has issued a very presentable directory of its members. The Union has now a large membership, and a supplementary list of those who have joined since the completion of the list in the directory shows that considerable progress is being made. A number of electrical and engineering firms appear. In addition to the circulation of the directory among members, some thousands of copies are being distributed through the British Dominions overseas to various trade associations and manufacturers, and particularly to producers of raw materials. Copies may be purchased (5s.) from the Secretary at 6, Holborn Viaduct, London, E.C. 1. Full information is given relating to the personnel of the various Committees of the Union. This is followed by an alphabetical list of firms in the organisation, with a brief statement ot their businesses, telegraphic addresses, telephone numbers, &c.; also a classified list of manufacturers and producers. The remainder of the book, nearly one-half of the whole, consists of members' advertisements.

Westinghouse Electric Export Deputation Arrives.—The *Financier* announced, on February 14th, that Brigadier-General G. Tripp, Mr. C. A. Terry, Mr. L. A. Osborne, Mr. M Foster, Mr. G. C. Bennett, Mr. G. M. Dah and members of the Westinghouse Electric Export Co. had arrived in London from America.

Ministry of Reconstruction.—On Monday last the Ministry of Reconstruction offices were transferred from Queen Anne's Gate Buildings, Westminster, to the Windsor Hotel, Victoria Street.

Engineering Ballot on 44-Hour Week.—According to the *Times*, the ballot of the Mersey Federation of Engineering and Shipbuilding Trades (representing 29 Unions) and the Amalgamated Society of Engineers on the length of the working week was declared last Friday as follows:—For a 44-hour week, 10,175; for a 40-hour week, 7,903; majority for a 44-hour week, 2,272. In favour of working while negotiations proceed there were 14,466 votes, and in favour of ceasing work to obtain a reduction of hours 3,156, showing a majority of 11,310 against a strike.

New German Ministry for Foreign Trade.—The *D.A.Z.* announces that negotiations are being conducted between the Foreign Office and the Economic Office with regard to the formation of a new department which is to deal with foreign trade. The idea is to create a bureau of information to which all Government bodies and private business people could apply in regard to all questions relating to the import and export trade. In the new department these sections of the Foreign Office and the Economic Office, which have hitherto been dealing with foreign trade, are to be united. A journal, *Nachrichten für Handel, Industrie, und Landwirtschaft* (commercial, industrial, and agricultural news) is to be issued. The late German Consul-General in New York, Herr Falcke, has been appointed to organise this new department on behalf of the Foreign Office in conjunction with a Commissary delegated from the Economic Office.—*Der Welthandel*, Dec. 20th.

Reconstruction Problems.—No. 13 of the Ministry of Reconstruction series of 2d. pamphlets deals with the subject of "Rural Industries."

Export Restrictions.—The *London Gazette* for Feb. 14th contains particulars of additions to, and relaxations of, export restrictions.

Manufacturers' Organisations Combine for Export Trade Effort.—The Provisional Committee of the British Manufacturers' Corporation has issued to firms associated with the Corporation a memorandum describing developments in connection with Sir Charles Mandleberg's scheme for British export trade expansion.

In the closing months of last year the Overseas Trade Committee of the Federation of British Industries desirous of a progressive overseas trade policy, reported that after careful consideration they had come to the conclusion that the principles first formulated in Sir Charles Mandleberg's scheme were sound, and that they had made them the basis of their own proposals. In these circumstances they thought it would be a waste of energy, and would lead to overlapping if the scheme went through independently, and they suggested a fusion of the B.M.C. with the Federation for the purpose of carrying out the schemes. A general meeting of the Federation on December 12th approved the proposals, and as the result of the negotiations then opened conditions of fusion have been agreed upon by the respective Committees, and these will he submitted to a general meeting of the British Manufacturers' Corporation on February 20th. We learn that the terms of the proposed amalgamation make it clear that the export trade development policy on which the Federation is about to embark is identical in essentials with the scheme first suggested by Sir Charles Mandleberg. Under the agreement the British Manufacturers' Corporation is to have immediate and substantial representation on the Committee that will administer the scheme.

Exports to China and Siam.—The *London Gazette* for February 14th and that for February 18th contain further lists of persons and bodies in China and Siam to whom exports may be consigned.

Agencies Wanted.—A Barcelona firm of electrical and mechanical engineers with branches at Madrid and Lisbon, already representing important British engineering firms, desires to take up the representation of British manufacturers and exporters of electric motors, electric lighting sets, Diesel engines, electric cables, turbo-alternators, &c. The managing director of the firm is at present in the United Kingdom. (Reference No. 219.) Particulars from the Department of Commercial Intelligence, 73, Basinghall Street, E.C.

Municipalities and Enemy Contracts.—Hammersmith B.C. Special Purposes Committee, at the last meeting of the Council, recommended that the Council refuse to accept any tenders from, and that no contracts be entered into with, any firms directly or indirectly connected with the Enemy Powers, and that no sub-contracting be allowed with firms connected with the Enemy Powers.

Dutch Embargo on German Goods.—The Dutch navigation companies have, so *Deutscher Aussenhandel* (December 10th) claims to have heard from trustworthy sources, been warned by official representatives of England and France, through confidential circulars, against warehousing German goods, since the Allies wish to pass a resolution that for two years after the war no German goods may be shipped *via* neutral countries without their consent,

Hours of Labour in the Rubber Trade.—"Subject to certain conditions necessary to maintain output," the National Joint Industrial Council of the Rubber Manufacturing Industry recommends a 47-hours week.

Reunion of ex-British Westinghouse Men.—On Friday last, at the Connaught Rooms, London, 150 ex-British Westinghouse staff foregathered, under the chairmanship of Mr. C. Dalley, who presided in the regrettable absence of Prof. Miles Walker, for the first reunion dinner. Upwards of 100 old Westinghouse men wrote expressing regret at their inability to attend. After the Royal toasts had been honoured, a silent toast to the memory of the Westinghouse men who had fallen in the war was drunk. Mr. L. R. Morshead (the chairman of the Reunion Committee) then stated that the response which had been received to the suggestion for the reunion was so good that it was hoped to make it an annual feature. The proposal was to form an Association of old Westinghouse men. Between the speeches, Mr. H. Coupé officiated at the piano and other gentlemen contributed humorous items. At the termination of the proceedings each guest was presented with a souvenir programme, which included many humorous features. Mr. Richardson, whose address is 14, Sydney Road, Richmond, Surrey, would like to hear from all ex-Westinghouse men who will join the Association and turn up at the next annual gathering.

Lamp Prices in Germany.—As from January 28th, increases in the prices of incandescent lamps have been made in Germany by the A.E.G., the Bergmann Co., the Osram Works, the Radium Electricity Co., Siemens & Halske, and the Siemens-Schuckert Works. The augmentations have been made in the sense that war-time additions have been abandoned and new basis prices have been substituted. Under the new arrangement the prices of wire lamps with pear-shaped bulbs ranges from 3 marks to 3·75 marks; wire lamps in globe form are at 3·60 marks to 7 marks; and gas-filled lamps are at 5 marks to 110 marks, exclusive of the lamp-tax in each case. As the makers expect an improvement in the present difficult conditions, it is said that the above prices have been calculated so as not to include the whole of the additional cost of production arising from the existing labour and other circumstances.

Trade Announcements.—Mr. Harry Fowler, electrical engineer, has resumed business at 25, William Street, Windsor.

Messrs. Hick Diesel Oil Engines, Ltd., have removed to larger offices at 70, Queen Street, London, E.C. 4.

Mr. E. H. Miller, sales manager in the meter department of the British Westinghouse Electric and Manufacturing Co., Ltd., has left the company, and has started the Cromwell Engineering Works, for the manufacture of small electrical details, at Romsey Road, Old Shirley, Southampton. Catalogues of wires, screws, loose brass, &c., are required.

Mr. Thomas S. Wallace, electrical contractor, having been released from the Royal Marine Light Infantry S.H.C.D., has resumed business at Breadalbane Place, Oban, Argyll, and invites manufacturers to send catalogues and trade terms.

The Chloride Electrical Storage Co., Ltd., are removing their London Vehicle Battery Depôt from 70, Romney Street, Westminster, to more commodious premises at 18, Hereford Road, Bayswater, London, W. 2, where all overhaul and repair work will in future be carried out.

Bankruptcy Proceedings.—R. E. Connold, late of 6a, The Parade, Canterbury.—Supplementary dividend of 3½d. in the £, payable February 22nd, at the O.R.'s office, 68a, Castle Street, Canterbury.

Liquidations.—Portable Electric Motors, Ltd.—Meeting of creditors, February 22nd, at 12, Lime Street, London, E.C.; Mr. A. F. Newton, liquidator.

Devonport and District Tramways Co.—A meeting will be held on Friday, March 21st, at 136, Aldersgate Street, E.C., to hear an account of the winding up from the liquidator, Mr. P. N. Gray.

South African Tour of British Industrial Centres.—The Federation of British Industries has organised, with the support of the various Dominion representatives in London, a series of tours of members of the various Dominion Imperial Forces to the industrial centres of Great Britain. The first of these tours started this week, when a representative party from the South African Imperial Force was entertained by the Federation at the Princes Restaurant before leaving for Grantham. During their tour the South African representatives will have the opportunity of visiting the firms of Ruston & Hornsby, Ltd.; the Birmingham Railway, Carriage, and Wagon Co., Ltd.; the General Electric Co., Ltd., at Witton; the Wolseley Motor Co., Ltd.; and the Handley Page Aeroplane Works.

Book Notices.—*Manual of Electrical Undertakings and Directory of Officials.* 1918-19 Edition. London: Electrical Press, Ltd. 22s. 6d. net.—The form and nature of the contents of this directory are so well known by now that little need be said about it, beyond the fact that it contains in a very accessible form great stores of statistical and general information, including names and addresses of officials, relating to nearly 3,000 electrical undertaking in the British Empire, representing a capital of 490 millions sterling. It has a 100-page section reviewing the progress of the year, after which 10 times that number of pages are set apart for material concerning light, power, and traction undertakings, and smaller sections for telegraph and telephone, manufacturing and miscellaneous, Colonial and British Possessions. A directory of 20,000 directors and officials and a number of maps are also features of the volume, which would have made its appearance at an earlier date but for production difficulties, which have confronted the printing and publishing trades as they have everybody else.

What Others Say. In view of the controversy which has taken place as to whether starters should be standard on after-the-war cars, a little booklet which we have received from C. A. Vandervell & Co., Ltd., is of interest. It sets forth the opinions of the foremost journals, technical and otherwise, on the electric starter as presented in its newest form by "C.A.V.," and goes a long way to show how the Press in general views the adoption of the electric starter for motor cars.

"A Criticism of the First Interim Report of the Committee on Currency and Foreign Exchanges." By Mr. Arthur Kitson, president of the British Banking Reform League. The League: Chamber of Commerce Buildings, Birmingham. 1s.

"Memorandum on the Industrial Situation After the War: The Garton Foundation." London: Harrison & Sons. Price 2s. net.

"Public Utility Rate Fixing." By C. E. Grunsky. Pp. 169; illus. San Francisco: Technical Publishing Co.

"The Practical Telephone Handbook." By J. Poole. Pp. xxiii + 725; 585 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d. net.

Auction Sale.—By direction of the Ministry of Munitions, Messrs. Edwards, Son & Bigwood will sell by auction, at Birmingham, on the premises, on Monday, February 24th, and following days, valuable engineering and munition-making plant and machinery, the property of the Ministry of Munitions, now lying at, and recently in use at, the Longbridge Works of the Austin Motor Co., Ltd.

Plant for Sale.—Bootle Corporation Electricity Department invites offers for the purchase of surplus plant at Pine Grove electricity work, consisting of Lancashire boilers, superheaters, economisers, Ferranti and Belliss engines and dynamos, &c. Full particulars are given in our advertisement pages to-day.

Bradford Corporation Electricity Committee invites offers by February 28th for one cross-compound Corliss vertical enclosed engine, coupled to a 1,000-kw. Westinghouse generator, with oil separator, air pumps, &c.

Non-Ferrous Metal Industry Act.—The *London Gazette* for February 18th contains further additions to the list of licences granted under the Act.

LIGHTING AND POWER NOTES.

Aylesbury.—Extensions.—The T.C. has provisionally agreed to supply 200 h.p. of electricity forthwith, 500 h.p. by April next, and 1,000 h.p. next year, to Messrs. W. Cubitt & Co., Bicester Road. It is proposed to apply for a loan for the provision of a 1,000-kw. generating set, and a further 1,000-kw. set is proposed, in view of further extensions.

Price Increase.—The T.C. has decided to increase the charges for street lighting by 20 per cent.

Barnsley.—Salaries.—The T.C. has acceded to the demand of the E.P.E.A. that the wages of power engineers be advanced by 20 per cent. on the salary paid on July 31st, 1914, plus £90 per annum, as from March 31st last. This is also to apply to the commercial assistant.

Batley.—Year's Working.—For the year ending March 31st, 1918, the working of the Corporation electricity undertaking resulted in a loss of £982, compared with a profit of £45 in the previous year. The cost of coal increased by £600, and the sales declined by 100,000 units.

Belfast.—Strike.—After a conference with the Irish Executive, the Commander-in-Chief of the Forces in Ireland gave permission for troops to be used in connection with the strike in Belfast, and on Saturday troops took control of the electricity works and gas works, in conjunction with the permanent officials. Upon this protection being afforded, the employés returned in large numbers, and a normal supply was available for lighting and power later in the day. The street switch-boxes were guarded, and a notice issued to the effect that the penalty for injuring or interfering with the electricity supply was five years' penal servitude, and a reward of £100 was offered for information leading to the conviction of anyone committing such an act. It is estimated that the resumption of the power supply enabled 45,000 persons to resume work in one industry alone. A picket was sent on Monday to bring out again several members of the A.S.E. who had returned to work at the electricity station, but without success. A limited tramway service was run on Sunday, and was improved on Monday. Two members of the E.T.U., employed by the Corporation Electricity Department, charged under the new Defence of the Realm Regulation with breaking their contract of service, were remanded on bail on Monday. The defendants were shop stewards, and were at work up till Saturday, but did not resume at midnight on Sunday. Late on Monday night the Strike Committee decided to leave the question of the acceptance or rejection of the employers' offer to the individual Unions; this practically meant the final collapse of the strike.

A full tramway service was being run on Tuesday, and the men had returned to work in practically all industries by Wednesday on the 47-hour week basis, pending a National settlement.

Bury.—Proposed Extensions.—The T.C. has decided to apply for L.G.B. sanction to a loan of £94.000 for electricity purposes, to be expended as follows :—Buildings, £19.000 ; boilers, £16.500 ; seatings, flues, &c., £2,000 ; economisers, pipes, &c., £3,500 ; ash-removal plant, £4.000 ; switchboards, £1.500 ; one 5,000 to 8.000-kw. turbo-alternator, £41.000 ; condensing pipes, &c., £6,000 ; and railway sidings, £500. The scheme has been approved by the B. of T.

Birmingham. — Wages. — The E.S. Committee has extended the award of 5s. per week, which had been already granted to the engineers, to all men in its employ engaged in the generation and distribution of electricity.

Burton-on-Trent.—Street Lighting.—The T.C. has decided to install electric lighting in the High Street and Station Street, by means of 600-c.p. lamps suspended from the tramway standards.

Bristol.—Extension of Supply.—Arrangements have been completed for the supply of electricity by the T.C. to Messrs. Derham Bros., Ltd., at Southwell, which is outside the Council's area.

Bury St. Edmunds.—New Mains.—The electrical engineer has recommended the T.C. to lay a new main to the Northgate area, at an approximate cost of £2,500.

Continental.—Belgium.—Several new electricity supply undertakings have lately been formed in Belgium, including the Société de la Central Electriqne de Rettigny-Renglez, at the town of that name, the Société d'Electricitè de et à Lantin, and the Société d'Electricitè M.C., organised at Ghent. The first two are co-operative undertakings.

France.—La Société Hydro-Electrique de l'Isère has been formed at Lyons, with a capital of £320,000, to utilise the water power of the River Isère, near St. Nazaire-en-Royans. The Société Metallurgique du Fravol and the Société de l'Electricitè de la Vallèe du Rhone are interested in the new undertaking.

Germany.—Notwithstanding the settlement of the strike at the electricity generating stations, Berlin remains unlighted on account of the lack of coal.—*The Times.*

Spain.—A Comision Permanente Espanola de Electricidad has been appointed by the Government to draw up a scheme for the establishment of a State electricity supply undertaking, which will cover the greater part of the country. The estimate for the scheme is £5.200,000.

Sweden. — Among the new concerns, mainly of a small character, recently formed to establish electricity supply undertakings, are the Alfsakers Kraft Aktiebolag, of Anneberg ; the Aneboda Kraft Aktiebolag, of Lamhult : and the Omne Elektriska Kraft Aktiebolag, of Nordingra.

Dartford.—Price Increase.—The U.D.C. has advanced the price of electricity for power purposes by a further 15 per cent. as from February 10th.

The Council has refused to consent to the West Kent Electric Co. supplying electricity to the Joyce Green Works of Messrs. Vickers, and has informed the firm that it is prepared to negotiate for a supply from the municipal works.

Dover.—Price Increase.—The T.C. has decided to advance the weekly payment for electricity supplied to the Pier Cottages from 6d. to 9d., and to 1s. where there are lodgers.

Salaries.—Regarding the demand of the E.P.E.A. that the salaries of the technical staff at the electricity works should be increased by 20 per cent., plus £90 a year, the T.C. has decided to reply that substantial advances had already been recommended.

Dundee.—Extensions.—The Electricity Committee has approved of plans for the proposed extension of the electricity works at Carolina Port.

Ealing.—Price Increase.—The T.C. is seeking permission to increase the price of electricity from 8d. to 10d. per unit. Alderman Peal (chairman of the Electricity Committee) explains that the coal bill this year will be £14,000, as against £8,000 in pre-war days, and that the estimate shows that there will be a loss of £5,300 if the current price continues.

Edinburgh.—Year's Output.—The annual report of the Corporation electricity department shows that the number of units sold for all purposes during the past year amounted to 20,945,404, as compared with 17,997,251 in the previous year.

The Corporation has decided to ask the Controller of Mines to extend to Scotland the recently announced increase of 25 per cent. of gas and electricity rations.

Epsom.—Chief Engineer's Salary.—The U.D.C. has referred to arbitration the claim of the Electrical Power Engineers' Association that the salary of the electrical engineer, Mr. Young, should be fixed at about £646 per annum.

Grantham.—Proposed Municipal Supply.—The T.C. has appointed a Committee to go into the question of taking over the E.L. undertaking.

Hastings.—Price Increase.—The T.C. has increased the charge for electricity for public lighting from 2d. to 3d. per unit.

Hebden Bridge.—The electrical engineer has been authorised to purchase 200 yards of 0·1-in. twin-armoured, paper-insulated cable and new switchgear, to cope with the increasing power load in the Hangingroyd district.

Hull.—Proposed New Plant.—The acting electrical engineer has recommended the Electricity Committee to replace Nos. 8 and 9 engines by a synchronous motor. This would bring the plant up to date, and effect a saving of 3,000 tons of coal per annum. It was decided to negotiate for the plant, and report further on the matter.

Keighley.—Wages.—A dispute between the Electricity Committee and its employés has been settled by the war wages being increased by 6s. per week, making the total 28s. 6d., payable from the first pay-day in December ; the claim as to the working hours has been deferred pending further inquiries.

Kirkcudbrightshire.—E.L. Schemes.—The burghs of Gatehouse, Creetown, and Newton Stewart are considering E.L. schemes : the last-named is estimated to cost over £50,000.

Lincoln.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £75,000, for the purchase of Messrs. Clayton & Shuttleworth's power station.

Liverpool.—Year's Working.—The total income of the Corporation electricity department for the year ended December 31st last amounted to £504,158 and working expenses to £301.479. Of the balance (£202,679) interest absorbed £73,082, sinking fund contributions, £58,078, renewals fund, £21.519, and £50,000 was contributed to the relief of the rates. The reserve fund now amounts to £18,445, the renewals fund to £126,472, and the fuel guarantee fund to £9.242. The capital expenditure on the undertaking totals £2,254,659, of which £25,679 was incurred during the past year.

London. — Hammersmith. — Year's Working. — The working of the B.C. Electricity Department for the year ended March 31st, 1918, resulted in a net profit of £1.464, compared with £2,476 in the preceding year. The income was £101.232, against £79,500, and working expenses amounted to £78,217, against £55,136. Interest on loans amounted to £7.742, against £8,140, and debt redemption to £13.340, against £14,645. The capital outlay at the end of the year totalled £399,470, an increase of £5,565. The maximum load recorded was 7,248 kw., against 7,050 kw ; the capacity of the undertaking was 10,300 kw. Units generated during the year numbered 20,753,920, against 17,226,200, and 1.116, against 1,555, were purchased ; 17,892,928, against 14.550,147 were sold to private consumers, and 242,815, against 256,523, for public lighting ; 2,498,794, against 2.207,789, were used on the works, and 120,499 were unaccounted for, against 213.296. The reserve fund now totals £33,370. The price of coal increased by $82\frac{1}{2}$ per cent. over the last pre-war year. The average price received was 1·29d. per unit.

Proposed Linking-up.—The E.L. Committee has recommended the B.C. to inform the Conference of Electricity Undertakings in Greater London that it is in favour of the formation of a Joint Board for the purpose of interconnecting existing stations, and the provision of a site for a bulk supply station either for the S.W. London area or such other area as may be determined upon.

Shoreditch.—Salaries.—The Lighting Committee has agreed to the application of the E.P.E.A. for an increase of salaries for its members of 20 per cent. advance on pre-war rates, plus £90 per annum. A further bonus of 5s. per week, making a total of 28s. 6d. per week, has been granted to other employés as from December 5th last.

Kensington.—Price Increase.—The Kensington and Knightsbridge E.L. Co. has decided to increase the price of electricity by two further additions of 10 per cent., one to take effect from the end of the March quarter and the other from the end of the June quarter.

Londonderry.—Price Increase.—The electrical engineer has recommended the Corporation to increase the charges for electricity from 15 per cent. to $33\frac{1}{3}$ per cent. on existing charges.

Masham (Yorks.).—Proposed Municipal Supply.—The U.D.C. has asked the sanction of the ratepayers to acquire the electricity undertaking.

Matlock.—Proposed E.L.—The U.D.C. is considering a scheme for the production of electricity by the utilisation of the water power of the Bentley Brook.

Southport.—Proposed Extensions.—In connection with its application for a loan of £132,000 for electricity extensions, the T.C. has decided to furnish the L.G.B. with an estimate of the cost per unit of generating electricity with the new plant during the years 1921-1924, and also the cost per unit for renewal and sinking funds. The L.G.B. has also been informed that the Council is willing to take a bulk supply from a central station, if it can be proved that the latter method is the more economical. The B. of T. has informed a deputation that Southport is one of the areas definitely excluded from the National scheme, and the Board has approved the proposed extensions.

South Wales.—Strike.—The fitters, wiremen, &c., on strike in South Wales are considering a proposal to form a company for the undertaking of electrical contracting work.

Mr. H. Wintle, secretary of the South-Wales Branch of the Electrical Contractors' Association, informed a Press representative that the Association had advocated this for some years, and he sincerely hoped that the men would give the proposal every consideration, because the employers felt that if the men would only run a business on their own account, especially on a co-operative system, they would know the various aspects from the employers' point of view, with which they were not conversant at present.

Swansea.—Wages.—The Electricity Committee has increased the wages of certain of its employés who are members of the A.S.E. to £305 10s. per annum, and the men have also been placed on the staff; it was mentioned that before the war their wages were £130 per annum.

Tonbridge.—Price Increase.—The U.D.C. has advanced the price of electricity for outside lighting to 3d. per unit, from April 1st; for bioscope supplies to a flat rate of 4d., as from February 1st; and for power from 33⅓ per cent. increase to 50 per cent., from April 1st.

Taunton.—Proposed Loan.—The T.C. has applied to the L.G.B. for sanction to a loan for the installation of a 500-kw. turbo set, and other plant.

Price Increase.—The T.C. has decided to increase its prices for electricity to 75 per cent. above pre-war charges.

Tuam (Co. Galway).—Proposed E.L.—The services of Mr. J. P. Tierney, of Dublin, have been engaged by the municipality, in connection with an E.L. scheme.

Walsall.—Proposed Extensions.—The E.S. Committee proposes to extend the supply of electricity to the Leamore district, and to purchase transformers and switchgear, at an estimated cost of £4,200.

Wexford.—Proposed E.L.—A Corporation Committee appointed to consider the question of public lighting by electricity has reported in favour of the scheme.

Wolverhampton.—Wages.—The T.C. has agreed to an award of the Court of Arbitration, dated February 5th, granting an increase of 5s. per week to employés of the electricity department over 21 years of age, and 2s. 6d. per week to those under 18.

Yorkshire.—Rural Electricity Supply.—The Reconstruction Committee of the East Riding County Council has reported to the Council on the desirability of extending the supply of electricity within its area.

TRAMWAY AND RAILWAY NOTES.

Blackpool. — Proposed Purchase. — The Fleetwood U.D.C. has decided to oppose the application of the Blackpool T.C. for powers to purchase the undertaking of the Blackpool and Fleetwood Tramroad Co.

Bradford.—Tramcar Letter-Boxes. — The T.C. has decided to make representations to the postal authorities, with a view to placing letter-boxes on tramcars, which was the practice some years ago.

Italy.—Steps have been taken by the communes interested to bring about the construction of an electric tramway between Poggio Mirtelo and Terni.

A Commission has been nominated to submit plans for the electrification of the tramway between Alessandria and Casala.

The Società Brioschi per Imprese Elettriche, of Milan, is increasing its capital from 6 million to 12 million lire, for the purpose of carrying out in conjunction with the province of Piacenza, the electrification of 200 miles of railway.

Lincolnshire. — Proposed Light Railways. — The Holland County Council has adopted a report of a scheme for the construction of 85 miles of light railways in the county, at an estimated cost of £640,000.

London.—District Railway Mishap.—A derailment, caused by a broken axle, took place on Saturday last at Bromley-by-Bow. Both the up and down tracks were completely blocked, and the service between Bromley, East Ham, and Barking was entirely suspended.

It is announced that from March 1st more trains are to be run at night on the North London Railway between Broad Street and Richmond, Poplar, and Bow.

Ticket Concessions.—Tube passengers who had taken out packets of workmen's tickets before the strike can legally demand the return of their money, says the Suburban Railway Passengers' Association, and should apply to the general manager of the company concerned. On renewing their tickets season-ticket holders on the District Railway have found that six days' extra travelling is allowed on the new ones to compensate for the strike.

Proposed L.C.C. Extensions.—The Highways Committee has recommended the L.C.C. to obtain power for the construction of the following tramway extensions and linking-up schemes:—Charles Street to Blackfriars Bridge; Gray's Inn Road to Farringdon Street; Aldgate Terminus to Aldgate Station; Hampstead Road to Oxford Street; Seven Sisters Road to Stamford Hill; Southampton Row to New Oxford Street. Exclusive of street widenings, the estimated cost is £429,140. The Council will also consider the running of omnibus services to link-up tramway dead ends.

Rail Welding.—The L.C.C. Highways Committee has recommended the provision of electric welding equipment for tramway track welding, at a cost of £700.

Eight-hour Day.—The L.C.C. tramcar washers are to have an eight-hour day, on the understanding that they undertake the same amount of work in eight hours as has hitherto been done in nine.

Hours of Labour.—The Transport Workers' Federation has asked the L.C.C. to grant a working week of 44 hours to its tramway employés.

West Hartlepool.—At a special meeting of the T.C., on the 14th inst., a proposal was approved to promote a Parliamentary Bill to empower the Corporation to construct and work tramways from the present light railway at Seaton Carew to Greatham Creek, and from the end of the present tramway in Stockton Road to a junction with the Seaton Carew line; also to run motor-'buses in and beyond the borough to Greatham Creek, and in other parts outside the borough, as may be deemed expedient. Power is also sought to increase the tramway fares and to charge specially-increased fares on Sundays and public holidays.

TELEGRAPH AND TELEPHONE NOTES.

Figures in Cablegrams.—The Eastern and Associated Telegraph Companies notify that it has been decided, by arrangement with the General Post Office, to accept figures in the text of deferred telegrams as a temporary measure. Figures, when not expressed in words, will be counted and charged for at the rate of one word for each group of five characters. The following places are exceptions to the above:—French Colonies, China, Brazil, Argentina, Punta-Arenas, Bolivia, and wireless offices in Peru.

Postal Workers' Claims.—At a meeting of the London Branch of the Postal and Telegraph Clerks' Association, on Saturday last, a resolution was carried calling for the immediate convening of a Postal Congress of the rank and file of the Association to formulate a charter of hours, wages, conditions, and status, covering the claims of the men and women in the Postal Services, the Army men now serving with the Postal Service, the permanent staff, and the temporary staff, the charter to be submitted without delay to the Postmaster-General, and negotiations to be opened with the railway Unions with a view to synchronising and co-ordinating any action considered necessary to enforce it. The chairman of the Branch, Mr. H. L. Upcott, said that the strike weapon might become an imperative necessity if their demands were not granted. They hoped to join the triple alliance of railwaymen, miners, and transport workers.—*The Times*.

Telegraph Messengers.—It has been decided to revert to the pre-war conditions of employing boy telegraph messengers in the Post Offices. The change will apply equally to London and the provinces. The change is being made neither for reasons of efficiency nor of finance. It is felt that the night work required is not quite suited to girls of 14, and that, when they reach the age of 18, they cannot be absorbed inro the permanent *personnel* of the Post Office. For some years all the boys employed as messengers have been absorbed into the permanent establishment of the Post Office, chiefly as postmen.

CONTRACTS OPEN AND CLOSED.

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices," Jan. 31st.

P.M.G.'s Department, Queensland. March 26th. Telegraph and telephone material, schedules 447/451 and 453. Specification from Australian Commonwealth Offices, Room 405, Australia House, Strand, W.C. See "Official Notices" to-day.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Aylesbury. — Corporation Electricity Department. One 1,000-kw. generating set complete; two 500-kw. rotary converters. See "Official Notices" February 14th.

Belfast.—February 24th. Electricity Department. Electric and hand cranes, pumps and tanks. See "Official Notices" January 17th.

Belgium. — The municipal authorities of Ixelles (170, Chaussee d'Ixelles, Ixelles, Brussels) are inviting tenders for the supply of electricity meters and armoured low-tension cables.

Birmingham. — March 5th. Tramways Committee. Additional rolling stock. See "Official Notices" February 7th.

Dublin. — March 3rd. Electricity Supply Committee. Extra-high-pressure and low-pressure cables. See "Official Notices" to-day.

King's Lynn.—March 3rd. Corporation. One 1,000-KW. turbo-alternator, one 400-KW. rotary converter or motor-generator, and one 400-KW. transformer and switchgear. See Official Notices" February 7th.

Lincoln.—March 5th. Corporation. Four water-tube boilers with stokers, &c., complete; two 3,000-KW. turbo-alternators with condensers, &c.; extension of E.H.T. switchboard, &c.; two 750-KW. rotary converters, &c.; two 2,000-K.V.A. three-phase transformers, &c. Specifications from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. See "Official Notices" Feb. 7th.

Manchester. — March 11th. Tramways Committee. Supply, &c., of (*a*) permanent-way special track work: (*b*) permanent way points, tongues, and hardened steel centres. Mr. J. M. McElroy, general manager.

March 11th. Tramways Committee. Stores. including several electrical items. See "Official Notices" to-day.

Mansfield.—Corporation Electricity Committee. 1,250-1,500-KW. turbo-alternator, condensing plant, 500-KW. rotary converter, transformer, and switchgear. See "Official Notices" February 14th.

Portsmouth.—March 4th. Tramways Committee. Tramway stores for six months. See "Official Notices" February 14th.

Rhondda.—March 5th. U.D.C. Electricity Department. Twelve months' supply A.C. meters, cable, joint boxes, compound cut-outs, &c. See "Official Notices" February 14th.

Salford.—February 24th. Electric light installation at Regent Road Police Station. Borough Engineer, Town Hall.

Swindon. — March 15th. Electricity and Tramways Department. Two double-deck tramcars. See "Official Notices" to-day.

Taunton.—Electricity Department. One 500-KW. steam turbine generator. travelling crane, cables and meters. See "Official Notices" February 14th.

CLOSED.

Australia.—Victorian Railways Department. Accepted.

250-volt rubber-covered cable 7/18, £66 per mile; 7/20, £50 per mile. Made in Japan. Australian General Electric Co.

P.M.G.'s Department. Queensland:

500 C.B. automatic telephones, wall pattern. £1,856; 500 do. table pattern, £186.—Automatic Telephones (Australia), Ltd.

P.M.G.'s Department, Victoria:

200 C.B. automatic telephones, wall pattern, £741; 200 do. desk do., £741.—Automatic Telephones (Australia), Ltd.

P.M.G.'s Department, N.S.W.:

Material for maintenance of automatic telephone equipment, £496.—Automatic Telephones, Ltd.
180 micro-telephones, £378.—Western Electric Co.

N.S.W. Public Works Department:

Electric lift at Goulburn Hospital, £1,079. Standard Waygood Hercules, Ltd.

COBURG (Victoria) T.C.:

Transformers, £691.—G. Weymouth.
H.T. equipment and meters, £909.—Australian General Electric Co.
Copper cables and fuses, £4,232.—B. I. and Helsby Cables, Ltd.
Street lamps, £430.—Lawrence & Hanson.
Insulators, £373.—Australian Porcelain Co.
Poles and erection, £1,744.—W. Clements.

Tenders.

Barnsley.—Corporation Electricity Committee:—

Copper bands and steel flanges, £85 per ton.—Jones Wildsmith.
Steam pipes and isolating valve, £85.—Babcock & Wilcox.

Glasgow.—Tramways Committee:—

Bowser pump and storage tank.—S. F. Bowser & Co.
Multijector air pump for Pinkston station.—Mirrlees, Watson Co., Ltd.
8/4-ton lorry chassis.—The Albion Motor Car Co., Ltd.

Electricity Committee:—

Turbo-alternator, condensing plant and transformer, £133,736.—Dick, Kerr and Co., Ltd.

London. — HAMMERSMITH. — Electricity Committee. Recommended:—

175 fuse boxes, 200 service boxes, 24 H.T. straight joints, 18 H.T. tee joints, 12 draw-box frames.—

W. Lucy & Co. (recommended) £444.
W. T. Henley's Telegraph Works Co., £656.

500 yds. each 1 sq. in. ·05 sq. in. service cable.—

Mackintosh Cable Co., Ltd. (recommended)	£346
Western Electric Co., Ltd.	389
Callender's Cable and Construction Co., Ltd.	392
B.I. and Helsby Cables, Ltd.	395
Henley's Telegraph Works Co., Ltd.	398
W. T. Glover & Co., Ltd.	402

100 new lanterns for street lamps—

W. Edgar (recommended)	£194
W. Lucy & Co.	195

Conversion fittings, &c.—34s. 9d. each., **W. Lucy & Co.** (recommended).
10,000 tons of Wernddu Thro' coal, f.o.r. Shepherd's Bush, at 33s. 9d. per ton.—**Messrs. Judd, Budd & Sons** (recommended).

Powdered fuel plant.—The Electricity Committee recommends that the tender of the Powdered Fuel Co. be accepted for—

Powdered fuel plant, £14,100; electric motors for driving ditto, £1,770; additional pulveriser and accessories and additional distributing mains, £6,600; motors for driving same, £1,015. Total £23,485.

The company have offered to enter into guarantees that there will be a saving of £7,000 per annum on fuel and labour, provided all the boilers are fired by means of the new plant, or proportionately for a less number of boilers. The Committee also recommends that the tender of the Powdered Fuel Co.. for £39,925, for additional plant be provisionally accepted, subject to the plant being required after the installation of the first part. The engineers estimate of the cost of the building for housing pulverising plant, &c., is £6,700.

BATTERSEA.—Electricity Committee. Recommended:—

Air cooler and heat conservator plant for 5,000-KW. extension plant, £980.—Babcock & Wilcox, Ltd.

In connection with annual contracts the Committee recommends that it be authorised to take such action as it may consider advisable to obtain tenders or to arrange for the works and services to be carried out in the ensuing year.

Sunderland.—T.C.—

Superheater blanks.—James Thompson & Co.
E.H.T cable.—British Insulated and Helsby Cables, Ltd.
Creosoted redwood capping.—Armstrong, Addison & Co.
E.H.T. C.I. joint troughs.—J. H. Waterston & Co.

Winchester.—T.C.:—

200-gallon water-softening plant, £110.—Wm. Boby & Son.
24-in. diameter electrically-driven fan and set of automatic shutters, £33.—James Keith & Blackman Co., Ltd.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, February 21st. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Annual general meeting. Adjourned discussion on "Electric and Oxy-Acetylene Welding."

Junior Institution of Engineers.—Friday, February 21st. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Earthquakes and how they are Recorded," by Mr. J. J. Shaw.

Midland Section.—Friday, February 28th. At 8 p.m. At the University, Birmingham. Paper on "The Boys' Welfare Movement," by Mr. T. Lewis.

Manchester Association of Engineers.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Paper on "Hardness Determination of Metals," by Prof. C. A. Edwards.

Birmingham and District Electric Club.—Saturday, February 22nd. At 6.30 p.m. At the Grand Hotel. Annual dinner and concert.

Greenock Association of Electrical Engineers.—Saturday, February 22nd. Visit to Brown & Polson's Corn Flour Works, Paisley.

Chief Technical Assistants' Association.—Saturday, February 22nd. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Problems in Connection with Linking-up," to be opened by Mr. Bowden.

Royal Society of Arts.—Monday, February 24th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture "Scientific Problems of Electric Wave Telegraphy," by Prof. J. A. Fleming, F.R.S.

Wednesday, February 26th. At 4.30 p.m. At John Street, Adelphi, W.C. Lecture on "The Wage Problem in Industry," by Mr. W. L. Hichens, Chairman of Messrs. Cammell, Laird & Co.

British Industries Fair, 1919.—February 24th to March 7th. From 10 a.m. to 6 p.m. At the London Dock, Pennington Street Warehouse, E., near Mark Lane Station (District Railway).

Institution of Civil Engineers.—Tuesday, February 25th. At 5.30 p.m. At Gt. George Street, S.W. Papers on "The Flow of Water in Pipes and Pressure Tunnels," by Mr. F. J. Mallett, and "Discharge of Large Cast-iron Pipe Lines in Relation to their Age," by Mr. A. A. Barnes.

Industrial and Reconstruction Council.—Tuesday, February 25th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Welfare Work," opening address by Miss Newcomb, Secretary of Central Association of Welfare Workers.

Illuminating Engineering Society.—Tuesday, February 25th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Paper on "Some Notes on Railway Lighting and its Maintenance," by Mr. A. Cunnington.

Institution of Electrical Engineers.—Thursday, February 27th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Determination of the Efficiency of the Turbo-Alternator," by Dr. S. F. Barclay and Dr. S. P. Smith. On account of the author's illness, the paper on "The Co-ordination of Research in Works and Laboratories" will be read at a later date.

(**North-Eastern Centre**).—Monday, February 24th. At the Mining Institute, Newcastle. At 6.45 p.m. Discussion on "The Electrical Equipment of a Suburban Residence."

(**North-Western Centre.**)—Tuesday, February 25th. At 7 p.m. At the Engineers' Club, Manchester. Paper on "The Determination of the Efficiency of the Turbo-Alternator," by Dr. S. F. Barclay and Dr. S. P. Smith.

(**Scottish Centre**).—Tuesday, February 25th. At 7.30 p.m. At 207, Bath Street, Glasgow. Lecture on "The Navigational (Magnetic) Compass as an Instrument of Precision," by Mr. M. B. Field.

Royal Institution of Great Britain.—Friday, February 28th. At Albemarle Street, W. At 5.30 p.m. Lecture on "Ether and Matter," by Sir Oliver Lodge, F.R.S.

NOTES.

Copper Prices.—Messrs. F. Smith & Co. reports February 19th:—Electrolytic bars, £90; electrolytic sheets, no change; electrolytic wire rods, £100; H.C. wire, 1s. 0¼d; silicium bronze wire, 1s. 4d.

Messrs. James & Shakespeare report February 20th:—Copper: Bar, sheets, and rods, £122.

Volunteer Notes.—ROYAL ENGINEERS VOLUNTEERS, LONDON ARMY TROOPS COMPANIES.—Headquarters: Balderton Street, Oxford Street, W. 1.

Regimental Orders No. 8, by Lieut.-Colonel C. B. Clay, V.D., Commanding.
Wednesday, February 26th.—Drill and Military Engineering, 1830.
Friday, February 28th.—Range, 1830.

C. HIGGINS, Captain, R.E., *Adjutant.*

The Industrial Reconstruction Council.—A Special Conference will be held under the auspices of this Council, on Thursday, February 27th, at 5.15 p.m., in the Hall of the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4, when an address will be given by Major Pells, R.E. (Assistant Director, Efficiency and Costs Section, Ministry of Munitions), on "Scientific Management in Industry." The lecture will be followed by a discussion. No tickets are necessary.

Institution and Lecture Notes.—Diesel Engine Users' Association.—Mr. Napier Prentice. A.I.E.E., engineer and manager to the Suffolk Electricity Supply Co., Ltd., has been re-elected president of the Association for the current year, and Mr. Percy Still, M.I.E.E., chief engineer and manager to the Chelsea Electricity Supply Co., Ltd., has been re-elected hon. secretary, The Association was founded in 1913, and in his annual report the hon. secretary referred to the rapid growth of its membership, which now includes about 200 subscribers. The Heavy Oil Engine Fuel Committee, consisting mainly of members of the Diesel Engine Users' Association, was formed in January, 1918, to assist the Mineral Oil Production Department of the Ministry of Munitions in the control and distribution of supplies of fuel oil, and in arranging, as far as possible, to substitute tar-oil fuel in place of imported petroleum fuel oil. The last two meetings of the year were taken up with the consideration of the subject of semi-Diesel oil engines, and, as a result, a very considerable amount of valuable information was collected and published in the reports of the proceedings of the Association.

Bradford Engineering Society. At a meeting last week, Prof. G. F. Charnock, of the Technical College, lectured and demonstrated on "Oxy-Acetylene and Electric Welding." After explaining the advantages of these systems, Prof. Charnock said that the British Admiralty evidently had much confidence in electric welding for ship construction. A considerable extension of the process in ship work was taking place.

Royal Society of Arts.—Dr. J. A. Fleming, continuing his Cantor Lectures at the Royal Society of Arts on Monday, discussed the passage of electric waves through the atmosphere. The course of the current was greatly affected by the earth's atmosphere, consisting, above 50 kilometres, of gases that had not been mixed by winds, but had sorted themselves according to density, and still higher almost entirely of hydrogen and helium. There were, moreover, particles arriving at enormous velocity, pushed as they were by light from the sun, and, to illustrate the energy possessed by this fine solar dust, Dr. Fleming remarked that as much as would go in one's pocket had enough energy to run a battle cruiser for 24 hours. When these particles struck the earth's atmosphere it became heavily ionised, and the effect was that the current was turned downward, like the light that gave an inverted mirage. This, and not diffraction, was the cause of the bending of the ray round the earth.

Physical Society of London.—At the meeting on January 25th, a paper, entitled "Electrical Theorems in Connection with Parallel Cylindrical Conductors," was read by Dr. A. Russell. The formulæ, he said, for the capacity between the conductors and for the effective inductance were well known, but the values of the capacity and potential coefficients and of the inductance coefficients had not been determined. It was shown that for the case of a cylinder inside a cylindrical tube their values could in all cases be easily computed. When the cylinders were external to one another, it was proved that the three capacity coefficients were connected by two very simple relations. Limiting values between which these coefficients must lie were found, and methods of obtaining closely approximate values in special cases were given. Practically identical formulæ were given to find the current-density and the inductance coefficients with high-frequency currents, both for a cylinder inside a cylindrical tube and for two parallel cylinders. In the latter case it was shown that when the phase difference between the currents was less than 90°, the mechanical force between the cylinders was repulsive when they were close together, and attractive when they were far apart. At a definite distance apart, therefore, the cylinders, when carrying high-frequency currents, were in stable equilibrium. Since the potential coefficients could always be determined experimentally, it followed that the inductance coefficients for high-frequency currents, which were equal to them, were also found by the same experiments.

Institution of Electrical Engineers. At a meeting of the Scottish Centre of the Institution, held in Glasgow on February 11th, Mr. P. Hunter-Brown read his paper on "Carbon Brushes: Considered in Relation to the Design and Operation of Electrical Machinery."

Automatic Telephones.—The automatic telephone system now in operation at Leeds was described, last week, in a lecture at the Philosophical Hall, by Mr. T. B. Johnson, Post Office Superintending Engineer for the North-Eastern Division. Mr. Johnson told an interesting story of how the automatic switch came to be invented. In a description of the Leeds Exchange the lecturer said that the system was being watched with great interest by people all over the world. The city possessed not only the largest automatic exchange in Europe, but the largest in the world to be converted from the manual to the automatic system. The system had a capacity of 15,000 lines and an existing equipment of 6,800 lines, but it would permit of additional accommodation up to 100,000 lines. The lecture was illustrated by lantern slides, and a working model was used to demonstrate the working of the automatic system.

The National Association of Supervising Electricians.—The fifth annual general meeting of this Association was held on Tuesday last. The report of the Board of Control states that the present rate of application for membership exceeds all records, and the average attendance at meetings when technical papers were read during the past year exceeded 70. The Institution of Electrical Engineers invited the co-operation of the Association in solving some of the problems of reconstruction, and the Association has also assisted the Engineering Standards Association in connection with the standards for wall plugs and ceiling roses. The Illuminating Engineers' Society has offered the privilege of membership to members of the Association. Application has been made for recognition of the Association on the Joint Industrial Council, on which it obviously has a right to be represented, and every effort is being made to enrol all the supervisors in the country and to raise the status of the Association. The social activities of the Association are to be resumed, and an evening concert has been arranged for March 8th. The balance-sheet shows that the financial position is very satisfactory.

The Association, which was formed in 1914, and is registered as a Trade Union, has been conducted since the commencement on lines for which we have nothing but commendation; the membership is rigidly confined to men of British nationality, and the qualifications of candidates are strictly scrutinised; supervising engineers or managers must have had at least eight years' experience in the electrical trade, of which three years must have been spent as supervisors or managers, and foremen must be competent electricians who have been employed in the electrical trade for at least 12 years, during four of which they must have been recognised foremen. The objects of the Association are to obtain for members adequate remuneration, to regulate the relations between employers and workmen and between workmen and workmen, to obtain the best working conditions, to provide assistance for members in case of need, and to foster the apprenticeship system, and promote the technical education of electrical workers. Lectures and technical papers are read at the meetings, by eminent authorities, and social gatherings are also organised. As we showed in our last issue, the Association took an active part in frustrating the recent attempted strike, on the grounds that it was an organised attack on the principles of true Trade Unionism and contrary to the public interests. Now that organisation is in progress on every side, and it is almost indispensable for everyone engaged in industry to belong to some Association representing his particular interests, it is desirable that the existence and constitution of such a Society as this, which is founded on the firm ground of high principles and qualifications, and is conducted on admirable lines, should be widely known. The address of the Hon. Secretary (Mr. C. J. Banister) is 83, Deodar Road, S.W. 15.

Rochdale Strike Incident.—At Rochdale Police Court, last week, an echo was heard of a recent strike at the Corporation electricity works, when Thomas E. Cayton (34), was summoned at the instance of Mr. F. H. Rudd, borough electrical engineer, for feloniously and maliciously injuring an electric telpher, with intent to cut off the supply of electricity; and with hindering an employé from using certain ash carriages. It was stated that Cayton was employed at the works to drive an overhead telpher system, used for carrying ashes in skips to a hopper. On the 3rd inst. the ash wheelers came out on strike, and Cayton went down to the ash trench and overturned the carriages on which the ashes should have been placed. He threatened that if anyone attempted to clear the ashes away he would "lay them out." If the task of handling the ashes had been stopped, the whole of the works would have been brought to a standstill. Cayton and another man were seen to climb up to the telpher, and later it was found that three fuses had been taken out. The strike trouble had been caused by a few ash wheelers, the representatives of the men having agreed to working arrangements. Cayton said the trouble arose over the question of a 47-hour week. A fine of 20s. was imposed on one summons, and the other was withdrawn.

The Edinburgh Strike.—The members of the Edinburgh Branch of the Electrical Trades Union having decided to resume work after being on strike, a deputation interviewed the secretary of the Electrical Contractors' Association (Mr. W. Finlay, W.S.) to ascertain on what terms work might be resumed. These terms were that, so far as the employers could arrange, work would be resumed on Friday (February 14th). Mr. Finlay, in a letter, further stated that there would be no victimisation of men or apprentices because of the strike, but his Association would give no obligation that all former employés should be immediately employed, as, owing to the strike, a substantial amount of work had been driven to other districts, nor would it agree to give any preference to recent civilian employés as contrasted with former employés who were returning from the Forces, in regard to whom the members of the Association had already given definite obligations in addition to the general obligation, which was incumbent on every right thinking man. It was equally understood that there would be no boycotting of any individual employer on the part of the Union. In addition to other conditions, the Unions were asked to undertake that they would not be parties to any future strike without giving seven days' notice.

The Union intimated a partial acceptance of the conditions, but was to discuss minor points.

Appointments Vacant.—Shift engineer (91s.) for the Stalybridge, &c., Joint Tramways and Electricity Board; engineering master for the Wellington (Somerset) School; lecturer in electrical engineering (£250) for the East London College (University of London); assistant electrical engineer for the Gold Coast Government Railway (£350 + £80 duty allowance + £120 war bonus); assistant electrical engineer (£175) for the Buxton Corporation electricity department; meter tester for the Greenock Corporation electricity department. See our advertisement pages to-day.

Shell Detector.—A *Daily Mail* correspondent states that Prof. Gurron, of Nancy, has adapted Hughes's induction balance for detecting unexploded shells on farm land. The apparatus, which signals only large masses of metal, deals with 18 acres in about 20 hours.

"Safety First" Awards.—At a meeting of the London "Safety First" Council, last week, it was announced that Dr. Addison, President of the Local Government Board, and the Lord Mayor of London had become vice-presidents. A "Safety First" scholarship of 10 guineas, and 76 prizes of value £50, are offered to schoolchildren for essays on the prevention of traffic accidents. Two thousand drivers entered for the "Freedom from Accidents" competition, of whom 90 are to receive money prizes and badges. In addition, 457 first and 147 second-class badges are to be awarded. The first recipients of the Meritorious Service Award are Staff Foreman Henry Pilch, who pulled a man off the track at Westminster District Railway Station while a train was approaching; and H. Bedford, who averted a serious accident at the Port of London Docks by stopping a pair of bolting horses. *The Times.*

Educational.—It is proposed to establish a technical institute at Coventry, at a cost of over £100,000. The manufacturers of the city are being invited to raise a separate fund of £50,000 to be spent mainly in equipment for trade instruction, and this fund has been started with a subscription of £5,000.—*The Times.*

Fatalities.—The death took place on Saturday of James Wright, a labourer employed at the Keighley Corporation tramway sheds, as the result of an accident at the works on the preceding Thursday. He told an Inspector that he had fallen down the stoke-hold of the heating apparatus. He was sent home, and became unconscious the same night. A doctor found a wound in the skull behind the right ear. He was suffering from concussion, and never regained consciousness.

A verdict of "Accidental death" was returned at an inquest concerning a fatality which occurred at the works of British Dyes, Ltd., Huddersfield. An apprentice aged 15 (F. Sykes) was helping to lay a lead-covered cable, and was passing it through a wall, when he received an electric shock. The cable passed over a live wire that went to another part of the works. The deceased was very eager to help, and his keenness to get on with the work was described as one of the contributory causes of the accident. The electrical superintendent (Mr. W. L. Ward), in giving evidence, said that he found that two small pieces of the insulation of the live wire had been snipped out, probably due to the lead-covering of the cable developing a sharp edge. There was also evidence of a flash caused by the contact of the electrified lead cable with two small pipes underneath.

NEW COMPANIES REGISTERED.

S. Pearson & Co. (Contracting Department), Ltd. (158,033).—Private company. Registered February 7th. Capital, £1,000,000 in £10 shares. To take over the business of contractors for public works carried on by S. Pearson & Son, Ltd., at 10, Victoria Street, S.W., or any parts or branches thereof, to construct, repair, administer or control railways, tramways, roads, tunnels, harbours, docks, slipways, shipping places, piers, jetties, wharves, staithes, quays, canals, reservoirs, tanks, oil wells and refineries, pipe mines, sewage, water, gas, electric light, and other works or conveniences, to carry on or assist in any commercial, financial, mining, oil, drilling, and industrial undertakings, &c. The subscribers (each with one share) are:—C. J. Newman, 12, Old Road West, Gravesend, secretary; S. R. F. Wickman, Wouldham, Tring Avenue, Ealing Common, incorporated accountant. First directors: Rt. Hon. Viscount Cowdray, Sir Clarendon G. Hyde, Sir Edward E. Pearson, Sir Ernest E. Moir, Bart., and Frederick T. Hopkinson. Solicitor: J. L. Walsh, 16, Finsbury Circus, E.C.

Ironclad Switchgear Co., Ltd. (153,023).—Private company. Registered February 7th. Capital, £4,000 in £1 shares. Electricians, electrical and general engineers, &c. The subscribers (each with one share) are: S. O. Ashworth, Rook Mount, Newchurch, near Manchester, slipper manufacturer; E. W. Morgan, 124, Manley Road, Whalley Range, Manchester, electrical engineer. First directors: S. O. Ashworth (permanent governing director), E. W. Morgan, and A. W. Ashworth. Registered office: 54, Corporation Street, Manchester.

Twiss Engineering & Electric Transmission, Ltd. (153,036).—Private company. Registered February 7th. Capital, £30,000 in £1 shares. Electrical and general engineers, and manufacturers of plant for the generation, accumulation, transmission, and supply of electrical energy, &c. The subscribers (each with one share) are: W. J. T. Monro, 28, Bishopsgate, E.C., member of Stock Exchange; A. J. Hall, 37, Blenheim Park Road, South Croydon, merchant. Subscribers appoint the directors.

Ernsmore Engineering Tool Co., Ltd. (153,052).—Private company. Registered February 8th. Capital, £2,000 in £1 shares. Engineers, tool makers, manufacturers of electric dynamos and apparatus, &c. The subscribers (each with one share) are: E. S. Moore, 2, Hungerhill Road, Nottingham, engineer; J. H. Rogers, 60, Robin Hood, Chase, Nottingham, engineer; H. Merchant, 134, Hungerhill Road, Nottingham, engineer. Subscribers appoint the directors. Solicitors: Hind & Godfrey, 15, Long Row, Nottingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Smith & Mortimer, Ltd.—Satisfaction in full on January 28th, 1919, of debenture dated May 25th, 1915, securing £350

W. T. Henley's Telegraph Works Co., Ltd.—Charge on £67,331 War Bonds, dated December 31st, 1918, by way of substituted security. Supplemental to trust deeds of 1905 and 1911, securing £300,000 debenture stock.

Auxiliary Engineering Co., Ltd.—A notice of the appointment of S. F. Cuffe, of 42, Old Broad Street, E.C., as receiver, on January 27th, 1919, under powers contained in debenture dated July 31st, 1918.

Trafford Engineering Co., Ltd.—Mortgage dated January 22nd, 1919, to secure £6,000 and other moneys becoming due from the company to Hibernian Bank, Dublin, charged on land and premises at Barton-on-Irwell, Lancs.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramways Officials.—The Highways Committee of the L.C.C. recommends that Mr. J. J. McGREGOR, charge shift engineer, be appointed as from January 1st boiler-house superintendent at the Greenwich power station, at £300 per annum, plus the special temporary allowance of £50 per annum, in addition to the war bonus.

The Faversham T.C. has increased the salary of the electrical engineer, Mr. G. SOMMERVILLE, by £23 10s. a year as from September 1st last.

Kendal T.C. has advanced the salary of Mr. J. A. T. BARNES, electrical engineer and manager, to £300 a year, to date from April 1st last.

Carlisle Electricity Committee has appointed Mr. H. P. BAYNHAM, station superintendent, to succeed Mr. J. H. Thompson as chief assistant at the electricity works, at £200 a year, rising £25 a year to £250, plus a war bonus of 35 per cent.

Wimbledon B.C. Electricity Committee reported that it had considered the claim made by the Associated Municipal Electrical Engineers under which the salary of the chief electrical engineer would be increased from £650 to £932 per annum. The committee decided not to accede to the claim, and the B.C. approved its action. The Committee has decided to refer the claim of the Electrical Power Engineers' Association concerning salaries to arbitration.

Lieut.-Colonel A. E. MAYES, lately returned from France, has resumed his duties as engineer and manager to the Isle of Wight Electric Light & Power Co., Ltd.

Stoke Newington B.C. General Purposes Committee recommends that £45 per annum additional war bonus be granted to Mr. H. LARGE, chief assistant and acting borough electrical engineer, as from October 1st, 1918; the present salary is £200 per annum, plus £15 war bonus.

General.—Mr. W. H. MULHALL, who joined the Royal Engineers on the outbreak of war, has now been demobilised, and has returned to the Edison Swan Electric Co., Ltd., in his old position as representative.

Roll of Honour.—We reproduce the following extract from the *Faraday House Journal*:—"Colonel SPARKS (President, F.H.O.S.A.), who was appointed Assistant-Director of Labour to the Third Army in France in January, 1917, was soon appointed Commandant of Labour. Colonel Sparks had for a considerable time a very much larger number of men under his command than any Army Corps Commander in France. He was mentioned in Sir Douglas Haig's dispatches, and he has been made a Companion of the Order of St. Michael and St. George. It is interesting to remember that he was mobilised as a sergeant in the London Scottish on August 4th, 1914, and that he was wounded on December 21st, 1914. He has gained the M.C., the D.S.O., the Croix de Guerre (with palm), has been twice mentioned in dispatches, and has now been awarded the C.M.G. His war record is one in which all Faradians will take pride. Colonel Sparks has resumed his consulting work with his brother, Charles P. Sparks (Faradian, President I.E.E., 1915-17), at 66-71, Moorgate Court, Moorgate Street, E.C. 2."

Lieut. E. H. DIMMOCK, R.A.F., who was stationed at the Wireless Telephony School, Winton, Bournemouth, died on February 3rd from pneumonia.

Obituary.—MR. P. F. EVANS.—The death occurred on February 8th, from pneumonia, of Mr. Percy Francis Evans, for some years engineer with the Market Drayton Electric Light Co. He was 29 years of age.

MR. E. O. WALKER.—We regret to learn of the death of Mr. Ernest Octavius Walker, C.I.E., late of the Indian Telegraph Service. Mr. Walker passed away on February 12th at Kensington, from heart failure.

MR. C. H. STEARN.—We regret to record the death, which occurred on the morning of February 14th, after a short illness, of Mr. Charles Henry Stearn, managing director of the Stearn Electric Lamp Co., Ltd. The deceased gentleman was the co-inventor with the late Sir Joseph Swan of the carbon-filament electric lamp. He was for some years managing director of the Swan Co., until its fusion with the Edison Co., into the Edison & Swan United Lamp Co., Ltd. On the expiration of the Swan patents he started the manufacture of electric lamps at Kew Gardens, and maintained an active part in the management up to the time of his illness. One of his inventions, the commercial success of which has been phenomenal, was the manufacture of artificial silk from viscose. The late Mr Stearn was 75 years of age The funeral took place at Richmond on Tuesday last.

PROF. G CAREY FOSTER.—The Institution of Electrical Engineers was represented at the funeral of Prof. George Carey Foster, LL.D., B.Sc., F.R.S. (past president, and one of the original members of the Institution), by the following: Sir R. T. Glazebrook, C.B., F.R.S., past president (also representing the president of the Institution); Mr. Alexander Siemens, past president; Mr. W. M. Mordey, past president; Mr. Walter Judd, member of Council, and Mr. R. H. Tree, chief clerk.

CITY NOTES.

Crompton & Co., Ltd.

At the meeting held on Friday last at Salisbury House, E.C., Mr. A. A. Campbell Swinton, F.R.S., who presided, said that the reason he was now chairman in place of Mr. Tufnell was because the board, having regard to the general conditions obtaining in the electrical industry, thought it might be in the interests of the company to have someone in the chair who had been associated, as he had been, with the technical side of the industry. Mr. Tufnell still remained on the board. The last time the directors presented accounts was in July, 1916. Meetings of shareholders were held in 1917 and 1918, and dividends were paid in respect of both those years, but no accounts were presented. As was then explained, certain matters arising out of the control of the company under the Munitions of War Act had to be settled before the accounts could be published. Although the company's liabilities for excess profits tax for the years 1916-17 and 18 had even now not been definitely ascertained, some progress had been made towards their settlement, and other questions concerning the accounts had also been settled. They were now able to submit accounts for the three years up to March 31st, 1918. At the meeting in July, 1916, the directors recommended that £10,000 should be placed to depreciation reserve. The additional depreciation which they had now been allowed to charge, and the arrangements made with the Ministry of Munitions in regard to certain items of capital expenditure now made that reserve unnecessary. The net profit for the three years had amounted to £114,268, or an average of £38,089 per annum. The rate of profit earned during the three years had, year by year, shown a steady increase. In the balance sheet the freehold land and premises stood at a rather lower figure than in March, 1916. The stock in trade had increased from £80,000 to £155,000—very nearly double, and after allowing for the increased costs, was some indication of the growth of the business. Investments had been increased by £2,500. In a company such as theirs, whose pre-war profits were not large, the special war taxation was a heavy drain upon their resources. Money that would otherwise have been used to improve their works and generally to increase their cash reserve had been taken by the Government. It was sincerely to be hoped, not only in their individual interests, but in the interests of industry generally, that the excess profits duty would soon be abolished, or at any event greatly reduced. It was a millstone round the neck of industry and enterprise, and unless removed would do more to prevent the re-employment of our demobilised soldiers than anything else. The imposition of the tax originally was part of a bargain made by the trade unions, and when first applied it had a certain amount of moral sanction, inasmuch as it was not considered right that while one part of the community should make great sacrifices, another portion should be making profits out of the war. Such moral sanction, however, had now ceased to exist, and the duty, if continued, would seriously hamper the development and expansion of industry. The Federation of British Industries, of which the company was a member, was taking the matter in hand, and was doing its best to press the question upon the attention of the Government. With regard to the future, the profits for the current year, so far as they had been ascertained, were good, and they looked forward to being able to show very satisfactory figures at the next annual meeting in July. Proceeding to refer to the proposals in the report for additional capital, the chairman said the directors felt it was essential that the capital should be increased in order to cope with the new business that was now offering itself every day. During the last four years of war, practically all manufacture of electrical machinery for ordinary purposes had been arrested, and there had also been practically an entire cessation of export, both to foreign countries and to the Colonies and India. The consequence was that an enormous amount of demand for electrical plant throughout the world had accumulated, and the company was simply inundated with work, which required capital to carry it out. The demand for electrical plant was intensified by the great demand that was now taking place for labour-saving appliances, most of which had to be driven by electric motors. There were, too, the new proposals of the Government for the development of electric power on a very large scale throughout the country by means of the proposed super-power stations, by which it was hoped to be able to enormously increase the use of electrical energy for power purposes in every part of the United Kingdom. That in itself would produce a further great demand for electric motors and other appliances, so he did not think there could be any doubt but that the market for the kind of things they made at Chelmsford was likely to be very considerable, at any rate for many years to come. Again, there was a great demand abroad, in France and Belgium, where a great part of the electrical machinery had been destroyed, and neither of those countries was in a position to renew it. In addition to that, various neutral countries had made a great deal of money during the war, with the consequence that they had got a good deal to spend, and they were intending to spend a considerable portion of it in electrical machinery. The directors' proposals involved the creation of £24,000 of additional preference shares and £254,993 ordinary. It was proposed to reserve the preference shares to be issued to the company's employés. The directors had very carefully considered the matter, and thought it would be in the general interests of the company to give the employés a direct interest in the profits. They proposed to issue those shares both to the workpeople and the staff on a plan whereby they would be able to purchase them by a certain sum being deducted weekly from their wages. Not only would there be a 7 per cent. preference, but as soon as the ordinary received 7 per cent., further profits would be divided equally between the two classs of shares. In addition, they had thought well in the case of preference shares issued to the employés to give an additional 3 per cent., so long as the shares were held by the employés. They had thought it necessary in the first instance to limit the amount that any one employé might apply for. They heard a great deal nowadays of industrial unrest, and the directors thought that was one way of meeting it. The amount that a company such as theirs distributed in the way of dividends was only a very small proportion of what it paid its workpeople as wages. If all the profits were paid over to the workmen it would only mean a shilling or two extra a week, and, of course, in such an event they would never be able to raise more capital. It was a common belief among workmen that there were only what they termed capitalists and workers; but taking that company, they had no less than 700 shareholders, and the average dividend received by them was under £20. The board had not yet decided when they would issue the ordinary shares, but the shareholders would be given an opportunity to subscribe for them. At the meeting in July, 1917, a shareholder proposed a resolution to increase the directors' fees, but the chairman pointed out that such a resolution was out of order, as the fees were fixed by the articles and could only be altered by special resolution. The directors now proposed to alter the articles so as to provide for an increase of £100 a year to each director.

Mr. C. Tufnell seconded the motion.

Replying to questions, the chairman said that the extra 3 per cent. on the preference shares to be issued to the employés would be a bargain between the company and the individual holder, and the 3 per cent. would be a first charge upon the company's profits.

The report was adopted.

Subsequently resolutions were passed increasing the capital of the company and altering the articles of association.

The London Underground Railways.

Reports have been issued by the five companies that are parties to the common fund agreement, and we extract the chief particulars below. The aggregate gross traffic receipts of the five concerns were £6,884,715, and the aggregate gross receipts were £7,743,451. The aggregate amount retained by the five companies as defined by the common fund agreement, which includes working expenses, prior charges, reserves, and other items of a similar nature, was £7,111,760. The balance, £631,690, was credited to the common fund, and is divided as shown below. The aggregate number of passengers carried by the concerns is estimated at 901,000,000, exclusive of through inwards passengers to the Metropolitan-District from other controlled railways.

City & South London Railway Co.—This company is entitled to 6 per cent. of the common fund (£631,690). It accordingly receives £37,901 for 1918. This company's total net income was £152,404 plus £21,226 brought forward. Interest, rentals, and other fixed charges absorb £47,003, and £25,000 is appropriated to reserve, £42,000 to preference dividend, and after paying the dividends on the ordinary stock, mentioned in our last issue, a further £5,000 is put to reserve. Capital expended during the year £33,612. Despite shortage of staff and other difficulties, the traffic carried constituted a record. Arrangements are in hand for the purchase of new and larger cars, and the work of enlarging the tunnels will shortly be recommenced. A late Bill is to be deposited in Parliament for raising additional capital to meet the contemplated expenditure. It is hoped that all restrictions imposed for conserving coal used in electrical generation will shortly be removed. An arrangement has been made between this company, the London Electric Railway Co., and the Central London, whereby the London Electric Railway Co. bears all the expenses of maintaining and operating the three railways, recognising advances of moneys from time to time as necessary. At the close of each year the total expenses are allocated on an agreed statistical basis. It is thus possible to deal with the maintenance and operation of the three tube railways as if in fact there were one railway, and considerable economies in the keeping of accounts are being effected.

Metropolitan District Railway Co.—This company is entitled to receive 12 per cent. of the common fund, namely, £75,803. The company's total net income was £583,703 plus £29,029 brought forward. Interest, rentals, and other fixed charges absorb £347,971, £35,000 is put to reserve, dividends on guaranteed and first preference stock required £124,930. After paying the dividends mentioned here last week a further £10,000 is put to reserve, and £21,331 is carried forward.

Central London Railway Co.—This company is entitled to receive 20 per cent. of the common fund, namely, £126,338.

The total net income was £227,571, plus £11,147 brought forward. Interest, rentals, and other fixed charges absorb £59,633, there is appropriated to reserve £20,000, dividend on preference stock £21,600, and after paying the dividends on other classes of stock as stated here last week, £17,485 is to be carried forward.

London Electric Railway Co.—This company is entitled to receive 30 per cent. of the common fund, namely, £189,507. The total net income was £650,604, plus £30,656 brought forward. Interest, rentals, and other fixed charges were £299,150, £35,000 was put to reserve, dividend on preference stock required £126,947, and after paying the dividends mentioned here last week, a further £10,000 was put to reserve, leaving £23,604 to carry forward. It is proposed to proceed at an early date with improvements which were postponed by the war, and a late Bill in Parliament will seek powers to raise capital necessary for the purpose.

London General Omnibus Co., Ltd.—This company is entitled to receive 32 per cent. of the common fund, namely, £202,141.

Dublin United (Electric) Tramways Co., Ltd.

Mr. W. M. Murphy, presiding at the meeting last week, said there had been no expenditure during the year on capital account; but further capital expenditure would be necessary to improve the electrical distribution system, and to meet the problem which had arisen owing to the increased and increasing volume of electricity which the main cables would be called upon to convey. It was proposed to erect a central sub-station, with machines effecting a considerable saving in power to be generated, and a site had been obtained from the authorities of Trinity College at the junction of College Street and Brunswick Street. The saving of coal by the proposed installation would more than pay the interest on the outlay, which would amount to £10,000. They had record figures both in receipts and expenditure, the increase in the former being roughly £90,000, and in the latter just under £70,000. The coal bill, on a rationed supply, reached £38,906, an increase of £8,580, and the whole cost of station operation, £47,106, showed an increase of £10,634, as compared with 1917. The total maintenance cost had increased by £30,542, which was mostly in wages. There was an increase in traffic expenses of £18,847. He believed theirs was the last undertaking of its kind in the kingdom that had increased its fares. On the question of continuance of increased passenger traffic, he would not forecast an opinion, but he was afraid they were living through a period of artificial prosperity, which must necessarily be of a temporary character, as it was due to the lavish expenditure of some of the thousands of millions borrowed from the State. This could not go on for ever, and he feared sooner or later they would have a rude awakening to the perception of the elementary principles which must ultimately govern the finance of the world.

National Electric Supply Co., Ltd.—The annual meeting was held at Preston last week. Mr. Booth, who presided, said that the restrictions imposed upon consumers and the company had seriously affected the income, but the directors felt that the worst period of depression had passed, though it might be some months before matters became normal. Increased wages and advances in the cost of materials had compelled an increase in the price of current. Only £817 had been spent on capital account, and over £4,000 on repairs and maintenance. It was proposed to place £5,000 to reserve for depreciation, &c. The cost of fuel, £10,858, was an increase of £2,232, and salaries and wages were £6,211, as against £4,561 last year. The two increases were equal to an additional 7 per cent. on the ordinary shares. Notwithstanding the restrictions they had sold 86,191 more units than last year, and the income had increased by £3,751. Regarding the Government proposals as to the erection of super-stations, they believed the scheme would go through. Everything would be done to protect their interests.

South Metropolitan Electric Light & Power Co., Ltd.—The accounts for 1918 show a credit balance of £63,387, plus £7,626 brought forward. After deducting £14,986 for debenture and other interest, and £7,895 for interim dividends paid on the pref. shares, it is proposed to pay a final dividend upon the 7 per cent. cum. first, and the 6 per cent. cum. second pref. shares, to put £20,000 to depreciation fund, to pay 6 per cent., less income-tax, on the ordinary shares, and to carry forward £12,857. The revenue account shows a satisfactory improvement, and the return from sales of current has increased. Notwithstanding a substantial rise in the cost of coal, wages, &c., the business has been well maintained. The installation of a third 5,000-KW. turbo-alternator and auxiliary plant is proceeding. The undertaking of the West Kent Electric Co., Ltd., has made further progress, and a dividend of 10 per cent. has again been recommended. Annual meeting: February 26th.

Prospectus.—*International Light and Power Co., Ltd.*—The list is to close on or before to-morrow in an offer for sale of £396,200 5 per cent. first mortgage debentures, of which £200,000 have been applied for and allotted in full. The debentures are offered by the Law Debenture Corporation, Ltd., on behalf of itself and others at £75 10s. per £100 debenture.

Lancashire United Tramways, Ltd.—The report for 1918 shows: Traffic receipts, £160,867; electrical energy sold and miscellaneous receipts, £21,174; less working expenses, £91,242; cost of generating electrical energy sold, £14,556; general charges (including direction, management, &c.), £6,647; rent of leased lines, £5,191; add dividend on holding in New St. Helens and District Tramways Co., Ltd., £3,068; profit of combined undertaking, £67,443. Receipts, compared with those of previous year, show an increase of £40,827, traffic earnings per car mile amounting to 17.85d. Increase in expenditure amounted to £25,925. The interest and dividends received by the company from the operating companies, together with sundry receipts, amounted to £19,973. After deducting interest on the prior lien debenture stock and expenses, there remains a balance out of which the full interest of 5 per cent., less tax, will be paid on the second mortgages debenture stock for the year 1918. The sum of £7 remaining is carried to depreciation account.—*Financier.*

Smithfield Markets Electric Supply Co., Ltd.—The gross profit for 1918 was £470, against £2,268 in 1917, and the net loss for the year was £1,749. £400 has been placed to the debenture stock redemption fund, and the balance of "Alteration of Pressure" account, £558, has been written off. After crediting £1,214 brought in from last year there is a debit at profit and loss account of £535. Owing to official control of the Central Markets and the closing of many buildings, there has been a serious reduction in the company's output, while the abnormal cost of fuel and materials, and higher wages and war bonuses have further adversely affected the profit. It is hoped that there will be a gradual improvement during 1919.

Electrical Distribution of Yorkshire, Ltd.—The net profit for 1918 was £3,168, as against £3,495 for 1916 and £3,693 for 1917. Adding £583 brought forward, £3,751 is available. A dividend at the rate of 6 per cent. per annum, free of income-tax, on the ordinary shares absorbs £2,738, leaving £1,012 to carry forward, subject to directors' remuneration. The difficulties of the year have prevented steady expansion, have increased costs, and have reduced the profit. Many demands for supply are now being made. The end of hostilities is permitting the gradual release of labour and material, and considerable extensions of mains must be made. Further capital is thus required. A resolution was passed a year ago increasing the nominal capital from £50,000 to £100,000.

St. James' & Pall Mall Electric Light Co., Ltd.—The connections increased during 1918 from 17,253 KW. to 18,114 KW., and 10,593,556 units were supplied to consumers. The net profits were £26,290, plus £5,286 brought forward. The dividends of 7 per cent. on the preference shares and a total of 10 per cent. per annum on the ordinary leave £4,576 to be carried forward. The units generated by steam plant were 341,639, and those purchased 13,600,079. For private supply 10,593,556 were sold; used on works 235,309; on batteries 193,446; transmission and transformation 2,455,121; distribution 464,286. Annual meeting, February 25th.

Westminster Electric Supply Corporation, Ltd.—The total connections increased during 1918 from 48,084 KW. to 50,166 KW. Lt.-Col. Sir James Remnant, M.P., has retired from the board, and Lord Downham of Fulham has been elected. After allowing for depreciation, sinking fund and other charges, and paying the preference dividend, a dividend at the rate of 9 per cent. per annum, less tax, is to be paid for the last half-year, making 8 per cent. for the year. £5,693 is to be carried forward. Units sold, 25,211,780, including 1,317,709 A.C. supply; used on works, 277,790. Annual meeting: February 26th.

Fife Tramway, Light & Power Co.—The directors report a profit for the year, after paying the interest and debenture redemption instalment, of £38,635, and recommend a dividend on the ordinary shares of 7 per cent., less tax, besides transferring £15,000 to the reserve account. They state that the abnormal costs affected the revenue from the power, lighting, and tramway properties adversely, but the result of the year's trading is regarded as satisfactory. The tramway to Rosyth has proved a very satisfactory addition to the company's system.

National Gas Engine Co., Ltd.—The net profit for 1918, after providing for depreciation, management salaries, excess profits duty and income-tax, is £104,012. Interim dividends of 5 per cent. per annum on the pref. and 7½ per cent. per annum on the ordinary have already been paid, and final dividends of the same amounts, both less tax, are now to be paid, together with a bonus of 1s. per share, free of tax, on the ordinary shares. £78,132 is to be carried forward.

Stock Exchange Notices.—The following have been ordered to be quoted in the Official List:—

Buenos Ayres Lacroze Tramways Co., Ltd.—£65,400 additional 5 per cent. consolidated mortgage debentures of £100 each (Nos. 10,001 to 10,600 and 10,661 to 10,714).

Morgan Crucible Co., Ltd.—Scrip for £500,000 6 per cent. first mortgage redeemable debentures.

Central Electric Supply Co., Ltd.—During 1918, 30,163,906 units were supplied to the Westminster Electric Supply Corporation, Ltd., the St. James' & Pall Mall Co., and the Chelsea Electricity Supply Co.

Vera Cruz Electric Light, Power & Traction, Ltd.—Mr. V. W. Yorke, presiding at the annual meeting last week, said that not only had they been able to resume payment of dividends, as he had anticipated at the last meeting, but they were able to recommend for 1917 the highest dividend in the history of the company. This had come about through the steadiness of the exchange all through the year under review, and the fact that there were no disturbances of the peace in Vera Cruz, and because the transmission line from Tuxpango, 70 miles long, suffered no serious damage. The profits for 1918 had not been quite so good, and the result was that the net earnings for the 10 months to the end of October showed a decrease of some 80,000 pesos. Construction of the tramway to Balnearios, which was commenced in August, had now been suspended for want of the necessary rails. Conditions in Mexico showed little, if any, improvement, but the termination of hostilities in Europe would bring the permanent settlement of the country appreciably nearer. Public utility companies such as theirs had suffered very little material damage during the whole revolutionary period. In a few outlying districts transmission lines had been destroyed, but generating plants had escaped damage.

Clontarf (Dublin) & Hill of Howth (Electric) Tramway Co., Ltd.—At the meeting held at Dublin, Capt. W. L. Murphy presiding, the directors' report was adopted, and a dividend at the rate of 3 per cent. per annum, less income-tax, was approved.

Mather & Platt, Ltd.—The dividend for 1918 on the ordinary shares is at the rate of 17½ per cent. per annum, free of tax.

Liverpool Overhead Railway Co.—Dividend on the ordinary shares for 1918, 3¼ per cent., leaving £6,120 to carry forward.

Held Over.—Owing to pressure upon our space, several City and other matters are held over until next week.

STOCKS AND SHARES.

Tuesday Evening.

Mexican securities are the outstanding feature of strength in Stock Exchange markets, which otherwise have been somewhat dull. The Labour position is making investors thoroughly uneasy. People say they will not put money into shares of domestic industries. The provincial centres continue to support their local companies, and this helps to keep industrial prices steady. But there is noticeable disinclination on the part of the ordinary buyer to pay heed to home shares, and the tendency is underlined by the willingness shown to embark money in ventures outside the strike area of our own shores.

Accordingly, the dramatic turn for the better taken by the Mexican situation has found a ready welcome waiting for it, and Mexican prices, advanced all round, are still better than they appear. Hardly any supply of stock was afloat, and what there was the early buyers quickly absorbed. Bonds in the Mexican utility companies are one to three points higher. Private advices are quoted as evidence that Mexico is in a much better way than most people suppose. After the past six years of chaos, mob-rule, currency depreciation, and interest suspensions, it is hard to believe that any good thing, save oil and minerals, can come out of Mexico. Physical deterioration of plant on railway and industrial undertakings must have made severe ravages upon capacity for immediate prosperity, yet at last week's meeting of the Vera Cruz Tramways Co. the chairman produced surprising testimony to the value, *e.g.*, of the Mexican dollar, and to the prospect of better times ahead.

Doubtless Mexico has many a long and dreary furrow to hoe before good times come again, but the outlook seems sufficiently promising to encourage proprietors of Mexican securities to hold their stock.

Other foreigners are flabby. The Argentine Labour leaders are taking leaves from the books of others nearer home, and, in consequence, the various Plate concerns remain out of favour. Brazilian Tractions continue to be a sagging market. No improvement has occurred to change the recent dulness of British Columbia Electric Railway issues. Only in the Mexicans is there any brightness noticeable.

The Home Railway list is equally heavy. All the dividend announcements are out, most of the reports too, and several meetings have been held. The Great Northern chairman declared that the wages increase since the outbreak of war was enough to wipe out all dividend earnings, including those of the preference and debenture stocks. This made Home Rails weak to flat. The Undergrounds shares in the malaise, Districts, Metropolitans, Underground Incomes, and several prior-charge descriptions have fallen from ½ to 1½ points. Nationalisation is no longer a word to conjure with. The public are afraid of Home Rails, refuse to touch them—except to sell the stocks to a market reluctant to add more to its present load.

Movements in the telegraph list are small and unimportant. Business is inactive, and there is nothing of fresh interest to kindle attention. Even amongst Marconis business is very quiet, and the same condition applies to shares in the telegraph manufacturing companies, as well as those in the cable group. As the date approaches for the introduction of the Budget, public speculation begins to revolve round the question of income-tax, but the chances of any relief in this direction are considered sufficiently remote to make the holding of cable stocks still worth while in those cases where dividends are paid free of deduction. West India and Panama ordinary have risen a little. Telegraph Constructions strengthened to 49. Siemens at 6¼ have gained half-a-crown.

The electric lighting market is also quiet. Wednesday this week was the last day for sending in applications for the new issue of Westminster Electrics, and allotment letters changed hands freely on the basis of 5s. 9d. premium up to Tuesday. This, making all allowances, is a little lower than the price for the existing shares, which seems to indicate that a majority of proprietors were willing to take the premium on the new issue as a little present, or extra dividend. In time, the shares will rank on all fours with their seniors. Electric Constructions have risen to 1¼, and British Aluminiums to 38s. 3d., but otherwise the manufacturing list has scarcely varied. An interesting new issue is that of the International Light & Power Co. The Law Debenture Corporation, Ltd., offered for sale—the list closing on or before Saturday this week—396,200 5 per cent. first mortgage debentures of £100 each at 75½ per cent. The Corporation bought the debentures at 70, but pays 3 per cent. underwriting commission and certain other expenses. The company's fields of operation are in Venezuela, the Argentine, and Mexico, and, having regard to this, it is obvious that a speculative element attaches to the bonds, which pay a trifle over 6½ per cent. on the money.

Castner-Kellners have gone back ⅛, other chemicals also being dull. The rubber share market has taken on a better tone. Base metals are mostly dull, on the drop in the price of tin. The armament group retains a fair degree of strength.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price		Yield
	1916.	1917.	Feb. 18, 1919.	Rise or fall.	p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7⅞	—	£6 16 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	8⅝xd	—	6 13 4
Chelsea	8	5	4	—	6 5 4
City of London	8	8	12⅝	— ⅛	6 6 9
do. do. 6 per cen Pref.	6	6	10⅛	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	4	5	4	—	6 5 0
Metropolitan	8	4	8	—	6 18 4
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	8	9	7¼	—	6 4 2
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¾	— ⅛	6 13 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98¼	—	6 1 10
do. Def.	1½	1½	21⅞	— ⅛	7 13 0
Chile Telephone	8	8	7¼	—	6 6 8
Cuba Sub. Ord.	7	7	10¾	—	*6 10 4
Eastern Extension	8	8	15¼	—	*5 3 3
Eastern Tel. Ord.	8	8	158½	—	*5 1 0
Globe Tel. and T. Ord.	7	7	14⅛	—	*4 19 1
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	4⅝	—	4 6 7
Oriental Telephone Ord.	10	10	2¼	—	*4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	6d.	1/3	1$\frac{1}{16}$	+ $\frac{1}{16}$	*3 14 6
Western Telegraph	8	8	16⅝	—	*4 16 3
Home Rails.					
Central London Ord. Assented	4	4	65¼	—	6 2 2
Metropolitan		1	28½	—1½	4 7 9
do. District	Nil	Nil	26	—1½	Nil
Underground Electric Ordinary	Nil	Nil	3¼	—	Nil
do. do. "A"	Nil	Nil	10/-	—6d.	Nil
do. do. Income	6	4	95	—1	*5 5 2
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref.	5½	5½	3$\frac{11}{16}$	—	—
do. do. 2nd Pref.	5½	—	3½	—	—
do. do. 5 Deb.	5	5	71½	—	6 19 10
Brazil Tractions	—	—	54	—1½	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	6	65½	—	7 12 8
do. do. Preferred	Nil	Nil	46	—1	Nil
do. do. Deferred	Nil	Nil	42	—1½	Nil
do. do. Deb.	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	64	+ ½	Nil
do. 6 per cent. Bonds	Nil	Nil	53½	+ 2½	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	50	—	Nil
do. 1st Bonds	Nil	Nil	66½	+1	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3⅞	—	3 17 5
British Aluminium Ord.	10	10	38/3	+2/-	5 4 5
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref.	7½	7½	2½	—	6 0 0
Callenders	20	25	10¾	—	5 16 3
do. 6½ Pref.	5	5	5⅝	—	5 2 4
Castner-Kellner	22	20	3$\frac{1}{16}$	— ⅛	6 1 3
Edison-Swan, "A"	—	—	18/9	+3d.	—
do. do. 4 per cent. Deb.	4	4	74½	—	5 6 0
Electric Construction	7½	10	1¼	+ $\frac{1}{16}$	8 0 0
Gen. Elec. Pref.	6	6	10¼	—	6 6 10
do. Ord.	10	10	17½	—	*5 14 3
Henley	25	25	2$\frac{1}{16}$	—	5 8 2
do. 4½ Pref.	4½	4½	4	—	6 19 8
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	10	—	6¼	+ ⅛	*8 0 0
Telegraph Con.	20	20	49	+ ½	*4 17 0

* Dividends paid free of Income Tax.

THE FUNCTIONS OF THE ENGINEER: HIS EDUCATION AND TRAINING.

By Bt.-Lieut.-Colonel W. A. J. O'MEARA, C.M.G., M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Unfortunately, an opinion has prevailed in this country in the past that the problems which present themselves in a technical undertaking fall under two independent heads, namely, the "technical" and the "administrative"; it has been assumed that the "technical" problems of an undertaking alone constitute the domain of the economics of practice, whilst the consideration of every other problem, financial, commercial, or administrative, belongs exclusively to the realm of the economics of policy. The consequence is that schemes prepared in connection with the education and training of the engineer have hitherto been framed for the purpose of meeting this condition of affairs. In some foreign countries a wider view has been taken than has been the case in this country, and it has been suggested that the instruction given to engineering students during the normal college course should include such subjects as accountancy and book-keeping, banking, mercantile law, political economy, repairs and depreciation, sociology, &c., and in some of the American institutes of technology, a department of "business engineering" has existed for very many years. The American engineer occupies, as a rule, a far stronger and a much more important position in the economics of industrial and commercial life than that accorded to his confrère in this country. The same is true as regards the position of the engineer in many of the countries on the continent of Europe. The Société des Ingénieurs Civils de France, last year, passed a resolution recommending that instruction in administrative subjects should forthwith be made obligatory for all students attending courses of instruction in the higher schools of civil engineering in France. The scheme of education provided for the engineering student in this country should aim at covering as wide a field as that covered in similar cases in any other country, in order that the British engineer may properly discharge the whole of the duties which may devolve upon him, and may be qualified for the wide responsibilities likely to fall upon his shoulders. The specialised education and training of the engineering student should be designed with a view to qualify him to fill, with the highest efficiency, the functions of the position in which he will find himself on obtaining his first responsible appointment after the termination of his complete course of instruction.

The greater part of the work that the engineer is called upon to deal with to-day consists in the construction of works and in the development and exploitation of enterprises which require the provision and maintenance of machinery and plant, the essence of a great part whereof is motion and in every part whereof expansion, progress, and growth are the predestined concomitants. These enterprises present not only technical problems of great complexity requiring solution, but also the equally important commercial and administrative problems relating to running costs, repairs, and depreciation, capital outlay *in futuro*, as well as *in præsenti*, the organisation of the undertaking and the personnel connected therewith, the control and management of the staff, &c. What knowledge other than that comprised in the normal college course is it necessary to call in aid in order successfully to grapple with the scheme as a whole and to see it through to completion?

Monsieur Henri Fayol, a distinguished French engineer, in 1917, pointed out that as a matter of fact the several operations connected with every enterprise fall into six distinct groups, namely:—

(i) The Financial.
(ii) The Commercial.
(iii) The Technical.
(iv) That of Custodianship.
(v) That of Book-keeping.
(vi) The Administrative.

The responsible engineer in every undertaking must be concerned in his professional work with every one of these groups or essential functions.

In order to demonstrate what is comprised within the ambit of each of the six functions in question, the author has collected a number of items or transactions, and has classified them in a table, each item or transaction being placed under its appropriate group or function. To-day, even in the organisation of the largest undertakings, the division of responsibilities is unavoidably so arranged, that every member of the controlling staff must concern himself with at least three of the six groups of functions.

The very important part administration plays in promoting success in the conduct and operations of undertakings of every kind is widely recognised; and therefore some knowledge of the principles involved in the science and art of administration is essential to everyone forming a link in the chain of organisation of commercial and industrial undertakings.

An attempt has been made by the author to estimate approximately the nature of the qualifications needed by certain officials in two engineering undertakings of different types; the information is tabulated in Appendix I. The figures bring into prominence the fact that the technical faculty by no means constitutes the qualification of the highest importance in those who reach the higher ranks of the engineering profession: further, it will be observed that the engineer must in many positions possess to some extent all six faculties.

Even in the case of the foreman the possession of the technical faculty alone is insufficient, very highly developed though it may be; he also must have developed in him faculties of other kinds if he is to fill his position with credit to himself and economy to the undertaking in which he is employed.

Of course, the 100 per cent. of the foreman's total capacity is as a rule something vastly different from the 100 per cent. of the capacity of those in the grades higher than his own; and the 45 per cent. of the assistant power engineer's technical faculty may be equal or even superior to the 82½ per cent. of the charge shift engineer's technical faculty.

In the same way that those responsible for the highly technical work of an undertaking must possess some measure of administrative talent, successfully to handle the problems falling within their proper sphere, so must those who are responsible for the management aspect of modern commercial or industrial undertakings possess some measure of technical knowledge to enable them to exercise their full responsibilities with efficiency and skill.

Diagrams have been prepared (fig. 1), in relation to one of the undertakings concerning which particulars are given in an appendix I, in which the verticals are divided so as to correspond with the percentage figures, whilst the horizontals have been drawn proportionate in length to the salaries and wages appertaining to the several positions in the organisation. The higher the ratio of the administrative faculty needed in any particular position, the greater as a rule is the remuneration attached to that position.

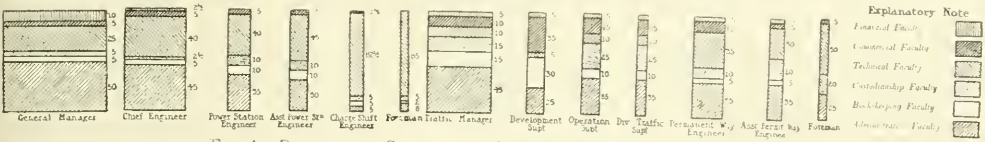

Fig. 1.—Diagrams of Salaries and Estimated Personal Qualifications.

The author suggests that steps should be taken to revise without delay the curricula of engineering courses, in order that a wider scope should be provided in the instruction given therein, so that the engineer, on entering upon the active pursuit of his career, may be better equipped than at present properly and efficiently to perform his professional duties from the administrative and commercial points of view as well as the technical.

It may be urged that no time can be allotted in the curricula of the present engineering courses; that commercial and administrative subjects cannot be taught by lectures; that such subjects are proper matters for treatment in graduate lectures; or that the engineer's employer is the best-qualified person to impart instruction to him in commercial and administrative subjects. These objections do not constitute a sufficient argument for the retention of the present schemes. The matter of finding time is solely a question of willingness to view the various aspects of the engineer's responsibilities and work in their true perspective. Those who may argue that commercial and administrative subjects cannot be taught by lectures, are invited to examine and consider the means that have been adopted at our universities and other institutions in order to assist young men to qualify themselves for positions connected with the administrative posts in the public service. A knowledge of commercial and administrative subjects can be acquired by every engineering student sufficient to enable him to carry on until experience comes to his aid.

The argument that instruction in commercial and administrative subjects is a matter exclusively for graduate lectures is really untenable, and employers are rarely in a position to afford to their employés instruction in commercial and administrative subjects systematically, even should they be willing to undertake the responsibility, which is extremely doubtful. There is a tendency on the part of many engineering students to despise the administrative and commercial aspects of engineering work and to consider the same unworthy of their attention. Therein lies a serious danger, unless some instruction is given in the subjects in question during the college course.

It is the author's opinion that the preliminary instruction in commercial and administrative subjects in engineering courses should extend at least to the numbers of hours stated below, and should cover the elements of the following subjects:—

Subjects.	Number of Hours' Instruction.
(a) Accountancy and book-keeping	8
(b) Administration and organisation	8
(c) Commercial law	6
(d) Depreciation	2
(e) Estimating and writing of specifications	12
Total number of hours' instruction during course	36

A brief outline is given in an appendix of the scope of the preliminary instruction in the above subjects which, it is recommended, should be given, and a short list of works dealing with commercial and administrative subjects has also been prepared. The ideal method of teaching engineering would be always to give the instruction in the practice and the theory simultaneously. In the United States of America in connection with the so-called "co-operative system," the courses are so arranged that the students spend, first, one week at the works of a manufacturing undertaking, and the next week in the college, this weekly alternation of practical and theoretical work being kept up during the whole period of the engineering course. The "co-operative system" is but a highly developed form of the "sandwich system" introduced some years ago into this country. It appears to be desirable, certainly in the case of the engineering schools and colleges situated in the great industrial centres, that a very considerable effort should be made to introduce "co-operative courses" into this country.

In many branches of engineering systematic practical training in the workshop is as indispensable to the student as the regular instruction in the engineering subjects given in schools and colleges. Some manufacturing firms have adopted the very wise and patriotic policy of receiving as pupils young men, who have been suitably educated for the engineering profession, into their workshops without the payment of a premium. If this policy be adopted universally by all manufacturing firms throughout the British Isles, it would prove of incalculable advantage to British industry. Engineering students must, whilst studying technology, be encouraged to improve their general education by widening their knowledge of the world and its affairs and by the study of foreign languages. One of the most important qualifications needed in a modern engineer consists in a command of the English language, and a facility to give expression to his thoughts through its medium with clearness, conciseness, and completeness, in speech as well as on paper. Great issues, involving considerable sums of money, sometimes depend upon the choice that is made of particular words and their collocation in a record.

APPENDIX I.

Estimate of Qualifications Needed by Certain Grades of Officials in Two Types of Particular Engineering Undertakings.

Grade.	Faculties. Financial.	Commercial.	Technical.	Custodianship.	Book-keeping.	Administrative.
Tramway Undertaking.	%	%	%	%	%	%
General manager	10	5	25	5	5	50
Chief engineer	2½	5	40	2½	5	45
Power station engineer	—	5	40	10	10	35
Assistant p.s. engineer	—	5	45	10	10	30
Charge shift engineer	—	2½	82½	5	5	5
Foreman	—	—	85	5	2	8
Traffic manager	5	10	10	15	15	45
Development supt.	5	35	5	—	30	25
Operation supt.	5	15	10	25	10	35
Divisional traffic supt.	5	15	10	25	10	35
Permanentway engineer	5	10	35	10	5	35
Assistant p.w. engineer	5	5	30	20	5	35
Foreman	—	5	50	20	—	25
Manufacturing company.						
Managing director	40	15	5	—	5	35
Commercial manager	20	35	15	—	5	25
Manager traction dept.	—	40	20	10	5	25
Manager cent. stn. dept.	—	40	20	10	5	25
Manager supplies dept.	—	45	15	10	5	25
Manager lamp dept.	—	45	15	10	5	25
Chief engineer	5	10	40	5	5	35
Works manager	—	15	35	10	5	35
Foreman	—	—	65	10	5	20
Inspector	—	—	70	10	5	15

The competitors of Great Britain in the coming economic struggle will take care not to leave unutilised any weapon of economic warfare likely to prove of advantage to them. Clearly, under these circumstances, what will be wanted in the leaders in commerce and industry will be not only high imaginative power, but also the skill to secure "unity of purpose" in those under them by the direction of their efforts into the most effective channels; a scientific education and technical training of a suitable kind are as essential to them as to the engineer. A mere theoretical knowledge of science alone will do little to provide British industries with the class of men required to conduct technical enterprises with sufficient skill and in the spirit of progressive knowledge; the qualifications that are needed in the leaders of industry consist in a combination of high scientific attainments and proficient technical knowledge. Hence it is from the ranks of those engaged on the technical sides of the important industrial undertakings of the country that the selection should in the future be largely made of those who are to take supreme control of Great Britain's technical enterprises.

The question of the education and training of the engineer is closely associated with that of his status. Under present circumstances anyone may, without offending against the laws of the land, hold himself out to be an engineer, although he may never have made any study of engineering subjects; unqualified practitioners in engineering have brought discredit on the profession in the past, and will continue to do so until steps are taken to put a stop to their activities. The author is of opinion that the constitution of a General Engineering Council, possessing statutory powers analogous to those of the General Medical Council, would not only be of benefit to the engineering profession, but also of advantage to the public at large.

Discussion.

Mr. A. P. M. **Fleming**, O.B.E., in opening the discussion, said that the author had thrown new light on a very controversial subject. He thought the author had advocated the adoption of foreign practice without first duly considering the special characteristics of different peoples; what was good for one was not necessarily so for the other. He did not agree that technical instruction should be restricted, on the contrary, he thought it should be intensified. Special university training had the disadvantage that it did not allow of men rising from the ranks; it was desirable, in his opinion, that men should have the opportunity of so rising. Personally he preferred a general rather than a specialist engineer, he thought a man who knew something about several branches of engineering would be much more useful than a man who specialised in one and only one branch. With regard to practical training, he did not think the aim should be to impart special knowledge, it should rather serve to bring the student into contact with the many sides of his profession and familiarise him with a wide range of work. He objected to the premium system, it restricted apprenticeship to those who could pay, and the man who could not afford the necessary premium was out of it altogether; that was not as it should be.

Mr. R. S. **Allen** thought the author had made out a strong case for the broader training of the engineer. Out of every ten men trained under the present system, the tenth man would probably be the only lucky one to reach success at the completion of his training. In the speaker's opinion, the college course should not aim at teaching facts, but rather it should teach the student how to learn in after life. Book-keeping and accountancy came under the heading of mathematics, and, as such, should be taught at school before the student reached college. He noticed that in the paper no mention had been made of tact, that was a very strong point in administration, but unfortunately it could not be taught. The training of an engineer should be divided into two periods, first should come the works training, to be followed by the college course; the two periods being quite separate. He did not agree with either the author's or Mr. Fleming's views as to the payment of premiums. The training of a mechanic was entirely different from that of an engineer, and it was a mistake to try to equalise them. If a man desired to give his son a higher training, he should be able to do so by paying for it.

Dr. W. H. **Eccles** said that the author had made charges against the teachers which he did not think were justified. He directed attention to the move in the right direction which had already been made at Manchester connected with the training of engineers. In this country there was considerable hesitation before new procedures were adopted; it was often preferred to try new schemes on someone else first to see how they worked. He thought the reason why they were late in moving was that they were slow to appreciate the benefits that would accrue from the suggested innovations. The author had blamed the teachers for inertia, but he, the speaker, considered that conservatism mostly came from the other side. On the whole, the author had his entire support, the matter was a national one, and most urgent.

Prof. E. W. **Marchant** said that some of his points had been covered by the previous speaker, with whom he agreed, that conservatism came from the other side. In his opinion, the author had been much too hard on the professors. With regard to book-keeping, accountancy, and administration, he thought that these subjects could be much better taught at school before the student reached college. He thought that administrative ability would be highly developed in all those young men who had served in the Army; during their period of service such men had seen more of the world and its ways as well as of the handling of men than they would have done in double the time in the ordinary course of events. With the statement that students specialised too much in technology he did not agree; on the contrary, he thought they should specialise more than they did. It was lamentable that in the past a large proportion of the designers in large firms had not been Englishmen, and he thought the colleges should see to it that that state of affairs was changed. He did not favour the educational "sandwich" system; as Dr. Eccles had said, it involved frequent interruptions to and changes over from one division to another of the training, which had a disturbing influence, and resulted in loss of time. In his opinion, the payment of premiums should be abolished; no student of the college with which he was connected had ever payed a premium. He thought the abolition of premiums would result in the best men getting the training, and not only those who could pay for it. He advocated more attention being paid to general education, especially during the last few years at school. Those years were very valuable; the impressions gained during those years had an important influence on the students' later college life.

Mr. A. P. Trotter said that too much time in the college courses was given to the teaching of details; it frequently happened that almost before the design of a certain article was completed it could almost be considered to be out of date, something newer having appeared in the meanwhile. Therefore details should be left alone, and he thought a more general training would be found more useful. He noticed that nothing had been said about costing the paper; that was a most important subject, ignorance of which lead to very serious results. After all, the success of an engineer was to-day judged by the economic results achieved, and his training should be carried out accordingly.

Prof. G. W. O. Howe explained that at the college with which he was connected, a course dealing with book-keeping and workshop accounting was given to all third-year students, and it had been found to be a valuable and most useful course. He said if they attempted to increase the number of hours at college they would get into difficulties. The engineering syllabus was overcrowded as it was, and new subjects were cropping up every day, each of which demanded its own line of instruction. Students spent no longer to-day over their training than they did twenty years ago, and yet they were supposed to know more. The real difficulty was to know what subjects to sacrifice in order to find the time in which to introduce new ones. There was a danger, he thought, in taking the syllabus of an American university at its face value; in the United States they gained breadth by sacrificing depth, which was a dangerous procedure. In his opinion, it was desirable to have depth rather than breadth.

Mr. J. S. Highfield paid tribute to the author for bringing up the subject. He thought that courses of instruction should deal more with broad principles rather than with details. A series of lectures on what the student ought to do when he left college would, in the speaker's opinion, be most valuable. The student would in that way be given some idea of what he would have to do, and he would be able to chose what to do. As a previous speaker had pointed out, the author had made no mention of tact, which was most important. Such things as the chosing of a staff could not be taught at college. Considerable anxiety had been expressed of late concerning the young men who were about to return to civil life after serving in the Forces. It was contended that these men had no training, and that they were older by several years than the age at which students usually entered college. In spite of all, the speaker did not think there was cause for anxiety, it was merely a case of the order of things having been reversed. Such young men had, during the term of their service, learned a good deal, which, in the ordinary course of events, they would have had to learn after they had left college. As a result, he did not think they ought to have any difficulty in acquiring the necessary technical knowledge in a comparatively short time, and he did not see why they should not be able to hold their own with men who had travelled the other way round —those who had gone to college first and then learned the ways of the world later.

Other speakers contended that the courses suggested in the paper were too short, and that what was being done in America must not be neglected. It was appreciated that British engineers were second to none, and it was therefore contended that professors had been teaching all along—though perhaps unconsciously—exactly what the paper was now advocating. The teaching of method and right thinking was emphasised, also that care should be exercised when changes, if any, were made. It was pointed out that students during their period of technical training often despised the commercial side of engineering, and it was urged that the tendency should be corrected. The importance of having a thorough command of the English language was dealt with, it being explained that it was necessary for an engineer to be able to convey to others his meaning exactly and clearly. It was very often a lack of command of the English language that led engineers into court.

The Author, in reserving his full reply to the discussion for publication in the *Journal* of the Institution, said that in writing any paper much was necessarily based on personal experience, and he had found that in foreign countries the commercial qualifications of engineers were appreciated, and given much more consideration than in this country. He did not advocate the making of engineers into specialists, he wished sign-posts to be erected to point out the quickest way to the necessary knowledge.

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

The paper by Prof. Miles Walker was read and discussed at the North-Western Territorial Centre of the Institution of Electrical Engineers on January 28th. An abstract of the paper appeared in the Electrical Review of December 13th. and 20th, 1918.

Mr. Ayres said that static condensers had been very much improved in recent years, and at a reasonable cost, if not of a reasonable bulk, they could be produced quite satisfactorily. But one trouble was that the static condenser was not flexible except with a large amount of switch gear. It was pointed out in the paper that if one had a static condenser to correct the balancing of the phases, when the unbalanced load was thrown off, the static condenser (being unbalanced in the opposite direction) made the phases just as unbalanced as they would be without the correction with the unbalanced load on in the opposite direction. That was rather a serious proposition. If one had more than one furnace and used static condensers, it would mean either a good deal of continuous switching in and out or else the load would be continually balanced and unbalanced in various directions. A consulting colliery engineer who had had static condensers to correct the power factor of the feeders in his mine proposed to throw them out and put in synchronous rotating machinery to do the same work. With regard to electric furnace work, one of the limiting features was the amount of power one could use per carbon electrode. At present the limiting size to which the electrode could be made was something like 16 in. or 18 in. square for the compressed coke electrodes, and 12 in. for the graphitic. This meant that at the ordinary voltages of about 500 one could use about 400 kw. per electrode. If the single-phase furnace with a single electrode was adopted, it seemed to him that they were going in for rather small furnaces, and the other furnaces using 3, 4, 6, or 8 electrodes would stand a better chance—where very considerable powers could be used in one furnace. For a small furnace like this, with double the voltage, they could go up to perhaps 800 kw. It would be used chiefly, he supposed, for refining purposes, and that not on a very large scale. If, then, they were going to be limited to furnaces of 400 to 800 kw. capacity he did not know whether a machine of this construction was going to be of any great advantage.

Mr. Chadwick described a method of balancing with series transformers and a synchronous motor.

Mr. Schaffer suggested that by using a synchronous motor instead of a condenser, and by over-exciting it, the necessary balancing effect would be produced automatically, without the use of intricate switchgear.

Mr. Stock said the question was discussed a few months ago whether the single-phase system would be useful in large units, the idea being that the electrode would largely control the amount of current which could be put into the furnace. That was perfectly correct, but in the system which Mr. Snyder had introduced to the steel-making world a rather high voltage was used which enabled them to carry quite a large amount of power in a single electrode. He did not think that at present there was any reason why the furnace should not be built to use, say, 2,500 kw., which would approximately mean about 15 tons capacity. He held that any furnace which would work at all would make equally good steel, and entirely disagreed with any claim that either polyphase or single-phase furnaces would make better qualities of steel than the other. If that were the case, it was obvious that the steel maker had to look to economy as the only guide for the selection of a furnace. Economy could be brought about in three directions. First of all the condition that the steel maker looked for was a fairly economical power consumption. Secondly, he examined his electrode consumption. Thirdly, there was the cost of maintaining the linings. Apart from those things he did not see that there was very much to consider in any type of furnace. In the arc type of furnace the obvious position to introduce the heat was in the centre of the furnace, because as the heat travelled towards the outside, it was absorbed as much as possible by the charge in the furnace. For that reason Mr. Snyder—and he agreed with him—was a believer in the single-phase system. The second point was the electrode consumption. It was quite obvious that if they could reduce the number of square inches of electrode exposed to the gases in the furnace they reduced the diameter of it. The electrode consumption was governed by the amount of oxidation which took place in the furnace itself, and this principally occurred during the time of charging. He believed it could be shown that the volatilisation of the carbon in an electric furnace ran about 1 lb. of electrode per ton of metal. Experiments carried out in single-phase work had shown that it was quite possible to operate a single-phase furnace of 400 kw. capacity making, say, 50 to 55 tons of metal per week with an electrode consumption under 0.6 lb. per ton of metal produced. The normal electrode cost a shilling a lb. This was undoubtedly an item which had to be considered in choosing the type of furnace. The life of the lining was entirely dependent upon the control which they had over the consuming power of the furnace. Given proper control there was no doubt that the linings could be made to stand up for quite a respectable period. They had at present four furnaces operating at Bradford, and were able to produce at least 200 tons of steel a week, working for a week without any repair whatever. These results had produced a very good load factor on the furnace. The method they used for judging the load factor was to take a full week of seven days, multiply the hours by 400 KW., and divide that by the number of units used to produce the steel during the week, 53 tons multiplied by 700 units That gave a load factor somewhere about 6 per cent Those were the only considerations which he thought one would be justified in regarding in the choice of an electric furnace. One objection which had been raised in this country to the Snyder furnace or the single-phase furnace when refining was the object of its operation. With furnaces of this type the theoretical considerations which governed the desulphurising of the steel were these. It was necessary to produce a melt which was entirely deoxidised and had pure lime slag above it. To achieve this condition they must have a very high temperature, and if, as would occur with the Snyder type of furnace, they were to carry out the refining operations with the full voltage, that was at 160-volts pressure, they would very soon find that the arc became drawn out, possibly to the extent of 18 or 24 inches. The drawing-out of the arc must naturally throw the heat from it in the direction of the roof, and the furnace would burn down and spoil the refining operations. It had been found necessary in refining operations to work with an arc of not more than 80 volts pressure to prevent this pulling out, and to concentrate the generation of heat on the slag itself. To arrive at this result Dr. Walker had given them a separate drop, which allowed them to drop the voltage down to his figure, and to maintain a sufficient impedance to keep the material hot, and under these conditions refining was a perfectly feasible operation.

Mr. Bolton Shaw believed that in America the single-phase furnace was a very attractive proposition, from the consumer's point of view. The diminished consumption of electrode, and the lessened cost of lining, were points in its favour. From the central-station engineer's point of view it was certainly not very attractive, but in America, where the Snyder furnace had been installed to a considerable extent, the large power companies did not object to put in furnaces to use single-phase with a three-phase set. In this country at the introduction of the single-phase furnace an objection was raised to having it put upon the supply system without any method of balancing, and a sort of compromise was adopted. Two single-phase furnaces were put down with transformers, and that gave a certain amount of balancing. In most cases a charge was made per KW.-hour plus a charge for maximum K.V.A. It was easy to see that if the furnace gave a considerable reactance the maximum K.V.A. would be a very high figure. The cost on the K.V.A. charge was considerably higher. In the case of the balancing of a number of furnaces working day and night the K.V.A. charge was less in proportion to the total charges, and did not offer the advantages that it did in the case of an installation where the load was intermittent. In the small power stations the question of balancing was very important. The central-station engineer would certainly object to have a single-phase furnace put directly on to his mains without any question of balancing. It did say a great deal for a machine if it could do this satisfactorily.

Mr. Angus said that Professor Walker in particular, and some other writers of papers, very often provided them with new viewpoints. For instance, he had a large amount of business to do with the undeveloped countries of South America, particularly Bolivia. In those countries, if they had been able to get hold of a machine of this sort they would have been able to do something which was most difficult to do, especially during the war. They had not been able to get hold of any machinery from England, and the consequence was that Japanese and American machinery had been pouring into the country. In Bolivia the circumstances they came up against were quite different to what one met in this country. For instance, cost did not matter very much, because the transport costs were generally three or four times the cost of the plant; the main consideration was whether they could do the work, and they generally could do it with electrical machinery where they could not do it with anything else. He would like to hear more of a practical nature from people who had been using static condensers and synchronous motors as correcting and balancing machines. There had been two cases just recently where they could have used them perfectly. Bolivia was a country which was at an altitude of something like three miles, and the Diesel gas engine was the only prime mover they could get hold of. Coal cost a tremendous amount—even before the war it went up to about £25 a ton—and the only other fuel was a resinous moss which grew on the mountain side, and was mostly exhausted. They used water power when they could get it, but it was generally not of much value, because it was so far distant, and in such remote regions that they could not run transmission lines. They put up a Diesel engine of about 450 H.P. (sea-level rating), coupled to a three-phase alternator for mining work. The engine, of course, was only able to give about 250 H.P. at that altitude, and they had put in an alternator that would develop the whole of the power of that engine at that altitude. Then they had a complaint from the owner of the mine saying the engine was much too big for the rating. He had three-phase induction motors, and could not get more load on because he had already chosen them far too large, and always got a low power factor. The trouble was that the low power factor simply swamped the alternator, and so he said, "I can do the whole of the work with two cylinders, but what is the good of giving me an alternator that will not do that?" If they could have got hold of a static condenser, or a machine of that sort, they would have been able to alter the position altogether They had had that sort of trouble on more than one occasion out there He asked the engineers of this country to pay a little more attention to these new fields in the export world. There were very few manufacturers in this country who realised that there were huge fields abroad which at present they did not touch. The only enterprising people here seemed to be the cotton manufacturers; they were the only people who sent out representatives to travel in those countries. During the war they had been swamped with Americans in person; with Japanese in person; they had the Germans always with them; but they had never had a single English firm which had been about business in Peru, Chile, or Bolivia. He would like people in that room to pay a little more attention to these countries, because now was the time. This matter should interest the suppliers of machinery, who seemed to get the idea that the only rules they had to fulfil were the voltage rules of this country. The reason why the Germans did so well in these countries was because their machinery was not designed for their own trade, but for their export trade. He had had the greatest difficulty in getting British manufacturers to alter their designs or modify them in some way or other to enable him to sell them. He could not sell them merely because they were suitable for British mines; the circumstances were quite different.

Dr. Cramp did not understand why Dr. Walker had ruled out a rotating balancing transformer with one winding, taking in the three-phase power into one winding and giving out single-phase power from the same winding, and then transforming down that single-phase power by means of a single-phase transformer, and balancing by means similar to those which Prof. Walker himself employed. There did not seem to be any reason why that type of machine should not work quite as well as the proposal put forward, and it would be a good deal cheaper to set at work. Possibly it would be cheaper to build. The author showed that there was a great advantage in having only two electrodes instead of three, but the disadvantage which Prof. Walker pointed out of a breakdown across the roof, due to the fact that there was a potential difference between the pair of carbons situated there was offset to a certain extent by the ease with which the furnace could be started. He was told by the users of these furnaces that in the future the furnace was going to be used much more for refining than for melting; and if that were so the advantages of high voltage very largely disappeared. They could easily deal with 15 tons with 2,000 KW. with a three-phase furnace. The power-station engineers with whom he had had to deal in connection with these furnaces had complained not about the large fluctuations of power, but about the large fluctuations of current, if the current was more or less wattless. It would be seen that according to the author's fig. 23 the current might vary from nothing to 4,000 amperes although the power varied very much less; so from the point of view of the power-station engineer it would seem that a constant-current machine would be more valuable than a constant-power machine for this class. Professor Walker said that automatic regulators were not found to be sufficient during the first twenty minutes after the furnace had been started up from cold, and it was sometimes necessary to have three operators (one at the regulating wheel of each carbon) with their eyes fixed on the ammeter, to screw up and down the carbons every few seconds in order to keep the currents approximately balanced. Evidently the author of the paper had not seen the regulator that had been recently introduced to cover that very point, by means of which, on the carbon being lifted out, the furnace circuit was closed, and the furnace was left absolutely to itself, and the carbons came down gradually on to the material. The only condition under which that regulator was not very satisfactory was in connection with new carbons; if they were treated in that way new carbons were apt to split the first time they were heated.

Professor Walker, in reply, said that in the actual performance of the machine not much depended upon the little leakages across the slots. The main portion of the leakage occurred between the narrow places which were only 5 cm. long. The main point that he wanted to make in connection with the Snyder arrangement of the reactance was obtaining stability. Upon that the integrity of the lining depended. When they introduced the balancer they got not only a small input of power but also a small input of current. There was no reason why they should not have a single-phase furnace with as many carbons as they liked. They might take six carbons and have a furnace occupying a large amount of floor space. The starting was done by an electrode at the bottom. There was no difficulty in starting, whether it were a silica and acid lining or a basic lining. Furnaces were used both for melting and for refining. In all the electric furnaces in this country that he had seen they did their melting first, and then their refining. The melting furnace was the one which took the power, therefore it was a very great advantage to be able to melt at a high voltage.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Battery Charging Equipment.

The attention now being given to electric vehicles and their growing popularity make the contents of a new leaflet (No. 780) issued by the Igranic Electric Co., Ltd., 147, Queen Victoria Street, London, of interest, dealing as it does with electric-vehicle battery-charging equipment.

The universal, unit type, charging panels (fig. 1) with self-contained rheostats consist of a number of unit sections (fig. 2) assembled in frames. The sections are only 24 in. wide by 10 in. high by 20 in. deep. Installation is easy and additions can be made at any time. The panels are designed for use on both two-wire and three-wire circuits, and the unit construction permits of meeting special requirements. A charging section (fig. 2) carries the rheostat contacts and sliding brush; a low current circuit-breaker at the left-hand side; an instrument switch, at the right; a pilot lamp, and a grid type resistance, which is mounted on the back. Two standard fronts are made, one having a maximum rating of 90 amperes and the other 180 amperes. For the 90-ampere front renewable button contacts and shoe contact brush are provided. For the 180-ampere front the sliding brush is of laminated copper and renewable contact segments or plates are used instead of buttons. The sliding brush supported by a guide rod moves smoothly over the contacts.

Each rheostat section with its resistance is a complete unit in itself. It is attached by bolts to the frame, and after disconnecting from the bus-bar can be readily removed if these bolts are taken out. The low current circuit-breaker mounted at the left has a laminated brush main contact and auxiliary arcing points. It is interlocked with the rheostat so that it cannot be closed except when the sliding brush is moved to the position of "all resistance in." It can then be closed, and a small magnet in series with the charging circuit holds it in this position unless the charging voltage falls to a value less than the battery voltage or in case the service fuses should be blown, when it acts as a line switch. The instrument switch is a three-position switch, having "open," "closed," and "reading" positions. When in the "open" position the circuit to the battery is broken; moving to the "closed" position completes this circuit—and when in the "reading" position the meter, mounted on a swinging bracket, is connected to the battery circuit indicating the voltage of the battery. If the low-current circuit-breaker is closed, the current is also indicated on the ammeter scale of the instrument. With regard to the operation, assume that all switches are open, the rheostat slider moved to the left-hand position and the battery connected to one of the charging circuits. This will be indicated by the lighting of the pilot lamp. The instrument switch can then be moved to the reading position, and this will show the voltage of the battery on the voltmeter, and if the battery leads are not properly connected, this fact will be apparent by the deflection of the needle in the reverse direction or off the scale. Assuming that the connections are properly made, the low-current circuit breaker should then be closed and the rheostat slider moved forward, increasing the charging current until the derived amperage is obtained as indicated on the ammeter. The instrument switch should then be released, when its spring will move it back to the "closed" position, thus allowing the charge to continue, but disconnecting the instruments from the circuit. The line and battery connections are all at the back, on the outside of the frame, making the installation work very easy, and as the apparatus is all self-contained, there is no assembling and rheostat wiring to be done on the job.

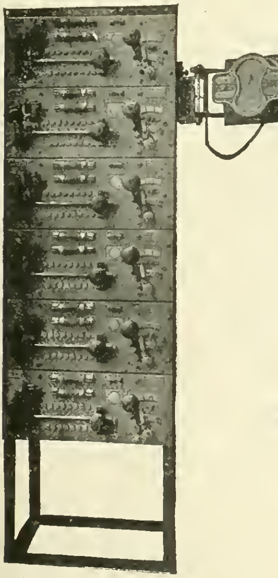

Fig. 1.—Standard Six-Circuit Charging Board.

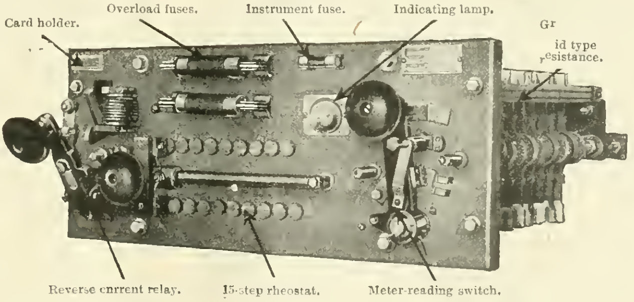

Fig. 2. 90-Ampere Charging Section.

Vacuum Sweeper for Textile Mills.

The portable broomless floor sweeper illustrated herewith (fig. 3), which is specially designed for use in textile mills, is manufactured by Mr. William Firth, 200, Devonshire Street, Boston, Mass., U.S.A. The motor is driven by an Edison B-6, 9-cell storage battery, which will continue to operate the sweeper at normal constant speed for eight or nine hours without recharging. The motor, which is of $\frac{1}{8}$ h.p., is directly connected to a specially-designed fan, which creates a suction that picks up the sweepings and delivers them to the waste receiver. When desired, the discharging air current can be deflected to either side of the machine, and can be regulated to force the sweepings from under machinery into alleys, where they can be reached by the machine. Where this method is not desirable, a flexible tube and special vacuum sweeping nozzle can be supplied, which reaches under the machinery and removes the waste by suction.

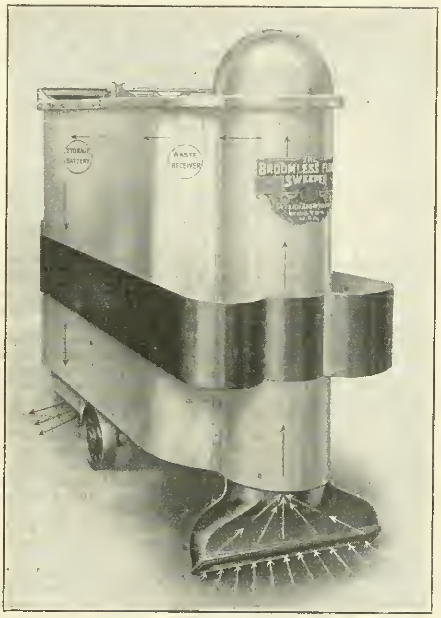

Fig. 3.—Broomless Floor Sweeper.

Woodhouse Automatic Clutches.

Owing to the war, the progress of the Woodhouse automatic clutch, which we described in our issue of November 3rd, 1916, has been much hampered, but the difficulties have now been overcome, and Messrs. Woodhouse & Co., of Sanctuary House, 33, Tothill Street, S.W. 1, have standardised a series of sizes from ¼ to 80 h.p., at speeds from 400 to 2,700 r.p.m. Special sizes are also made, and the largest so far put in service being rated at 500 h.p. These clutches are now built wholly inside the pulleys, in a greatly improved form, and are extremely simple in design; their special virtue is that they leave the motor entirely free of load up to a definite predetermined and adjustable speed, and then take up the load smoothly and without shock, the drive being purely by friction. Some of them, we understand, have been in use for over four years, and have never required renewals, the wear being negligible. Obviously they are particularly suitable for starting squirrel-cage motors, single-phase or polyphase, and they have the advantage that the rush of current at starting is minimised, and the starter may be of the simplest and most inexpensive type—the motor may, in fact, be switched direct on the mains up to at least 10 h.p.—so that the extra cost of a slip-ring motor and ordinary starter is eliminated. There is no risk of damage through careless starting, the rate of taking up the load being dependent only on the load, and independent of the operator. The clutch is useful also for d.c. motors, reducing the starter to a two-step apparatus, and for petrol engines, and is applied to couplings as well as to pulleys. In a recent test carried out by Mr. H. P. Stokes, of Bexley Heath, with the clutch applied to an 8-h.p. single-phase motor, which was formerly started with a loose pulley and absorbed 9 to 10 kw., the consumption on starting with the clutch never exceeded 7.6 kw.

THE SALARIES OF ELECTRICAL STAFFS AT ELECTRICITY WORKS.

In our leader last week we referred to the critical state of the negotiations between the Electrical Power Engineers' Association and the supply authorities. The following particulars, which were before the Hammersmith Borough Council last week, will serve to explain the allusion:—

A resolution passed by the Standing Conference of Electricity Supply Associations on January 8th, with regard to the salaries of the technical staffs of electricity undertakings recommended the constituent associations to agree to an award of the Court of Arbitration to pay as from March 31st, 1918, to technical engineers on the staffs of the undertakings from and including the grade of junior charge engineers to and including the deputy chief officials (that is to say, excluding all the grades for which basic rates were settled by the award (2772) Electricity Undertakings (General) London District), the salary paid at July 31st, 1914, plus merit and grade increases between that date and March 31st, 1918, plus 20 per cent., plus an additional sum at the rate of £90 per annum, war advances and war bonuses to be merged in the above.

This arrangement was to be operative until March 31st, 1919, or such other date as might be mutually agreed, and in the meantime the Conference and the E.P.E.A. were to meet and proceed to settle basic rates of remuneration for the various grades as above, pending which sectional discussions as to basic rates were to be adjourned.

The matter was referred to the Ministry of Labour for an award, but the Minister intimated that he had no power to give statutory approval to the agreement or to make any order extending it; but he added that there was nothing to prevent the grant being put into operation by the parties concerned as from the date agreed upon.

The Incorporated Association of Electric Power Companies had definitely undertaken to make the payments of the amounts recommended at the Conference, and the Incorporated Municipal Electrical Association representatives had decided that all their members also should make the payments as recommended, forthwith. In the meantime the following notice had been served by the Electrical Power Engineers' Association upon the Standing Conference of Electricity Supply Associations, viz.:—

"If the claim is not paid or agreed to be paid within seven days the National Executive Council have decided to bring out the members of the E.P.E.A. in the defaulting undertakings. If after a further fourteen days these undertakings have not paid the claim the National Executive will bring out all the members of this association from all undertakings in support of the men in those undertakings which refuse to pay or have not paid."

A circular letter from the Standing Conference dated January 31st, 1919, urged that, having regard to the emergency of the matter and its vital importance to the electricity supply industry, the claim should be accepted by all electricity supply undertakings within seven days, and inquired whether, in the event of the council being unwilling, for any reason, to pay the claim forthwith, it would agree to submit the matter to arbitration, the arbitrator being appointed by the Minister of Labour.

The total present wages, with bonus, of the members of the staff affected, including also the increase recommended in the resolution of the Standing Conference, were as follows:—

Ordinary wages.	Present bonus.	Total present wages.	Proposed bonus.	Total proposed wages.	Increase.
£	£	£	£	£	£
400	133	533	170	570	37
350	127	477	160	510	33
200	108	308	130	330	22
175	74	249	125	300	51
164	74	238	123	287	49

To those who have not yet returned from war service, the increased rates will only be payable as from the date of their return. The Electricity Committee and the Salaries and Wages Committee recommended that the resolution of the Standing Conference should be adopted by the council.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

43. "Electric accumulators." W. A. T. Furst. January 2nd.

1,960. "Magneto motor." D. Suchostawer. January 27th.

1,971. "Electric clock." A. G. Wallis & N. Collins. January 27th.

1,976. "Electric and gas lamps or lanterns." F. W. Ball & J. Y. Fletcher, January 27th.

1,984 "Means for suspending conductor wires on electric railways, &c." P. Dawson & F. W. Fawdry. January 27th.

1,985. "Supporting device for overhead electric trolley wires." P. Dawson & F. W. Fawdry. January 27th.

1,986. "Means for suspending trolley wires of electric railways, &c." Dawson & F. W. Fawdry. January 27th.

1,991. "Electrical connections." H. Garde & C. G. Bennett. January 27th.

2,015. "Relays for alternating or intermittent currents." C. V. Drysdale. January 27th.

2,020. "Intercommunication telephone systems." L. C. Bygrave. January 28th.

2,038. "Magneto-electric machines." G. M. Turner. January 28th.

2,052. "Attachment to flexible connections to telephone receiver and transmitter." M. Barthropp. January 28th.

2,053. "Electric lamps for vehicles." Fuller Accumulator Co. & A. P. Welch. January 28th.

2,601. "Process for building up or growing iron upon steel, &c., surfaces." S. O. Cowper-Coles. February 3rd.

2,602. "Electrolyte for deposition of iron." S. O. Cowper-Coles. February 3rd.

2,626. "Sparking plugs." J. E. Barrows. February 3rd.

2,644. "Electrical phase-converting systems." British Westinghouse Electric & Manufacturing Co. February 3rd. (U.S.A., March 14th, 1918.)

2,649. "Electric lampholders." J. T. Jennens and Morum & Co. February 3rd.

2,654. "Electric lampholders." C. G. Bennett & H. Garde. February 3rd.

2,656. "Electromagnetic signalling apparatus." A. Bagutii. February 3rd.

2,663. "Railway electric track circuit systems." W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. February 3rd.

2,672. "Electric bells." F. J. Shenton. February 3rd.

2,681. "Electrical apparatus for preventing burglarious acts, &c." P. B. Metchim. February 3rd.

2,693. "Electric dining-table fitment and indicator and recorder." S. W. Parker. February 4th.

2,710. "Terminal electrical connections for sparking plugs." C. F. Burton & H. Burton. February 4th.

2,742. "High-tension distributors for electric ignition apparatus." Akt. Ges. Brown, Boveri et Cie. February 4th. (Germany, February 4th, 1918.)

2,751. "Electric wave meters." J. S. E. Townsend. February 4th.

2,761. "Tools for slotting commutators, &c." J. Gardner & C. Y. Knight. February 4th.

2,785. "Electric fuses." British Westinghouse Electric & Manufacturing Co. & W. A. Coates. February 5th.

2,786. "Electric clocks, and contacts for same." R. C. Halford, W. J. Halford & F. T. Reid. February 5th.

2,793. "Sparking plugs." F. W. Hill. February 5th.

2,816. "Holders for electric lamp shades." H. Ward. February 5th.

2,821. "Magnetos for internal-combustion engines." L. J. Stokes. February 5th.

2,833. "Dynamo-electric machines, &c." W. G. Ivamy. February 5th.

2,835. "Rotary electric converters." British Westinghouse Electric and Manufacturing Co. February 5th. (U.S.A., March 13th, 1918.)

Errata.

Delete entry under W. A. T. Twist in the issue of January 17th, 1919.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

6,344 Electrical apparatus for detecting, measuring, and indicating the deviation of boreholes. H. Briggs. May 4th, 1917. (122,204.)

10,778. Electric heat radiators. A. F. Berry. July 26th, 1917. (122,206.)

10,779 Electric heat radiators. A. F. Berry. July 26th, 1917. (122,207.)

14,685. Electric heat radiators. A. F. Berry. October 10th, 1917. (122,210.)

16,738. Method of and apparatus for heating by electric induction. Ajax Metal Co. November 25th, 1917. (111,844.)

18,976. Electrical cables or conductors. A. V. L. Hubert & G. E. Turnbull. December 21st, 1917. (122,219.)

1918.

684. Circuit arrangements for operating the selecting devices of telephone installations by number impulses. T. Pettigrew. January 11th, 1918. (122,235.)

757. Electrical transformers and the like. A. Schanning. January 12th, 1918. (122,238.)

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. FEBRUARY 28, 1919. No. 2,153.

ELECTRICAL REVIEW.

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OFFICE :—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE ELECTRICAL DEVELOPMENT ASSOCIATION.

THE attention of our readers is directed to two items in the current issue—a letter from Mr. Hardie on the Electrical Equipment of National Building Schemes, and an advertisement of the Electrical Development Association for a director.

Mr. Hardie refers to the propaganda of the British Commercial Gas Association, which Association is flooding all who are, or may be, interested in the national building schemes, with advertising matter in relation to gas. The value of its publications may be gauged by that entitled "Gas Lighting for Health," which, as Mr. Hardie points out, dilates upon the healthful nature of gas as an illuminant!

The activities of the gas industry have, no doubt, been stimulated by the report of the Committee appointed by the President of the Local Government Board and the Secretary for Scotland, to consider questions of building construction in connection with the provision of dwellings for the working classes in England, Wales, and Scotland. In the report of this Committee (Cd. 9,191, price 1s.), recommendation No. 139 reads: "Electric light, as compared with other illuminants, has the great advantage of not vitiating the atmosphere, and tends to economy in maintenance"; whilst recommendation No. 141 states that "expensive and elaborate wiring systems are not necessary for cottage use." Turning to the body of the Report, it will be found that the advantages of electricity are referred to in Clause 302 as follows:—

> The popularity of electric lighting in cottage dwellings is undoubted; not only does it save considerable expense in white-washing ceilings, re-decorating walls, &c., but it has a much more important advantage, as compared with gas, in that this light consumes no oxygen, and does not vitiate the air. We have already seen how difficult it is in cottage dwellings to secure the minimum amount of air space per person which the medical authorities regard as desirable; therefore, it is an important argument in favour of electric lighting, that it may be safely said that, in order that a room lighted by gas may be as healthy to live in as one lighted by electricity, it should contain additional cubic air space, unless some special and effective form of outlet ventilation be installed to carry off at the ceiling level the vitiated air as fast as it is formed. In deciding between the two methods where an alternative is available, this advantage in connection with electric lighting should be considered.

In view of the foregoing recommendations, it is, perhaps, not surprising that the British Commercial Gas Association has become alarmed.

Mr. Hardie, however, pertinently asks in his letter what the electrical people are doing, and trusts that bodies like the B.E.A.M.A. and the recently-formed I.E.E. Committee will get to work before it is too late.

Readers will remember that an Electrical Development Committee was set up by the Institution of Electrical Engineers in July last, consisting of representatives of practically all sections of the industry, viz.:—Electricity Supply, Manufacturing, and Contracting. We understand that the Committee has been actively engaged since its formation in formulating a scheme and interesting the various sections of the industry sufficiently to raise the necessary preliminary funds for establishing the Association on a sound basis. That the funds are forthcoming would appear to be evidenced by the advertisement of the Association in this issue, from which it will be seen that it is proposed to appoint a director at a commencing salary of £1,000 per annum. We are given to understand that the headquarters of the Association will be situated in a central position in London.

Whilst not at present in a position to give any further details of the proposals or plan of campaign, we welcome the formation of the Association and wish it every success. When we reported its inception in our issue of September 13th, 1918, we inferred that while its first concern would be the development of electrical cooking and heating, that would only be the beginning; we hoped that it would take a vastly wider view of its functions than was implied by its nominal purpose, and would do for this country what the Society for Electrical Development and the N.E.L.A. have done for the United States. We believe that our hopes have now some prospect of fulfilment, and we shall be glad to do all in our power to assist the Association in attaining success.

Industrial Statecraft.

At the present moment, when the industrial world is in a chaotic condition more unsettling to commerce than the war itself, anything that lifts our eyes to the ideals for which we have fought is to be welcomed, for we are in grave danger of forgetting, in the task of patching up a peace with Labour, the greater work that lies before us. The present friction should be done away with at once, for without amicable relations between worker and employer, the work of reconstruction can hardly be commenced; but no solution of our troubles can be permanent which fails to recognise that hours and wages—even the whole question of the relations of Capital and Labour—are not the fundamental principles that we have to keep in view. Our every thought should be fixed on the well-being of Industry, since from Industry alone comes the wealth of the nation. A full grasp of the essentials of industrial economy is shown in the Memorandum on the Industrial Situation after the War,* which has been rewritten and revised by the Garton Foundation. This report covers very wide ground, and raises a large number of questions which will awaken a great deal of thought and controversy in the mind of the reader—perhaps the more so since the report never expresses an opinion except in the most guarded, hesitant, and prolix manner. This, and a certain long-winded and obscure style of diction, are serious faults, for we fear that the average working man will cast the book aside without discovering that it contains a well-reasoned and fair statement of the case for labour. We would recommend every man, in particular every employer or organiser of labour, to read the Report carefully. Much of it is already being put into effect by the Industrial Councils set up under the Whitley Report; but it will give every man a true conception of his own place in industry, and a fair statement of the rights and needs of the other classes of labour.

It is interesting that the first edition of this Memorandum (which was published in 1916) foreshadowed the scheme of Joint Councils recommended in the Whitley Report. We must hope that the speedy setting-up of these Councils will enable a true view of the welfare of our industries to be taken by the parties now in conflict. These Councils have a sphere of usefulness that is almost unlimited, since they afford neutral ground for the discussion not only of the internal troubles of an industry, but also of the external obstacles that oppose its progress. There is only one danger which must be averted: we must not let our dreams of reconstruction, our hopes for a new world, materialise only in the setting-up of Committees. These Committees are useful as a means; they are not an end, or the beginning of an end, and every one that is unnecessarily set up is a drag on the wheels of industry. There are signs, particularly in the report of the Councils to be set up in connection with workers in Government Departments, that Councils are being created for the pure joy of creation. Each one of these can be the source of wasted time and wasted labour—the Councils, in size and in number, must be reduced to a minimum.

Compensation for Officials.

The National Electricity Scheme seems to cause as many ripples as a stone thrown into a duck-pond. But the many ripples differ in character from one another. In some directions, satisfaction is the dominant feeling; in others, expectancy; and in one, at least, perturbation. The ordinary householder, of course, looks forward with satisfaction to everything "being done by electricity" at a "farthing a unit." Again, we may fairly surmise that certain of our consulting-engineer friends are not unmarked by an attitude of expectancy—as well they might be, with such an orgy of prospective super-power stations to gloat over. But alas! these rose-tints are not universal, and there are signs of disquietude in one quarter at least. The menace of being "taken over" has begun to loom somewhat definitely in the minds of certain of the staffs of the companies, and they are looking about to find some surety for their future. When the scheme matures, they not unnaturally surmise that they may be faced with the prospect of being squeezed out of their present posts. Amalgamations of undertakings such as are proposed under the new scheme cannot fail to make necessary considerable alterations in staff, and perhaps a rearrangement *in toto*. Hence the present feeling of uneasiness. As an outcome of this general feeling, a Conference has been formed by the staffs of the London companies, who have discussed their positions, and have decided to invite the staffs of the provincial companies to join them in a proposed representation to the Board of Trade. Their minds will naturally turn, we take it, to the compensation provided for officers displaced when the new Water Board was established. Section 47 of the Metropolis Water Act, 1902, provided that all officers and servants of the Metropolitan water companies became automatically servants of the new Water Board—the Board, however, being empowered to abolish any office, or to assign any new duties to the officers. On the other hand, any officer was at liberty to relinquish his office if the new duties were an unreasonable addition or not analogous to his former duties. All officers thus affected, or who otherwise suffered any direct pecuniary loss in consequence of the Act, were entitled to compensation by the Water Board. This extended to a period of five years after the constitution of the Water Board—that is, anyone who suffered as above, at any time within five years, was entitled to compensation in proportion. As to the amount of compensation, the Act provided that Sec. 120 of the Local Government Act, 1888, relating to compensation of existing officers, should apply to such claims, the references to the bodies therein being, of course, amended. Sec. 120 of the Local Government Act, 1888, provided that an existing officer should be entitled to have compensation paid, subject chiefly to the "conditions on which his appointment was made, to the nature of his office or employment, and to the duration of his service." The claimant, in the event of his being dissatisfied with the amount assessed, had a right of appeal to the Treasury. Anyone making a claim was required to deliver a statement of the amounts received by him covering a period of five years next before the passing of the Act.

Since the foregoing was written we have received a letter from Mr. O. M. Andrews, hon. secretary of the new Association, in which some particulars regarding its formation and purpose are given. The title of the Association being a rather ponderous one, it will, in accordance with the prevailing fashion, be represented by initials—A.O.E.C. Not only is the single purpose of the new Society one which commands our sympathy and support—it is also in the national interest that the just claims of the officials shall be satisfied, and the opposition to the national scheme thereby lessened. The letter appears in our "Correspondence" columns to-day.

---

* "Memorandum on the Industrial Situation after the War." The Garton Foundation. Revised and enlarged edition. Price 2s. Pp. 175. Published by Harrison & Sons.

SEARCHLIGHTS.

By HUGH M. GOODY.

A CERTAIN amount of attention has been given lately to the military applications of electricity during the present war; and while it would be impossible in an article of this length to deal with the somewhat elaborate tactical details of searchlight work, perhaps a few notes on the various designs of projector and control gear may be of interest.

Dealing, first, with the electrical portion of the apparatus, there is a choice of a wide variety of "automatic" lamps and of several designs of hand-operated lamps. For coast-defence work the projector, and incidentally the lamp portion, is only required to move through a small angle either vertically or horizontally, but should be capable of being run continuously for hours at a stretch, either "exposed" or "under cover." For this purpose it is essential to have some form of automatic feed, consisting in its simplest form of a coil and solenoid actuating a pawl and feed arm. Since the solenoid circuit is in parallel with the arc, variations of current in the main circuit, caused principally by the gradually increasing arc length, will cause corresponding variations in the solenoid circuit, and give a suitable rate of feed to adjust the arc length to its correct value.

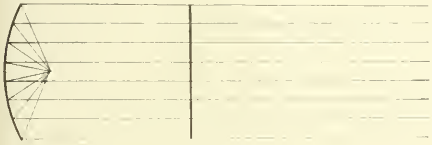


FIG. 1.—BEAM WITH PARABOLIC MIRROR.

Such arrangements, however, work best in a horizontal position, and for anti-aircraft work where the lamp may be moved through 180° vertically, but where, on the other hand, the projector is only in action for short periods at a time, a simple hand-feed lamp is usually adopted, most automatic types having been found both unnecessary and unreliable.

In considering the size and design of the projector itself, two main points must be kept in mind:—

(*a*) The necessity, or otherwise, of portability, and

(*b*) The intensity and field of illumination required for the work in question.

For coast-defence and anti-aircraft purposes four main sizes of projector have been standardised (60 cm., 90 cm., 120 cm., and 180 cm.), the largest of which, however, is suitable for stationary work only, on coast and permanent anti-aircraft stations. For mobile anti-aircraft work in France the largest size in use is the 120-cm. diameter projector, and even this is very heavy. The 90-cm. diameter projector is the one most generally in use, but there are still a few 60-cm. sets about.

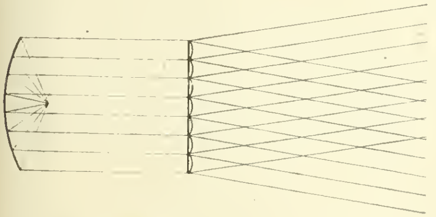


FIG. 2.—BEAM WITH PARABOLIC MIRROR AND DIVERGING LENS.

Under certain circumstances two 60-cm. diameter projectors situated at the same point, which can be used independently for "searching" and with their fields of illumination superimposed one upon the other for holding and illuminating targets for gunfire and aeroplane attack, have been found very useful. It is difficult, however, under these circumstances, to arrange a completely satisfactory system of control, and it is more general to employ a single lamp (90 or 120 cm. in diameter), which, by the use of a diverging lens, may be used for either intensive or extensive illumination. With the sectional type of front lens which is generally used, the extension of the field of illumination is in one plane only—*i.e.*, it can be made either horizontal or vertical, according to whether the lens sections are horizontal or vertical.

While there have been some modifications in the design of both lamp and projector during the war, the principal field for experiment during the last four years has been in the direction of finding a suitable system of control, the choice lying between three types of "distant" control (electrical, "wire," and "bar") and simple hand-control from behind the projector.

This last system has been very largely abandoned, as, having the whole of the beam between the operator and the target, the latter is to him invisible, and he must be directed by someone else who can see the target. This entails delays which, although only of a few seconds' duration, may be disastrous, and some form of "distant" control is now very generally in use. Electrical control from a considerable distance is possibly the best system, or, at any rate, the one with the greatest potentialities, but up to the present it has not been found possible to adapt it to mobile work, and it is by no means perfect (in its present form) even for stationary purposes.

Mechanical control by means of wires operated from a distance of 25 to 50 ft. to a flank of the projector has been much experimented with. Owing, however, to temperature variations and other causes, the wires have been found to need such constant adjustment as to constitute a grave element of unreliability.

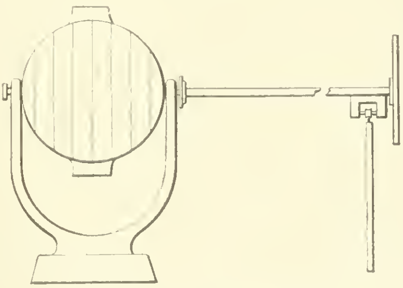


FIG. 3.—PROJECTOR WITH BAR CONTROL.

For mobile anti-aircraft work the type of control now standardised is the "bar" control from a distance of 12 ft. This consists of a 24-ft. diameter metal raceway (made up of seven-strip iron—2 in. × ½ in.—segments, bolted together), supported at intervals of about 7 to 10 ft. on uprights consisting of 1-in. metal piping. A 12-ft. flanged bar (2 in. iron piping) is screwed on to the projector in place of the capstan wheel, which wheel is placed on the far end of the bar. A small carriage is fitted to the end of the bar, and this carriage runs on the raceway first mentioned. This gear obviously leaves something to be desired from the point of view of portability, and it is also somewhat of a compromise optically, as it is quite possible for the operator's vision to be occasionally "blanketed" by the beam. Generally speaking, however, he can, by skilful manipulation, keep the field of illumination in such a position in relation to the target, that it remains in view. This type of control gives, moreover, the advantage of instant and rigid control over the beam, so that quickly moving targets may be successfully dealt with.

Although this "bar" type of control has been latterly in almost universal use in France, it is by no means perfect, and it would appear to the mind of an electrical engineer to be somewhat of a retrograde movement. At all events, electrical control presents a wide scope for experiment and research, and may eventually supersede the mechanical types at present in use.

THE HUMAN FACTOR IN EFFICIENCY METHODS.

By Major E. A. Pells, R.E.

Psychological study is a thing which is looked upon as new, and yet it is as old as the ages. The study of our fellow men has such attractions that it has been practised by mortals from the earliest days of the world's existence. But this study of the inner soul of the labourer, who perhaps shows no positive interest in the world's progress, and appears to have no interest beyond a desire to eat, drink, and sleep, is a matter which shows some definite difficulties; and as one proceeds, many more of a more indefinite and nebulous character crop up. A sarcastic man might say that one might just as well study the psychology of the beasts of the field as attempt to understand the working of the mind of a labourer of low intelligence. This is all very well as regards such a low type of labour: but things have changed so much within the last decade, and the education of the working classes has so improved, that there is a good deal more to understand; and the half-educated are in most cases more difficult to understand than the wholly ignorant man of old. Do not get the impression that I consider the working class as ignorant; it has been, I am proud to say, my good fortune to come in contact with some exceedingly well-educated men amongst the workers, and men of intellectual worth, with whom it has been a pleasure to converse. On the other hand, I have met people among the moneyed classes who were grossly ignorant, and of whom it was hard to believe that they had received any education at all.

It is not always education that makes a man an interesting study; the native wit and cleverness of some men who have never enjoyed the opportunities of education are an ever-present source of interest to the student of human character. There is one very definite point in this knowledge of human nature, and that is the likeness of the human to the animal world, inasmuch as they must always have a leader, and never will think for themselves, or if they do, they must have the feeling of mutual support or companionship. Look how a flock of sheep, even when on the way to their daily pasture, all seem to wait for each other, whilst their human prototypes cluster and crowd, and all talk together, or agree with their appointed leader with cries of acclamation and support. This appointing of a leader or spokesman on the part of the worker is not always an unmixed blessing, for it is often the undesirable who can talk, but not work, who gains this distinction; and in the world of industry it is not the talkers that know the most, or—putting it differently—it is not the man who spouts the most that has the most to say. Very often one finds, when dealing with labour trouble, that it is some misunderstanding which has caused all the bother, and at the bottom of the trouble is the man who talks too much, generally spoken of as the "Sea Lawyer." The psychology of labour varies in different countries, and in different parts of the same country, too. What you can do with impunity in the North of England you dare not do in the South, and *vice versa*; but whatever country you may be in, however uneducated or stupid people may be, there is always one thing which they appreciate, and that is the "square deal." If the worker finds that his co-operation with the management has the effect of raising his own wages, and also helps his fellow-worker to earn more, then he is satisfied. On top of this, he finds that he is helping his employer to reduce production costs, and thus enabling him to compete more successfully in the world's markets, and so providing more work of a remunerative character. All this on top of a fair deal, and as a direct result thereof, must convince the worker that herein lies the future, and that, contrary to what he has been taught to believe, that Capital's interests are directly opposed to Labour's, they are identical, and success and prosperity for both lie along the same road.

Many employers have in the past, when introducing "efficiency methods" in their works, completely ignored the psychological value of the human, and encouraged by the success of their early efforts, have gone on speeding up until they have been rudely awakened to the fact that the human is not a machine, by trouble with their employés. Overspeed is almost as bad as underspeed; the ideal is that at which the worker can thrive continually with satisfaction.

There is another side of the human factor which has to be reckoned with, and that is the physiological. The worker must rest as well as work; he must feed and be housed somewhere away from the works, and on the suitability of this housing and food and the sufficiency of his rest depends to a great extent his efficiency as a worker. If the employer does not provide housing accommodation near to the work, then he must expect to pay sufficient wages to enable the workers to travel to and from such places; in some instances he may be forced to provide the means of transit. He must pay sufficiently well to enable his employés to feed well, and must so arrange his working hours as to reduce the possibility of accidents through over-fatigue or the uneconomical running of his plant for the same reason. The week-end rest is imperative. It has been proved during the recent period of intensified production of munitions, necessitated by the war, that constant working through the week-end causes innumerable cases of physical breakdown, and in one authenticated case 22 per cent. of the men operatives went sick after a fairly continuous spell of Sunday work. Early morning work has also been proved inefficient, and the abolition of before-breakfast work has resulted in reduced sickness, increased output, and increased average earnings, even where the same rates have held. The provision of comfortable canteens has proved their value in all cases where such have been provided, by a great reduction in sickness and lost time.

Very often in making any innovation for the benefit of the worker, one is astounded by the opposition, often covert, of the workers themselves. Especially is this so where they think there will be a reduction in their weekly earnings, as in the abolition of before-breakfast work; but once they find that a reduction in hours worked does not mean a reduction in wages, they hail the shortening hours with delight.

So long as workers are paid good wages they must also be given opportunities of spending them in a rational manner. To obtain this rational home life and recreation for the worker it is necessary carefully to study employed time and provide correct rest pauses, so that the workers do not become satiated with work at high tension, with the consequence that when they are free from their work they seek relaxation in excesses; an example of this has been seen in the abnormal results of a sudden ceasing of work at a very high pressure on the declaration of the Armistice.

Finally, the whole question of efficiency depends upon the social, economic, and hygienic conditions as affecting the life of the worker. So that, without a thorough appreciation of the human factor, all efforts in the direction of efficiency fall to the ground.

A Commercial Staffs' Association.—Towards the end of 1917, a Society called "The Shipbuilding, Engineering, and Steel Commercial Staffs' Association" was formed at Newcastle-upon-Tyne to take care of the interests of the members of the staffs indicated by the title, and quickly attracted strong support in that neighbourhood; the promoters aimed at building up a National Association, with centres in all parts of the country, and such a centre has been established in the Bristol Channel area. The avowed objects of the Association are to increase the efficiency and improve the status of the commercial staffs, and to secure for them proper representation in all schemes of industrial reconstruction. Particulars can be obtained from the secretary, Church Institute, Hood Street Newcastle-upon-Tyne.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Pulverised Coal for Boiler Firing.

The decision of the Hammersmith Borough Council, reported in your current issue, to spend £70,110 of the ratepayers' money on pulverised-coal plant for the boilers at the electricity works is surprising in view of the fact that the proposed saving in fuel and labour is only £7,000 per annum, and a gross return of 10 per cent. is obviously inadequate to cover capital charges, upkeep, and depreciation of such plant.

As reported elsewhere in your current issue, for the year ending March 31st, 1918, the Hammersmith electricity department generated 20,753,920 units; the income was £101,232, and the net profit was £1,464. The plant capacity was 10,300 KW., and its capital cost £399,470.

Experiments in firing boilers with pulverised coal date from 1831; the fuel, with its incombustible matter, is first dried, and then finely pulverised, and sprayed or carburetted. Every experimenter has been able to secure good figures for a boiler test with a selected high-volatile coal thus carburetted after drying and pulverising; the fact that much of the incombustible ash goes up the chimney does not affect the thermal efficiency; but this fact, and the cost of drying and pulverising the coal, have made commercial success unattainable.

In Portland cement works throughout the world rotary cement kilns use either fuel oil or pulverised coal; the latter is much cheaper, and as most of the fine incombustible is absorbed by the cement materials, forming a harmless slag adulteration to the cement, the nuisance of fine dust carried up the chimney is mitigated and is disregarded. The steam-power plants of Portland cement works have an extremely high load factor, presenting conditions altogether more favourable for pulverised-coal boiler firing than elsewhere. But, actually the boiler plants of Portland cement works use coal direct in the ordinary way, either on hand-fired grates, or preferably with labour-saving coal-handling plant and automatic stokers; the latter give a thermal efficiency equal to that attainable with oil-firing, or gas-firing, or with pulverised coal similarly carburetted, and the elaborate plant for drying and pulverising the coal is absent.

In urban electricity works, the dust nuisance allowable at a cement works would be intolerable; the relatively poor load factor makes the capital charges for pulverised-coal plant extremely high, and it is difficult to imagine any inducement to consider an expenditure which only promises 10 per cent. per annum gross return in view of the capital charges, upkeep, and depreciation, even assuming that all technical troubles hitherto experienced could be overcome.

Mechanical Engineer.

February 22nd, 1919.

The Shorter Working Week.

I am desired by my Branch to submit these two cases in support of our contention that a reduced number of hours per worker means more employment:—At a certain public institution two stokers were employed 12 hours per shift, seven days per week. The trade union asked for an eight-hours shift, seven days per week; the request was granted, and the third man engaged. At a certain factory one handyman was employed to act as stoker, gas-engine attendant, and to fill up spare time doing odd repairs; hours worked between 80 and 90 per week. The trade union asked for a second man; the request was granted—the work rearranged on a 56-hour basis for each man. The rates of pay remained the same. Apply this principle as far as possible to every industry, and the unemployment problem will be solved.

The Editor referred to the word "production." I am very much afraid "production" is an ambiguous term, because the productive value of the workmen's labour in each of the above instances could not exceed the value of the steam raised in a given number of hours. To judge accurately the value of the engineman's or fireman's labour, the value of the time worked per individual inside the factory must be taken into account. This statement may not suit the critics of the shorter working week, who seem to us to have at the back of their minds "piece-work." In fact, with some production and piece-work may be regarded as synonyms. The critic must ever bear in mind that what may be true of the pieceworker cannot always be affirmed of the workers engaged in occupations ancillary to repetition processes. Even the repetition-process workers, piece or time, are subject to limitations, for the chances are that no amount of coaxing will induce the machine to yield one article more in the day if the machine has been consistently run top-notch.

We take it that it is the duty of the employer of labour to assist in procuring increased production by doubling the shifts worked and arranging the working hours to the best advantage. Even if the wages show an increase per shift-hour worked, this should not be detrimental to the progress of the business, because by doubling the shift the capital would almost certainly be turned over 20 times during the year as against, say, 12 times on the single-shift system—a very great gain to the business in the long run. The fear that paying the same wages for a 47-hour week as for a 56-hour week is not sound economics is groundless, and it matters nothing whether the worker be on piece-work or time-work—whether he be a factory hand or a public-utility servant. It is quite fair to assume that the workers' purchasing powers would be considerable. Their good wages would make them great consumers, and with but a small residue unemployed the home market would be one of first-rate importance to the manufacturer and importer, while with the double shifts and treble shifts, if need be, a splendid surplus should be available for export. The term "increased production" should be used with caution with respect to electrical workers and others performing duties of an ancillary nature. All such as they ought not to be lowered in status because they do not produce the machines they run or assist in running. They may follow ancillary occupations (whether they be on the wages book, salaries book, or receive managerial remuneration), and be regarded by some economists as excresences on the order of society, but it is a fact that such workers have become part of the order of our civilisation. Power-plant workers of any grade, calling, or capacity enable people to carry on production and distribution, and assist in carrying out the normal functions of a civilised State. Such workers may be deemed to be essential to society generally, and thereby entitled to the shorter week, with its extra remuneration, without having regard to increased production—for their labours become proportionately valuable to those who use machinery and earn high wages by so doing. If shortening the week entails bringing in more assistance to the power houses and offices to get the work done, society will be benefited, because it will all help to strip bare the labour market of the unemployed—a most important consideration at this juncture.

Better by far allow the trade unions to try the experiment for two years and see if the profits from trade are such as to warrant continuance. At the end of two years, falling values and a hundred other causes may operate to compel a reduction in all wages, salaries, and other classes of remuneration. Even rates of discount and interest may be affected; but nothing need be feared if values of commodities are in proper proportion to the needs of the community and can satisfy all reasonable requirements.

John Vincent,
Hon. Secretary,
National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers, Marylebone Branch.

London, N.W., *February 22nd*, 1919.

[In both the instances quoted by Mr. Vincent the justice of the Trade Union's demand was undeniable, for the hours of working were excessive; we would gladly support the Union in any similar case. But we do not agree that these exceptional examples justify the suggestion that the problem of unemployment in "every industry" can be solved by multiplying the number of workers (and the wage expense) *without increasing the amount of work done*. Abundant evidence has been forthcoming during the war that the reduction of working hours from 12 to 10, and from 10 to 8, has in each case resulted in an increased rate of production more than sufficient to counter-balance the shortening of the working time, and it is unquestionably in the best interests of all parties that this process should be carried on as far as possible, but a point will inevitably be reached beyond which the result will be lessened output, and therefore increased cost of production. Unless the rate of output is increased by the reduction of hours, the cost increases all the time, and this must be the case where the output is fixed by considerations independent of the worker, as in the instances cited by our correspondent. The assertion that fears on this score are "groundless" is merely an expression of opinion.—EDS. ELEC. REV.]

A Protective Association for Non-Technical Officials.

With reference to the correspondence that has appeared in your valuable paper under the above heading, I am writing on behalf of the whole of the clerical staff of this department to strongly support the claims of the Clerical Assistants' Association (Electricity Supply Undertakings), the particulars of which were so ably set forth by the Hon. Secretary (Mr. G. R. Smith) in your issue of the 7th inst.

In view of the future of the electric supply industry, and the formation of National Industrial Councils, it is clear that members of non-technical staffs must of necessity band themselves together with a view to their interests being fully protected, and to their proper recognition by the competent authorities handling such questions as status, rates of pay, working hours, &c. As a separate Industrial Council has been formed to deal with the electric supply industry I think there can be no doubt that pertinent matters can be much better dealt with by an association having special electrical interests rather than by a body representing clerical workers generally.

The Clerical Assistants' Association is making very rapid strides, and it is hoped very shortly that the whole of the clerical staffs of electricity undertakings in the country will be represented. The machinery for establishing branches to cover all districts is practically complete, and will be put into operation forthwith. It is intended to establish a branch for the Midlands, with its headquarters in this city.

In conclusion, I would like on behalf of my colleages to acknowledge with gratitude the very able assistance which the Secretary of the Association rendered in obtaining for us the 12½ per cent. award of the Chief Industrial Commissioner last year.

H. C. Taylor,
Acting Hon. Secretary,
Midland Branch, Clerical Assistants' Association.

Electric Supply Offices, Birmingham,
February 17th, 1919.

With further reference to my letter of the 18th inst., which appeared in last week's Electrical Review, it would appear that some of your readers are not quite clear as to the amalgamation scheme detailed therein. In order to make it quite clear, I would state that the Chief Commercial Officers' Association and the Clerical Assistants' Association (Electricity Supply Undertakings) are now amalgamated into one Association, which is to be known as the Electricity Supply Commercial Association. Many of your correspondents have expressed their opinion that this Association would be strengthened by an affiliation with the E.P.E.A. There are, however, always two parties to consider in the question of affiliation, but I am now in a position to state that the latter body have promised their hearty co-operation and support in all matters of common interest as soon as we are registered as a Trade Union, which course is being proceeded with as speedily as possible.

May I again remind intending members that it is necessary when making inquiry, in the first instance, to state the undertaking in which they are employed. I should like to take this opportunity of thanking "Another Supporter" who, unknown to me, put the case so clearly for this Association in his letter of last week's issue.

G. R. Smith,
Acting Hon. Gen. Sec.,
Electricity Supply Commercial Assn.

London, S.E., *February 24th*, 1919.

The Abortive Electrical Strike.

In studying the current issue of the Review one views with delight or disgust, whichever side one's leaning may be, that high compliment paid to the alacrity which the E.P.E.A. so promptly and publicly displayed in announcing that they were prepared to attempt to negative any action which their fellow-workers in the E.T.U. might take. Yet in the same issue one observes the E.P.E.A. had given 14 days' notice to withdraw their members if their demands were not conceded; beyond failing to notice any retaliation by the E.T.U., comment on this paradoxical absurdity is superfluous. One wonders how far advanced to-day would the E.P.E.A. programme be had it not been for trade-union education in their industry; much has been heard, from many and varied sources, each claiming intimate knowledge of the exact position which the station-engineer members of the E.T.U. were in during the threatened strike period, but we have not yet heard of an official statement by the chairman of the London Station Shop Stewards, who undoubtedly could reduce the present position of conjecture into hard facts.

Observer.

The Future of the Electrical Trades Union.

When I linked up with the other admirable members of this Union, all we had in view was a better life for ourselves and those who follow us, but if what I read in the Press every day is true we have been deceived.

Now, this said Press is the mouthpiece of one class, and one class alone, and when we cast our memories back over the last four years, and reckon up the various names and indignities we have silently endured, we should understand who they are, and what they are, but I notice some don't.

When we were working long hours and at the highest pitch, under the control of the employers, Munition Act, and D.O.R.A., and answering the many calls of :—Guns, more guns, ships, more ships, shells, more shells, aeroplanes, more aeroplanes, eat less food and buy more War Bonds, we were called shirkers drunkards, pacifists, murderers of our brothers in the trenches, wasters, &c., &c., but now, after that, we are "Bolsheviks," and after a day's work we are plotting treason, running about with a pocket full of bombs, and a few spare tanks trying to create a revolution to bring immorality and lawlessness to our own homes, —doesn't this sound real?

No! Mr. Editor, a thousand times No! we are not "Bolsheviks" nor "pro-Germans" nor "Anarchists"; we are British to the very letter, only we are workers who are looking forward very keenly to something better in life, and some of the fruits of victory that we have been fighting for.

Finally, if "Member E.T.U.," "An E.T.U. Worker," and "Constitutional" have a grievance, or a charge to make against their fellow E.T.U.'s, or if they have caught cold feet, they should not blame their leaders, but act as *Trade Unionists* and MEN, and put it before their branches, and be "constitutional." Further, I should advise all of them to attend and take an active part in their branches instead of hiding under a cloak and criticising those who do.

J. W. Woolley.
Electrical Trades Union.

East Ham, *February 22nd*, 1919.

With reference to the editorial article and your correspondent's letter in current issue *re* Union men, it is exactly what is needed, viz., a society or organisation of proved skilled men. I have always maintained that in our trade, or profession, especially, it is absolutely necessary that the fact of a man being a "Union" man should be a guarantee that he is proficient.

Moreover, were this so it would be an inducement for employers to give the preference to such men. Of course, there are good men both in and out of any society or organisation, but it has become more than ever necessary for all workers to organise themselves. It seems to me that the essential points in any new organisations are: That the members should be "graded," and some provision made for mates, improvers, &c., as well as for foremen, supervising foremen, and such like. I can fairly claim to have a wide knowledge of the matter, having had about 30 years' varied experience in all branches of installation work.

There is no doubt that such an organisation on the lines suggested would do much to improve the trade generally, as any man debarred for the moment from becoming a member would undoubtedly use his efforts to become proficient, and thus receive the benefit of increased rates of pay and better conditions. I am ready to give every assistance in my power to further some such scheme in this town. Wishing this new move every success,

S. O. Hoad.

Eastbourne, *February 24th*, 1919.

National Building Schemes and Electrical Equipment.

Having just read through a booklet, "Gas Installation for Housing Schemes," issued by the B.C.G.A., also "Housing Economy Number: One Thousand and One Uses for Gas" from the same quarter, it occurs to me: What are the electrical people doing by way of getting ready to have their apparatus represented in the huge building schemes about to be set a-going? The gas people have everything prepared, from gas lighting down to the scullery washing copper, but I can find no evidence of combined action on our part. It is obvious that if gas equipment becomes standard practice (as it threatens) at this juncture, we shall have a hard job displacing it later, or even getting a share of new business. Surely, now is the time to attempt through combined action on the part of manufacturers of electrical apparatus and supply authorities to obtain an electrical cooking and heating equipment which could be offered on competitive lines for installation in these new houses, otherwise our appeal is likely to remain confined to the Rolls-Royce section of the community. Our inaction seems all the more inexplicable in view of the fact that we are alleged to have friends in high places—has not Mr. Lloyd George repeatedly indicated that cheap electricity must play a major part in reconstruction, not only for power, but for cooking and heating? Yet we stand idle with folded arms, and admit that the cheapest cooker we can offer for a small dwelling costs in the region of from three to four times the price of the gas equivalent.

I trust that bodies like the B.E.A.M.A. and the recently-formed I.E.E. Committee will get to work before it is too late, and give us a proposition enabling us to wage the contest on something like level terms.

R. Hardie,
Show Room Manager.

Glasgow Corporation Electricity Dept.,
February 19th, 1919.

P.S.—The atavistic possibilities of the future are impressed upon one by the latest advertisement by the B.C.G.A., "Gas Lighting for Health," which dilates on the pre-eminently healthful nature of gas as an illuminant.

[We refer to this matter in our leader.—Eds. Elec. Rev.]

The Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain.

At a meeting held at Caxton Hall, Westminster, on January 30th, 1919, which was attended by nearly 200 long-service officers and members of the permanent staffs of the London electricity supply companies, it was unanimously resolved to form this Association.

The immediate future will probably see the absorption or amalgamation of the existing electricity (power and supply) companies throughout the kingdom in one way or another, and, as a result, the positions of some of their staffs may be adversely affected. The right to compensation of those officers and servants of the London water companies who suffered loss or diminution in position through the institution of the Metropolitan Water Board was embodied in the Metropolis Water Act, 1902; and the principal object of this Association is to ensure for its members the recognition of similar rights. It is obvious that the co-operation of all those interested will be the most effective means of securing the desired result.

The Association will take all steps necessary to foster and protect the interests of its members. Membership is open to the staffs of the power and supply companies of Great Britain, both technical and commercial, whose period of service, not necessarily with the same undertaking, exceeds 10 years; and if any of your readers wish for further particulars I shall be glad if they will communicate with me.

Oswald M. Andrews,
Hon. Secretary.

19, Carnaby Street, W., *February 25th*, 1919.

[We refer to this subject in our leading columns to-day.—Eds. Elec. Rev.]

Engineer Surveyors' Salaries.

As an original member of the London Branch of the Engineer Surveyors' Association, I feel that "Pitman's" letter appearing in your current issue calls for a reply.

Names of companies, including my own—"The Ocean"—and figures, having been freely used, perhaps I may be permitted to state that in my company all surveyors of ten years' service receive £360 per annum by way of remuneration—a scale of pay much in excess of that asked for by the main Executive of the Association.

Amongst many other privileges, we enjoy the benefit of a non-contributory pension scheme at least equal to that of the Civil Service, and also what amounts to a free life insurance policy of £200. What quarrel, then, have we with employers who treat us with every decency and consideration?

A not unfair inference from "Pitman's" letter would be that the profits mentioned therein are made out of engineering insurance, and, whilst such is very far from being the case, it does seem that the companies are all in a prosperous state. Given good management, therefore, there would appear to be no adequate reason for such disparities as "Pitman" indicates, and I hope that this letter will be of some service to him and others in similar plight.

My colleagues and I feel that the sneer as to genteel poverty is unwarrantable, and in fairness to us and our employers, I hope you will see your way to publish this letter.

Finally, I cannot agree with "Pitman" when he says the employers are organised—they are *not*, but I hope the day is not far off when they will be. It will not only be to their own advantage, but also to the advantage of their surveyors for obvious reasons.

R. J. Forsyth.

East Ham, E. 6, *February 19th*, 1919.

I note in to-day's issue of the Electrical Review that Mr. Trapnell, on behalf of the Executive of the Engineer Surveyors' Association, denies that that body either circulated the figures I gave *re* company dividends or knew anything about their being circulated. After each branch meeting the branch secretary forwards copies of the minutes to Mr. Trapnell: Mr. Trapnell then forwards to each branch secretary a copy of the minutes of all the other branches. I enclose one such copy *sent out by Mr. Trapnell* which gives the figures I gave in my letter to you, *and from which I took the figures.*

Pitman.

February 21st, 1919.

[The cyclostyled sheet enclosed contains the minutes of the Glasgow Branch meeting dated October 4th, 1918, and is signed by the Hon. Branch Secretary. The list of dividends in question is given in the minutes.—Eds. Elec. Rev.]

The Policy of the Electrical Power Engineers' Association in Contemporary Trade and Labour Disputes.

The National Executive Council of the Electrical Power Engineers' Association (the protective association for all technically-trained staff engineers in the electricity, power, and supply industry) at a recent meeting decided unanimously on a policy for members of the Association during contemporary trade and labour disputes.

In view of the present critical days, it was decided that the public should be advised as to this, and also all the trade unions connected with the engineering and electricity supply industries.

1. That where the members of any other trade union strike with the object of coercing members of the E.P.E.A., the members of the latter Union shall make every endeavour to maintain continuity of supply.

2. That where a dispute or strike appears to be due to failure of an employer or a trade union to carry out an award or agreement, or where either party has refused arbitration or to negotiate after the receipt of not less than seven days' notice in writing from the other party to enter upon negotiation or submit to arbitration, or where the members of a trade union are acting contrary to the constitution of their Union, the National Executive Council of the E.P.E.A. shall immediately get into touch with the employer and with the officers of the Union concerned to ascertain the facts and decide upon the line of action for members of the E.P.E.A. affected, and in the meantime members of the E.P.E.A. shall make every endeavour to maintain continuity of supply in the public interest.

3. In all other cases of disputes or strikes where constitutional methods have been adopted and failed, the Divisional Emergency Committee will instruct members of the E.P.E.A. to carry out their normal duties only.

It will be seen that this is a well-balanced attempt on the part of an organisation of professional men to steer a perfectly just middle course and to repress any hasty action. It is entirely in the public interests that this should be so if we are to solve the difficult industrial problem now facing us.

Employers no less than employed must travel on lines of sanity and reason, with fair and frank discussion of all differences, and due observances of the moral as well as the legal obligations of all agreements arrived at. Only by cessation of Prussian overbearance on both sides can industrial harmony be secured.

W. Arthur Jones,
Hon. General Secretary.

Leytonstone, *February 24th*, 1919.

Electrified Seed.

There is much virtue, it appears, in inverted commas. They enable "Wide Awake" to repudiate his belief in electrified chickens, and to impute to me the purpose of causing great pleasure to Mr. Fry and his friends. I should be glad to be the means of causing great pleasure to anyone, and I hope to cause, before I have done, great pleasure to "Wide Awake"; but I have never used the phrase he attributes to me.

I may be mistaken—*humanum est errare*, as we were taught at school—but not through neglect of obvious precautions, as "Wide Awake" suggests. I am pleased to tell him that I have carried out proper trials. To forestall an obvious question that "Wide Awake" is sure to put, for he is wonderfully wide awake to the obvious, I may say that by proper trials I mean trials checked by proper controls, as customary in scientific experiments, with which I am not unfamiliar; but I do not place as much reliance on the results of these experiments, strongly in favour of the electrification of seeds though they are, as upon Mr. Fry's, and for this reason: my experiments were limited to a few hundred plants. Mr. Fry's experiments have extended over hundreds of acres of plants, and in each acre some 130,000 plants were subjects of experiment.

Another very obvious point that "Wide Awake" is wide awake to is that dried seed may be lighter than seed that has not been soaked and dried; and in that case, if the sowing is by weight, more dried than untreated seed will be sown per acre. If "Wide Awake" will refer to the instructions issued to farmers by the inventor of the process of electrifying seeds, he will find the following passage, which I am sure will afford him great pleasure:—"Another effect of the process on the seed is that the weight is, or may be, diminished. The farmer . . . . may therefore not receive as much weight of seed as he sent, and he must be careful to sow by bushel measure, and not by weight." "Wide Awake" must wake a little wider if he wants to catch Mr. Fry tripping.

Chas. Mercier.

Parkstone, *February 24th*, 1919.

On the appearance of the very interesting article by Mr. H. Hammond Dunn, F.L.S., on "The Electrification of Seeds" in the Electrical Review (January 24th, 1919), one wondered why figures had not been given showing what proportion of the increased corn crop alleged to be due to "The Wolfryn Electrochemical Process" was attributable to immersion in "liquid chemicals," and how much to the electrical part of the treatment.

It was gratifying, therefore, to read in your leaderette of January 31st, "Electrified Seed," a pertinent suggestion to submit two similar samples of seed to the process, omitting the electrical treatment in the case of one, and to sow them in adjacent ground plots with a third sample wholly untreated under identical conditions.

The fact that Mr. Henry E. Fry, the enterprising inventor of the process—according to Dr. Charles Mercier—has repeatedly carried out the test suggested would appear to point to the ease with which these *triple* data could be produced and published.

It is in no captious spirit that I venture to press for these data, but purely with a desire for information. Sometimes one is appealed to in these matters as I was appealed to the other day by my friend "A." He is a member of a famous Service Club, and had been told by friend "B" that "C" and "D," "scientists" belonging to another club, had informed him ("B") that, by electrical process, chickens had been hatched from *un*fertilised eggs of a hen. Stress was laid on the "*un*"——, and this preposterous nonsense was solemnly enunciated as the *dernier cri* of scientific accomplished fact.

Compared with the "electrified chickens" shown up by your correspondent "Wide Awake," "C" and "D's" alleged electrically-generated beauties would be SOME chicks.

One has heard of a *homunculus;* likewise, perhaps, of a *gallunculus;* but by what weird means did *electrunculi* (which are alleged ultimately to have grown into chickens) get into "C" and "D's" *un*fertilised eggs?

E. Raymond-Barker.

London, S.W., *February 24th*, 1919.

LEGAL.

Strike Prosecutions.

William Thomas Weekes, president of the Camberwell Branch of the Electrical Workers' Union, was summoned for assaulting Walter Henry Godfrey, employed by Messrs. Payne & Co., tan merchants, of Tooley Street.

Complainant's solicitor explained that the alleged assault arose out of the recent electrical strike. Godfrey was a non-Unionist, and on February 8th he was proceeding to his work, when he was spoken to by defendant and other men on strike. Complainant alleged that he was struck, and kicked on the leg.

The Magistrate dealt with the case as one of common assault, and bound both men over in the sum of £10 for six months.

The prosecution of two electricians named Armstrong and Gilmour, at Belfast, for leaving their work before the proper time, resulted in the cases being dismissed without prejudice. The two men were arrested under D.O.R.A., and released on bail after the first hearing of the case. The defence was that the men had no contract with the Corporation, and did not come out on a sympathetic or syndicalist strike, but as loyal Trade Unionists. Armstrong was a member of the Strike Committee, and it was his desire to conduct the strike on as peaceful lines as possible.

Metropolitan Electric Supply Co.

Relief Sought under Building Agreement.

An important decision was given by Mr. Justice Sargant, in the Chancery Division, on an application by the Metropolitan Electric Supply Co., Ltd., for relief under Sec. 1, Sub-Sec. (2) of the Courts (Emergency Powers) Act. 1917. The case related to a building agreement, dated December 31st, 1912, between the company and the London County Council with reference to a site fronting on the west side of Kingsway, and the company asked that the right of the Council to receive the full rent reserved under the agreement might be suspended upon such terms as the Court might think fit, on the ground that, owing to the prevention and restriction in the supply and delivery of materials and the regulations and orders made under the Defence of the Realm Act, the agreement could not be enforced without serious hardship to the company. As formulated in Court, the claim was for a temporary reduction of rent, or an annulment of rent for such period and to such extent as would be proper in the circumstances. The Council met this claim with the contention that there was no case of serious hardship which was a necessary preliminary to the grant of any relief under the Act, and that the Act gave no power to suspend or annul part only of the terms of a contract such as in this case, the agreement to pay rent, though they admitted that the Act gave express power to stay proceedings for a time in respect of the recovery of rent under the agreement. The site was let to the company to be developed as a single building site in connection with a much larger area of back land, and the company in turn let both sites on a building agreement to the General Electric Co., Ltd. The excess rent for the back land was estimated at £832, only £6 less than the total rent payable by the Metropolitan Electric Supply Co. to the County Council. If the site in question had not been disposed of by the M.E.S. Co. it would have been leased to other persons at a rental of 4s. per sq. ft. (being the rent agreed with the M.E.S. Co.). In July, 1916, the Minister of Munitions Order prohibited building at a cost of over £500. The rent of £838, payable on June 24th, 1918, had not been paid, but since then £429 (the rent to which the applicants claimed that the rent of £838 should be reduced) had been paid to, and accepted by, the Council without prejudice to their rights.

Mr. A. Grant, K.C., and Mr. R. Goddard appeared for the plaintiffs (the M.E.S. Co.): and Mr. Rolf, K.C., and Mr. T. H. Attwater for the defendants (the L.C.C.).

His Lordship, after reserving his judgment, said the question of serious hardship must be answered against the plaintiffs in the negative. The position of the defendants in relation to the plaintiffs was entirely different from that of the plaintiffs to the G.E. Co., who were not only giving a large rent for a property from which they could get no immediate return, but they were also standing out of any return on a very large capital expenditure. The plaintiffs had escaped from all unproductive capital expenditure, and were getting, even after the reduction, a rent but a few pounds short of the total rent payable for both sites. As to the second defence, that founded on the construction of Sec. 1, Sub.-Sec. (2) of the Act, his Lordship said, on the face of the words used, the power of annulment or suspension was given only as to the whole of a contract, though the power of staying proceedings was given either as to the whole of a contract or as to any term thereof or any rights thereunder. In the case of an ordinary contract of tenancy, while it might be advisable to allow the Court to annul the tenancy altogether or for a certain period, or to allow the Court to stay for a time proceedings for enforcement of rent, it would be going very much further to give the Court power to alter entirely the nature of the contract by annulling the rent or suspending it for a time, while still allowing the tenant to have the benefit of the right of occupation. A change of this kind would be a variation of the contract in such an essential respect as to amount to a completely new contract, and he did not find in the section anything to point to an intention to give the Court any power of general variation of contracts. In his judgment, both grounds of defence were sound, and he dismissed the application, with costs.

BUSINESS NOTES.

Callender's Hospital Fund.—The annual meeting of Callender's Hopsital and Distress Fund was held at the Belvedere Works on 15th inst., Sir Tom Callender presiding. The report for 1918 showed that of 300 members who joined the Forces, 24 had made the great sacrifice. The sum voted to hospitals was the highest on record. A large number of hospital letters were issued, as well as a number for nursing and convalescent homes; surgical appliances were supplied in 69 cases, and spectacles in 79: 33 applicants received financial assistance. The employés at Picardy Works joined the Fund, and began subscribing in June, 1918. The total subscriptions from Belvedere and Picardy amounted to £394. The company donated £50 to the Fund, and Sir Tom Callender five guineas, while there were nine two-guinea donations from directors and others. The amount distributed amongst hospitals and other institutions was £371, an increase of £73 for the year.

World Politics and Advertising.—The following two pictorial advertisements may be of interest to students of publicity, and especially to critics of contemporary British advertising. The advertisements appear in current issues of the Continental technical Press. In No. 1. President Wilson (with halo) adds yet another point to his famous charter—"Gentlemen, before everything this point must be stated: The best switch is the 'Metron.'" In No. 2 John Bull has just discovered how to deal with Bolchevism—"Now, if they were disconnected by means of this 'Metron' disconnecting pole. . . ."

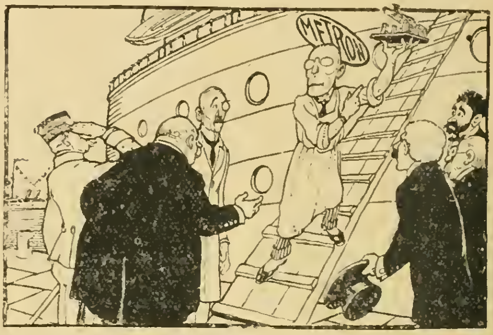


Fig. 1.

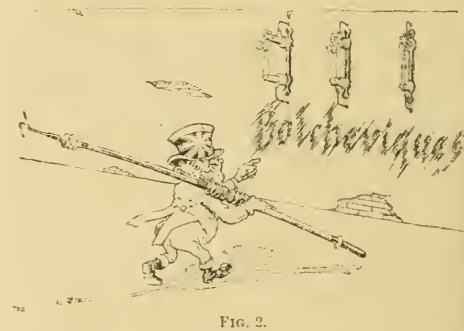


Fig. 2.

In Defence of Norwegian Industries.—According to the *Intelligenssedler*, the Norwegian iron industry, fearing the competition of the numerous foreign munitions and war-material factories with their up-to-date equipment, is urging the Labour Distribution and Trade Office, through the agency of the Association of Engineering Works, to adopt effectual defensive measures. The leading offices are to be urged not to place orders in foreign countries instead of with Norwegian factories save for imperative reasons. "The products of the Norwegian factories are fully capable of competing with foreign goods as regards quality, and, to some extent, as regards price."

The Combination of Manufacturers' Organisations.—At a meeting of British manufacturers at Manchester, last week, Sir Charles Mandleberg drew an inspiring picture of the future of the British export trade under new auspices. After Sir Charles and Mr. Fred Dearden, a member of the Committee, had explained the terms of fusion and the reasons why the Provisional Committee recommended acceptance of the Federation's offer, the resolution in favour of joining forces with the F.B.I. was carried unanimously. The matter is referred to in another note in this issue.

For Sale. — Wolverhampton Corporation Electricity Works invites offers for a steel chimney, 90 ft. high. 4 ft. 6 in. in diameter, in three pieces, with flanged joints for bolting together, complete, with base-plate and guide-ropes. See our advertisement pages to-day.

The Struggle for South American Markets.—The *Tribuna* (February 3rd) publishes an article by a South American correspondent on the struggle which is taking place for the capture of the markets in Latin-America. The struggle is resolving itself into a fight between British and U.S.A. interests, both of which are endeavouring to capture the trade previously in German hands. The North Americans had a great advantage during the war, and flooded the markets with their goods; but the Latin-Americans did not like their methods, and they also have a long-standing prejudice against the North Americans. The latter are now recognising the error of their ways, and are adopting other methods. The National City Bank of New York has arrived on the scene, with its powerful organisations, and is establishing itself at all the strategical points. It will be interesting to see the outcome of this struggle.

Reconstruction Problems.—No. 12 of the "Reconstruction Problem" pamphlets issued by the Ministry of Reconstruction deals fully with the Resettlement of Officers now in the Navy.

Trading with the Enemy.—A further list of names of bodies and persons in several countries with whom trading is prohibited, or whose names have now been removed from the list, is published in the *London Gazette* for February 21st.

Export Restrictions Relaxed.—The *London Gazette* for February 21st contains a notice of further relaxation of export restrictions.

The Director of Electric Power Supply.—The offices of the Director of Electric Power Supply have been removed from the Victoria Hotel, Northumberland Avenue, to Avenue House, Northumberland Avenue, W.C. 2, to which all communications should henceforth be addressed.

Trade Representation Abroad.—A further step in the furtherance of the overseas trade of this country has just been taken by the amalgamation of the British Manufacturers' Corporation with the Federation of British Industries, to which step we referred in our last issue. The object of this amalgamation is to proceed with the appointment of unofficial representatives of British industries abroad. Such a project has for long been under discussion by the Federation of British Industries and by the British Manufacturers' Corporation, and the amalgamation will render possible the more rapid extension of the overseas work already undertaken by the Federation of British Industries, whose membership will be reinforced by the members of the British Manufacturers' Corporation. Briefly the scheme is as follows:—The Federation will select suitable representatives possessing business experience and a knowledge of the foreign country in which they are to serve, to represent the interests of British manufacturers in the various markets of the world, and they will render all services in their power to the members of the Federation. The plan is, in effect, an attempt to represent British industry by men chosen by the industrialists themselves.

There is no danger that the appointment of such men would lead to overlapping with the Government Intelligence Officers abroad, for there are many directions in which it is impossible for the Government servant to render the services desired by British industries. Moreover, it is the intention of the Federation that its Commissioners shall work in the closest touch possible with the Government representatives abroad, since both are working with the same end in view—namely, the furtherance of the commercial and industrial prosperity of this country.

Before the recent amalgamation took place, the Federation had already taken certain preliminary steps with a view to setting up such an organisation. For instance, at the request of the Government, the Federation early this year took over the Commercial Intelligence Bureau at Madrid, which was started by the Ministry of Information during the war. This bureau is now a branch office of the Federation in Spain.

Further, the Federation, at the conclusion of the recent tour of Greek delegates, sent a temporary representative to Greece, who performed most valuable work in the interests of British industry. This appointment has now been made a permanent one, and a permanent Federation office is being opened in Athens. Steps have also been taken to dispatch an investigator to South and East Africa for a tour of some months, in order to investigate market conditions probably this will be followed by the appointment of a permanent representative in that part of the world.

It is inevitable that some time must elapse before all the main markets of the world are covered by this Industrial Commissioner Service, but it is confidently hoped that in the course of the next few months it will be possible to appoint a considerable number of commissioners.

Fire.—A fire, which caused extensive damage to the electrical plant, occurred on February 18th at Halton Camp, Aylesbury. The old power station was involved.

Cape Town Council and Enemy Subjects.—The Cape Town Electricity Committee has considered an application for re-engagement from an enemy subject who expects shortly to be released from the internment camp. The Committee has refused the application, and asks the Council to confirm the principle that no enemy subjects shall be employed by the Council in any department.

Recent Applications for British Trade-Marks.—Below we give a summary of recent applications for British trade marks in respect of goods connected with electrical industries:—

Design, consisting of a double P, No. 384,425, Class 11.—Accumulators, induction coils, magneto-electrical machines, &c., all being apparatus for surgical or curative purposes. Jakob Pillischer, 88, New Bond Street, W., July 22nd, 1918 (to be associated).

Kicker, No. 385,007, Class 6.—Motors. Vickers, Ltd., Vickers House, Broadway, Westminster, August 31st, 1918.

N.K. (design consisting of combined letters NK within a heart). No. 386,673.—Electrical fittings included in Class 13. Napier-Kimber, Ltd., 109, Great Portland Street, London, W., December 7th, 1918.

Lauraine, No. 383,922, Class 6.—Magnetos, electric starters, and electric motors for automobiles. Menominee Electric Products Co., 1,765, Broadway, New York, June 14th, 1918.

Eclipse, No. 384,473, Class 13.—Electric cigar lighters, electric switches, connector plugs and adapters, and electric cooking and heating appliances. Electric & Ordnance Accessories Co., Ltd., Ward End, Birmingham, July 14th, 1918.

Elo., No. 385,862, Class 50.—Electric insulating materials made of asbestos, mica, resin, shellac, oils, bitumen, and other similar materials. Arnold T. Birkby & F. E. Birkby, Woodfield Mills, Liversedge, Yorks., October 29th, 1918.

Aabada Battery (lettering included in design, with Pyramid and dry battery), No. 386,781. Class 8.—Electrical batteries. The Aabada Dry Batteries, Ltd., 61, St. James's Street, London, S.W. December 12th, 1918 (to be associated).

Fallolite, No. 386,507, Class 8.—Searchlight apparatus, lamp signalling apparatus, &c. Fallolite, Ltd., 27, Noel Street, London, W., December 3rd, 1918 (to be associated).

Orbit, No. 386,648, Class 8.—Electrical batteries not for medical purposes. The Orbit Electric Co., Ltd., Electric Works, Station Road, Chadwell Heath, December 7th, 1918.

Vanduara, No. 386,758, Class 50.—Electrical insulating materials and preparations. John MacLennan & Co., 166, Ingram Street, Glasgow, December 12th, 1918.

Italian Company Notes.—Increases of capital have been made by the Società Laziale di Elettricità of Rome and the Elettrodinamica of Milan from three to five million lire in the case of the former, and from 60,000 to 500,000 lire in that of the latter; also the Società Bresciana, from 25 to 36 million lire; Società Generale Elettrica della Sicilia (formerly the Sicilia Orientala), from 15 to 32 million lire; the Unione Esercizi Elettrici, of Milan, from 15 to 25 million lire; the Società Piemonte Centrale di Elettrici, of Turin, from 5 to 6 million lire; and the Officine Elettro-Ferroviarie, of Milan, from 3 to 8 million lire.

The Romeo Co., of Milan, capital 50,000,000 lire, is issuing 30,000,000 bonds, in order to start the construction of electric locomotives and auto-motors, and embark in the manufacture of tramway material.

Under the style of the Fabbrica Italiana Apparechi e Materiale Elettrico, Società Anonima, a company has been formed at Milan with a capital of 1,500,000 lire.

The Società Anonima Forze Hidrauliche del Moncenisio, of Turin, has decided to enlarge its capital from 7,000,000 to 10,000,000 lire.

Spanish Companies. — Extraordinary general meetings have authorised the joint companies—the Hidro-Electrica Iberica and the Hidro-Electrica Espanola—to double each of their capitals, from 20,000,000 to 10,000,000 pesetas, in order to carry out the large hydro-electric plans already decided upon.

Laboratorio Electrica Industrial is the title of a limited liability company just formed at Madrid, with a capital of 100,000 pesetas.

Auction Sale.—The Assets (Auction) Co., Ltd., will sell by auction on November 18th and the following days, at 119-121, Newington Causeway, S.E., a quantity of conduit fittings and tubing, electric cable, switchgear, motors, lamps, lathes, machine tools, &c. For further particulars see our advertisement pages to-day.

Receiver Appointed.—In the Chancery Division, on February 20th, Mr. Justice Sargant appointed a receiver and manager of the Bourne End Electric Installation Co. Counsel stated that a writ in a debenture-holder's action had been issued, the principal moneys having been due since December, 1918. No interest had been paid for five years. A series of 40 debentures of £50 each had been issued.

The Lyons Fair.—The Federation of British Industries has issued a finely-produced edition of its *Bulletin*, in connection with the Lyons Fair which opens in March. As many as 330 British firms are exhibiting their products at the Fair, and increased Franco-British trading will result. The contents of the *Bulletin* are given in both French and English, and they include many interesting features. There are appropriate messages from important public men connected with the Government or with our great industrial organisations, expressive of the willingness and ability of our manufacturers to co-operate in the reconstruction of France. Among other good things, we find an article on the electrical engineering and allied industries and the place of the B.E.A.M.A. in connection with them.

Bankruptcy Proceedings.—H. W. Hill, 58, Rossiter Road, Balham, late of Battersea, instrument maker and electrician.—Receiving order made February 18th, on debtor's own petition. First meeting, March 3rd. Public examination, March 20th, at Wandsworth.

Australian Works Visit.—The Federation of British Industries is entertaining the following representatives of the Australian Imperial Force:—Capt. E. P. Norman and Lieuts. Wright, Hunter, Collins, and Matey, who are all engineers, and Lieuts. Rawe, Crool, Dix, Somerville, Corporal Nixon, and Private Wright, and either Capt. Bell or Colonel Bachtold. On Monday last the party began a tour with a visit to the works of Messrs. J. Stone & Co. at Deptford and Charlton. They proceeded to Bradford, where on Tuesday the works of Messrs. Isaac Holden, David Illingworth, and the Bradford Dyers' Association were inspected, and on Wednesday the weaving works of Messrs. H. Longbottom and Co., Ltd. Thursday was devoted to a trip down the Tyne and a visit to Messrs. Spencer's steel works. To-day the Consett Iron Works are to be visited, and to-morrow the delegation leaves for London.

Trade Announcements.—An arrangement has been entered into between Messrs. Automatic and Electric Furnaces, Ltd., of Westminster, and Messrs. August's Muffle Furnaces, Ltd., of Halifax, whereby Messrs. August will supply coke, gas, and oil-fuel furnaces equipped with the Wild-Barfield (Patent) automatic electric-magnetic detector winding of furnaces for correctly ascertaining the change point of carbon steel. Messrs. August's Muffle Furnaces, Ltd., will also advertise and sell the Wild-Barfield electric furnaces jointly with the Automatic and Electric Furnaces, Ltd. The latter have obtained the sole rights for foreign countries for the sale of Messrs. August's coke, gas, and oil-fuel furnaces equipped with the Wild-Barfield patents.

Mr. G. Tester, electrical contractor, of Hastings, has been discharged from the R.A.F., and has taken larger premises at 194, Queen's Road.

Mr. A. C. Baker has resigned his position as Bristol and West of England representative for Messrs. Siemens Bros. Dynamo Works, Ltd., and joined as partner Mr. C. M. Simpson. electrical manufacturer and supplier, of 4, St. Augustine's Place, Bristol. They will trade as Simpson, Baker & Co., at the same address.

The Enterprise Manufacturing Co., Ltd., have appointed Messrs. Rose Bros., of 194, St. Vincent Street, Glasgow, sole Scottish agents for the sale of their box-blade exhaust fans.

Mr. R. P. Wilson, electrical engineer, of 22, King Street, Lancaster, having been demobilised, will in future carry on business in partnership with his stepson under the style of R. P. Wilson & Jackson.

Messrs. Sloan Electrical Co., Ltd., of 12, Golden Lane, London, E.C. 1, are opening a new branch and warehouse at 79, 81, and 85, Hanover Street, Edinburgh, on March 1st, which will be in charge of Mr. James Sloan, who was for many years with Messrs. Mackenzie & Moncur, Ltd., of Balcarres Street, Edinburgh.

Messrs. Wright & Wood, Ltd., Century Works, Halifax, have changed their name to Wright Motors, Ltd. The change has been made for private reasons only, and the business will be carried on as hitherto.

For the more efficient carrying-on of their business, the Electric Construction Co., Ltd., will open a branch office at 166, St. Vincent Street, Glasgow, on 1st prox. Telegraph address, "Winningly, Glasgow"; telephone number, "Central 1044." Mr. W. L. Winning, who has been connected with the Glasgow office of the British Westinghouse Co., Ltd., for 12 years, and who is well known in the West of Scotland, has been appointed sole representative.

Mr. B. T. Davies (formerly trading as Davies Bros., electrical engineers, Swansea), who has been, for the past four years, works manager to the Western Engineering Co., has severed his connection with the latter company, and has resumed business on his own account at Post Office Chambers No. 2, Swansea.

Dissolution and Liquidations.—W. Canning & Co., electroplaters, engineers, and chemical manufacturers, 133-137, Great Hampton Street, Birmingham.—Messrs. T. R. & E. R. Canning have dissolved partnership. Mr. E. R. Canning will attend to debts.

Portable Electric Motors, Ltd.—Winding up voluntarily for reconstruction purposes, with Mr. A. F. Newton, of 12, Lime Street, E.C., as liquidator, who is authorised to consent to the registration of a new company to be called "Portable Electric Motors (1919), Ltd.," and to enter into agreements with the same.

Rotherham Electrical Engineering Co., Ltd.—Liquidator (Mr. J. C. Clegg, official receiver) released February 19th.

To be Wound Up.—Under the Trading with the Enemy Amendment Act, the Board of Trade has ordered the realisation and distribution of the assets of the following:—

The Electrical Works (Miller), Ltd., 16, John Street, Bedford Row, London, W.C. 1. Founders of electrical manufactories. Controller, Mr. Elles Hill, 4B, Frederick's Place, Old Jewry, E.C. 2.

Non-Ferrous Metal Industry.—A further list of licences granted under this Act is published in the *London Gazette* of February 25th.

Book Notices.—*The South African Mining Journal*, a weekly contemporary issued at Johannesburg, has been appearing under difficulties for some time owing to the absence of its staff with the Forces, and to the insufficiency of paper supplies. Now that some of the *personnel* have returned, the paper is resuming its normal standard of usefulness. The name is being changed to *The South African Mining and Engineering Journal*.

"Melting Points of Chemical Elements, and other Standard Temperatures." 1919. Washington: Government Printing Office. Price 5 cents.

Tables of British Decimal Coinage, Metric and British Weights and Measures. By A. J. Lawson, M.Inst.C.E. London: Eyre and Spottiswoode, Ltd. Pp. 211. Price 7.50 lire.—These tables, specially designed to promote trade relations between Great Britain and Italy, but useful for a wide range of engineering and other applications, were first reviewed in our issue of May 17th, 1918; they are identical in the present issue, which, as before, is printed in English and Italian, but the new issue is evidently intended for the Italian market, the titles on the cover being in Italian. A noteworthy feature of the new volume is the inclusion of a considerable number of advertisements of banks—British and Italian—and of manufacturing firms. We have no doubt that the volume will be welcomed by Italian engineers and business men.

The Bulletin of Scientific and Technical Societies (No. 1), which is issued by the Conjoint Board of Scientific Societies, has taken the shape of a handy "diary of forthcoming meetings," and forms a very useful and convenient reminder of approaching events of this kind. It gives a list of the constituent societies of the Board, with their addresses, particulars of society meetings, and the dates of meetings up to Easter. A diary of forthcoming meetings up to March 8th on a separate sheet is also provided. The Bulletin is obtainable from Messrs. A. & F. Denny, 117, Strand, W.C. 2, price 6d.

Faraday House Journal. Vol. VIII. No. 2. Lent Term, 1919. London: Faraday House, Southampton Row, W.C. 1.—The current issue of the *Journal* recalls sad memories of those students who, alas! will never return, thirty having made the Great Sacrifice in the war. Besides the usual notices of interest to students there are a number of most interesting notes in which reference is made to a paper on "Economies of Power Utilisation in Ceylon," by Mr. D. J. Wimalasurenda, district engineer, P.W.D., Ceylon, who points out that while the island is lacking in coal, there is considerable power available all the year round in the waterfalls. By using high voltage this power could be transmitted to the Cingalese railways, and thus they could be operated more economically. As the average cost of steam coal in Ceylon is well over 20 rupees per ton, it is obvious that the change over to electric traction cannot be long delayed. It is also pointed out that there is a great demand in Ceylon and the East for synthetic manures and other products, the manufacture of which would provide a highly desirable constant electrochemical load for the author's projected hydro-electric stations.

"Memoirs of the College of Engineering, Kyoto Imperial University." Vol. II, Nos. 1, 2, and 3. June-November, 1918. Kyoto: The University.

"Practical Tests on Resistance to Wear" is the title of Heat Treatment *Bulletin* No. 7 of Messrs. Automatic and Electric Furnaces, Ltd.; it relates to tests carried out by the Ministry of Munitions on tank link-pins for caterpillar tractors, hardened by the Wild-Barfield process.

"Standard Tables and Equations in Radio-Telegraphy." By Bertram Hoyle. Pp. xiv + 155; illustrated. London: Wireless Press, Ltd. Price 9s. net.

"Science Abstracts." Sections A and B. Vol. 22, Part 1. Jan. 31st, 1919. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"Sound, Light, Electricity and Magnetism." By W. B. Anderson. 1919. Pp. 13 + 794; 373 figs. London: Hill Publishing Co., Ltd. Price $2 net.

LIGHTING AND POWER NOTES.

Aberystwyth.—Street Lighting.—The T.C. has accepted the tender of the Electric Supply Corporation for the lighting of 200-c.p. half-watt lamps at £5 5s. per annum, in place of 100-c.p. lamps at £4 per annum.

Aldershot.—L.G.B. Inquiry.—An inquiry by a L.G.B. Inspector was held, last week, into the application of the U.D.C. for a loan of £7,000, for the re-laying of electricity mains.

Atherton.—Overhead Transmission.—The U.D.C. has given permission to the Lancashire E.P. Co. to erect a new overhead transmission line in the district.

Australia.—E.L. Schemes.—The Tweed (N.S.W.) Shire Council has applied for permission to purchase electricity in bulk for the lighting of the Tweed Heads area. West Maitland (N.S.W.) municipality has decided to borrow £11,500 for an E.L. scheme. Yorketown (S.A.) has decided to proceed with an electrical street-lighting scheme. A company has been formed to supply electricity at Boonah (Q.); energy is to be purchased in bulk. The Wagga (N.S.W.) and Bothwell (Tas.) municipalities are considering E.L. schemes.—*Tenders*.

Barmouth.—E.L. Scheme.—A scheme for the supply of electricity to Barmouth and district, at a cost of £12,000, is being carried out by Mrs. Prys Owen, of Aberartry.

Battle.—E.L. Scheme.—The U.D.C. has decided that it is unable at present to consider the E.L. scheme proposed by Mr. J. A. Tasker.

Beckenham.—Bulk Supply.—An offer of the West Kent Electric Co. with regard to a supply of electricity in bulk has been referred to a Sub-Committee by the U.D.C.

Birmingham.—New Power-station Site.—The E.S. Committee, it is understood, is recommending the City Council to purchase Hams Hall estate of 1,000 acres, with the ultimate idea of using part of it for the construction of an electric power station in connection with the Government scheme of national electricity supply. With regard to water supply, the site has the advantage of being in the valley of the Tame, about nine miles from the city; it is also within a short distance of an important coalfield and the main Midland railway line. It is proposed to utilise the sewage effluent for cooling purposes. Negotiations for the acquisition of the estate have reached an advanced stage, says the *Birmingham Gazette*, and the purchase price has been fixed at £37,500.

Rate Relief.—It is proposed to allocate £15,000 from the electricity department's profits to the relief of the rates, and a similar amount from the tramways account.

Proposed Price Increase.—The chairman of the Finance Committee states that the revision of the electricity charges will have to be considered, as at present they are below cost.

Bury.—National Electricity Supply.—The T.C. has asked the M.P. for the borough to support the views of the I.M.E.A. when the question of the proposed national scheme for electricity supply comes before Parliament.

Carrick-on-Shannon (Co. Leitrim).—Strike.—The town was in darkness at the end of last week, owing to a strike of employés at the electric power station.

Castleton.—Mill Driving.—The Dunlop Rubber Co. is building at Castleton what is stated to be the largest mill of its kind in the world; the mill is estimated to cost £1,500,000, and is to be electrically driven.

Continental.—Spain.—Our Special Correspondent in Spain sends the following:—

Water Power Concessions.—Don José Rivas Massegui has been granted the use of 2,000 litres of water per second on the river Guaro (Málaga), for the production of electrical energy.

The use of a waterfall on the river Arandilla (Burgos) has been conceded to Don E. Gallo Rico, for electric lighting and motive power in the town of Huerta del Rey; 300 litres per second are allowed, at a head of 8½ metres.

Don Luis Iribarren has been granted the use of 48,000 litres per second from the river Tagus, within the municipal boundary of Toledo. A head of 3 metres is available, and the resultant electrical energy will be devoted to industrial uses.

Don Rodrigarez Soriano has been granted the use of two falls on the River Taria, developing 5,230 h.p. in the dry season and 8,340 h.p. during the rest of the year.

Applications.—An application has been made before the Civil Governor of Valencia to utilise the Calderones waterfall on the river Turia. This fall has a head of 56 metres; 5,230 h.p. can be developed in the dry season, and 8,346 h.p. during the rest of the year.

Don José Alvarez Valdes, of Sama, is applying for the use of 1,500 litres per second of the river Nalon, in the district of Caso, for the production of electrical energy. He proposes to construct a canal 1,836 metres long, and to build a dam across the river, with its crest 1·8 metres above normal water level.

Don Fernando de la Guardia asks permission to utilise 10,000 litres per second from the river Caudal, in Mieres, and is willing to build a dam and to construct a canal and a siphon of reinforced concrete to obtain a useful head of 60 metres at the proposed power house. An application has also been made to build the power house on public lands. D. Fernando further applies for a concession of 2,000 litres on the river Nembra.

The use of two falls on the river Navia has been asked for by Don F. P. Casariego, for the production of electrical energy.

Don Candido B. Varela has applied to the Civil Governor of Gijon for powers to utilise 8 cb. metres per second on the river Nalon, for electricity supply purposes.

A company has been formed at Bilbao, with the title La Sociedad Hispano-Portuguesa de Transportes Electricos, with a capital of £6,000,000, to establish hydro-electric stations, and in particular to erect a large plant in the Province of Zamora to utilise the water power of the River Duero.

Strike.—In spite of the suspension of Constitutional rights, strikes are spreading at Barcelona. On Friday last, all the employés of the Barcelona Traction, Light, and Power Co., the big Canadian enterprise, ceased work, and the city was in darkness. The authorities have taken over all the works, so as to ensure the lighting of the city, a portion of which is already lit owing to a supply of electricity being available from small private works.

Sweden.—Among new companies organised in Sweden in connection with the supply of electricity are the Taliasens Kraft Aktiebolag, at Tallasen, and the Burea Electriska Kraft Aktiebolag, of Burea.

Italy.—According to the *Evening Standard*, the Italian Commissioner of Combustibles has announced that, under a project prepared by Government experts, all electricity stations will shortly burn lignite in place of coal.

France.—Water Power.—A Congress was opened on Monday, at Paris, to consider the problem of water power. There was a full discussion as to the best means of utilising the facilities offered by the Rhône, and the demand made by the authorities of the Ville de Paris for the utilisation of that river as a source of power met with some opposition. It was insisted that the problems of motive power, navigation, and irrigation must be considered as interdependent. The Rhône, it is estimated, can be made to furnish the equivalent of 750,000 h.p. Ultimately a Committee was appointed by the Congress to draft a scheme that would enable all the various interests concerned to form part of a unified whole. This project would also include suggestions for the full development of the canal between the Rhône and the Rhine.—*Morning Post.*

Coventry.—Mains Extensions.—The T.C. is to lay a new electricity main from the generating station to Stoke, at an estimated cost of £15,260.

Edinburgh.—Electricity Supply Control.—The Leith T.C. and the Leith Dock Commission have asked the B. of T. for a Joint Board to be formed to control the supply of electricity to their areas from the Edinburgh Corporation.

Halifax. Year's Working.—The working of the Corporation electricity undertaking for the year ended March 31st, 1918, resulted in a net profit of £12,283, which was carried to the appropriation account, against £12,694 in the previous year. The total income was £100,146, against £83,715, and the total expenditure was £59,198, against £46,278, to which has to be added interest on loans £9,177, against £8,367, bank interest £2,204, against £46, sinking fund £10,291, against £9,260, interest on sinking fund £3,024, against £2,741, and income-tax £3,968, against £3,529; a total on capital account of £28,664, against £24,743. The total capital expenditure on the undertaking now amounts to £358,810, of which £16,198 was incurred during the year under review. Generating costs totalled ·547d. per unit, against ·5d., including coal ·382d., and the total cost was 1·198d., against 1·203d. Units generated numbered 21,928,210, against 18,321,260: 12,091 were sold for street lighting, against 8,167; 4,549,440, against 4,572,571, for traction; and 15,488,340, against 12,123,749, to private consumers; 679,400, against 605,600, were used on the works, and 1,198,939 were unaccounted for, against 1,011,173. The highest maximum demand was 7,732 kw., against 6,784 kw. Since its inauguration the undertaking has transferred a net sum of £39,367 to the relief of the rates.

Hastings.—Salaries.—The T.C. has acceded to the request of the E.P.E.A. that the salaries of the technical staff at the electricity works be increased by 20 per cent. on pre-war salaries, plus merit and grade increases, plus £90 a year.

Huddersfield.—Proposed Loan.—The T.C. has applied for sanction to borrow £90,000 for the provision of additional plant for the electricity department.

Kinghorn (Fifeshire).—New Mains.—The Fife E.P. Co. has informed the T.C. that it proposes to lay a main through the burgh. To double a part of the existing tramway line between Dunfermline and Rosyth, and carry out other improvements, a cable line is also to be laid from Burntisland, through Kinghorn and Kirkcaldy, to Wemyss.

Lancaster.—Price Increase.—The Electricity Committee has increased the charges for electricity for lighting to 8d. per unit; for power to £1 per quarter per b.h.p., plus 1½d. per unit; and to 2·5d. per unit for traction.

Limerick.—Price Increase.—The T.C. has received permission of the B. of T. to increase its charges for electricity to 9d. per unit.

London.—Hammersmith.—Powdered Fuel.—The Electricity Committee is bringing a proposal forward at the next Council meeting to use powdered fuel for boiler firing. The system which it is proposed to make use of is patented by the Powdered Fuel Co., Ltd., which company has made three propositions for the consideration of the Council. The borough engineer suggests that the first be adopted. This involves the firing of one Stirling boiler; but sufficient plant would be laid down by the terms of the proposition to enable an easy extension of the system to be made to the firing of the other boilers in the station. Such extension is dealt with in the second and third propositions.

Battersea.—Salaries.—The Electricity Committee has been requested by the Associated Municipal Electrical Engineers (Greater London) to pay to the chief engineer and manager the various awards made by the Committee on Production to the engineering trades, together with all future awards, and to place the salary of the engineer on the basis of a stated formula based on output; the awards have been paid, and favourable consideration will be given to any decision in the matter that may be arrived at by the Standing Conference of Electricity Supply Associations. The recommendation of the Joint Standing Conference to pay the award of the Court of Arbitration to all members of the technical staff has also been accepted, the cost of the advance being £404 per annum.

Linking-up.—A draft agreement with Stepney Borough Council for reciprocal supplies of energy has been approved by the Battersea Electricity Committee.

Mansfield.—Loan.—The T.C. has applied for a loan of £32,000 for extensions to the electricity works.

Salaries.—The application of the E.P.E.A. for advances in the salaries of the technical staff has been referred to arbitration.

Price Increase.—For public lighting the charge has been advanced to £3 5s. a-year for small lamps, as from April 1st.

Middleton-in-Teesdale.—Proposed E.L.—The P.C. has adjourned consideration of an E.L. scheme for the district, for further information.

National Electricity Supply.—The Government was to introduce in the House of Commons on Wednesday the Bill to create a Ministry of Ways and Communications. The Bill was to be introduced by the Home Secretary under the 10 minutes' rule. The new Ministry, it is stated, will be concerned with the development of the national electricity supply scheme, and will have control over canals, railways, and roads.

Newry.—E.L. Scheme.—The U.D.C. has decided to engage an engineer to report on the question of an electricity supply scheme for the district

Rochdale.—Proposed Extensions.—A deputation from the Electricity Committee interviewed the Ministry of Munitions last week on the proposed extension of the electricity works, and the question of the advisability of a new power station, or a bulk supply from other authorities.

Sheffield.—L.G.B. Inquiry.—On the 21st inst., Col. T. C. Ekin held an inquiry into the application of the T.C. to borrow £699,692 in connection with the new power station at Blackburn Meadows. This is the balance of the original application for £2,419,865 for the construction of a 100,000-kw. station, and is required for the construction of a station, and the provision of two 25,000-kw. turbo-alternators, boilers, &c. The chairman of the E.S. Committee said that many large works had found it advantageous to obtain energy from the Corporation, and had dispensed with their own private plant. There were 51 furnaces obtaining electricity from the Corporation, to the extent of 40,000 kw., and 11 others awaited connection. There was abundant evidence of the growing demand for electricity in small houses, and it was anticipated that a large proportion of the 15,000 new houses to be built at Sheffield would be wired during construction. The general manager (Mr. S. E. Fedden) said the total connections between 1914 and 1918 increased from 41,109 to 133,149, and the total capacity of the plant from 17,580 kw. to 68,225 kw. They had agreements with Rotherham Corporation for 10,000 kw., with the Yorkshire E.P. Co. for 5,000 kw., and with Vickers, Ltd., for 3,000 kw. When completed, the total capacity of the undertaking would be 114,225 kw., with a safe running capacity of 76,150 kw. The estimated maximum demand in March, 1919, was 65,819 kw., 74,300 kw. in 1920, 92,262 in 1922, and 99,743 in 1923; therefore, additional plant must be available by the autumn of 1921.

South Africa.—The Mossel Bay (Cape Province) T.C. is considering an offer by a private firm to install an electric lighting scheme; the charge to private consumers would be 10d. per unit, and the Council would have an option to purchase the installation.

South Wales.—Strike.—A Conference on Wednesday, last week, between the strikers and the employers in the electrical trades, resulted in the men agreeing to resume work on Monday last, on the old terms, pending a further Conference to have taken place at Cardiff on the 26th inst. The secretary of the men's Union states that the employers have withdrawn the legal proceedings they had taken against the apprentices who were called out.

St. Helier (Jersey).—E.L. Scheme.—Proposals have been made to the Constable of St. Helier regarding the lighting of the district with electricity by a local company.

Swansea.—Proposed Loan.—The T.C. has decided to apply for sanction to a loan of £40,000 for the provision of new boiler plant at the electricity works.

Walsall.—Proposed Extensions.—The Corporation has decided to apply for powers to supply electricity to Pelsall, Brownhills, and Cannock.

Waterford.—Power from Submarines.—The *Waterford News* understands that it has been suggested that two of the German submarines now being exhibited should be purchased by the Corporation and used for supplying the city with electricity. Submarines of the type exhibited at Waterford have engines of 1,100 h.p., and dynamos capable of generating sufficient electricity to supply about half the city. Two of them would be, it is said, capable of dealing with the whole of the city's requirements.

Willesden.—Price Increase.—The U.D.C. has increased its charges for electricity by a further 10 per cent.

Street Lighting.—The electrical engineer has suggested that the arc lamps at present in use be replaced by half-watt lamps, for a period of one year.

York.—Price Increase.—From March 31st the price of electricity will be advanced by a further 50 per cent. above prewar charges by the Corporation.

TRAMWAY AND RAILWAY NOTES.

Brentford.—L.U.T. Fares.—The District Council has protested to the B. of T. against the fares charged by the London United Tramways Co.

Continental.—Spain.—Extensions on the Metropolitan, Madrid.—According to our Spanish correspondent, the construction of the tunnel between the Puerto del Sol and Cuatro Caminos is now completed. This extension is 4 km. long and of double track throughont. It has eight stations, each 60 metres long, with a platform on either side of 4 metres width. Overhead conductors will be used, and the tunnel will be lighted electrically throughout. The coaches will carry accumulators for lighting purposes in case the main supply fails. Each train will consist of five coaches. The coaches are 12 metres long, with a capacity of 80 passengers. The whole journey will take 10 minutes, including stoppages at stations, and there will be a train every 2½ minutes, so that the maximum number of passengers will be 9,600 per hour in each direction. At the present time over 60,000 passengers are carried daily by the street tramways over the same district, in spite of the slowness of transport, due to narrow streets and frequent crossings. The fares on the new line will be 15 centimes first class, and 10 centimes second class.

It is announced that the line will be opened in October of this year. It has also been decided to lengthen the line in a southerly direction, and so communicate with the Mediodia railway station.

The Direciou-General de Obras Publicas has opened a competition for plans for the construction of the section of the projected strategic railways running from Matallana to Leon. The line is to be worked either by electricity or steam, and the applications to take part in the competition were returnable by February 21st, so that probably English competitors are excluded. Full conditions of the competition are set out in the *Gaceta Oficial* of December 27th, or may be seen at our office.

Strike.—Owing to a general strike of the employés of the electricity supply company at Barcelona, all the tramway services have been stopped. Mules took the tramcars back to the depôt.

Italy.—Work has commenced on the electrification of the tramway between Pinerolo and Perosa.

Edinburgh.—Car Alterations.—The Corporation has agreed to acquire 50 top covers, suitable for fitting on the existing open-top tramcars, at a cost of £17,500.

The tramways manager has recommended the T.C. to replace the cable tramways with the overhead system.

Halifax.—Year's Working.—The following statistical information is gleaned from the tramway accounts:—The figures in parentheses are those for 1917. Total borrowing powers, £504,033 (£504,033); borrowing powers exercised, £419,342 (£418,235); unexhausted borrowing powers, £84,691 (£85,798); gross capital expenditure, £424,378 (£422,327); total route mileage, 37 miles 935 yards, as in 1917; population served by tramways, 176,000, as in 1917; traffic revenue, £128,627 (£114,092); total revenue, £129,680 (£115,075); working expenses, £87,610 (£76,136): interest on capital, £11,941 (£10,983); contribution to sinking fund, £13,265 (£12,843); net profit, £16,837 (£15,113); total car-miles run, 1,869,357 (2,018,772); passengers carried, 22,822,341 (21,180,584); total number of B. of T. units used, 4,524,291 (4,546,756); units used per car-mile, 2·42 (2·22); number of cars in stock, 101 (101); average number of cars in use daily, 64·4 (68·9); traffic revenue per mile of single track, £2,318 (£2,056); traffic revenue per car-mile, 16·51d. (13·36d.); total revenue per car-mile, 16·65d. (13·48d.); working expenses per car-mile, 11·25d. (8·92d.); average car-miles per car per day, 79·7 (80·61); average speed per hour, 7·23 miles (7·23 miles); average car hours per car per day, 11·03 (11·29); average length of 1d. stage, 1 mile 553 yards, as in 1917; average fare charged per mile ·82d., as in 1917; average journeys per head of population per annum, 130 (120).

Huddersfield.—Proposed Extensions.—The T.C. has decided to apply in October next for powers to extend the tramway system to Brighouse.

Lincoln.—Car-shed Extensions.—The T.C. has applied for a loan of £5,000, for extensions to the tramcar-shed.

Liverpool.—New Tramcars.—The Tramways Committee has decided to purchase 25 new tramcars and 30 motor-buses, and to refit some of the old cars with new electrical equipment.

London.—Proposed Underground Extensions.—As soon as possible, the London Electric Railway Co. intends to connect the terminns of the City and South London Railway at Euston with Camden Town, in order that a thorough service may be run from Golders Green to South London.

The Central London Railway intends, at an early date, to proceed with the extension of its line to Ealing, work on which was commenced before the war.

An escalator between the Waterloo and City Tube and the platforms of the L. & S.W. Railway at Waterloo will be opened, it is hoped, next month.

At the annual meeting of the London Electric Railways, on Friday last week, it was stated that the position of the company had not been made any easier by the ending of the war. An order was placed in 1914 for new rolling stock, but delivery could not be promised before the end of this year. An improvement in the design of the rolling stock and the provision of larger and more doors would add to the convenience of passengers, and help to accelerate the train service. To secure the necessary funds to carry out improvements it became necessary to secure additional capital powers. A special Bill, which the company wished to submit to Parliament, would shortly be considered. The directors had no intention of embarking on any elaborate new schemes under present difficult circumstances. Some further increases in fares would be necessary to meet the additional costs certain to accrue during the current year from the adoption of the shorter working day. The war bonus to railway men during the past year increased the wages bill of the five companies by £750,000 per annum. The combined gross receipts of the five common fund companies for 1918 increased by £1,081,588 over the previous year. For the same period the expenses of the group increased by £970,234. The total number of passengers carried by the companies during 1918 increased by 8·3 per cent., while the receipts per passenger are estimated to have increased by about 9 per cent. The combined effect of this increase was a total increase in the receipts of 18 per cent.

Musselburgh.—Proposed Extensions.—It is proposed to extend the tramways from Musselburgh to Tranent.

Northampton.—Breakdown.—The delay of the tramway service on February 10th was due to the water-pipes at the electricity works being frozen. The tramcars are not run on Sundays, and the water-cooling pipes to the turbine, the condenser discharge pipes and the water-circulating pipes were frozen by Monday morning. During the week-end the thermometer registered 23° below zero, which is the coldest experienced in the district for many years.

Rawtenstall.—Fares.—The B. of T. has authorised the Corporation to charge 1d. for ¾ mile for ordinary passengers and 1d. per 1¾ miles for workmen, subject to an agreement with the Bacup Corporation.

Scotland.—Fares.—The question of fares was discussed at a meeting of the Scottish Tramways Association, held at Glasgow, and proposals for the abolition of the ½d. fare, and an increase in other fares, were considered.

Sheffield.—Accident.—A Corporation tramcar ran away at Nether Green, where it jumped the track and dashed into a shop, doing great damage. A conductress and a woman passenger were seriously injured.

Tramways Committee.—The President of the B. of T. has decided to dissolve the Tramways (B. of T.) Committee, which will wind up its affairs this month, and its office will be closed from to-day.

Tramwaymen's Wages.—A conference between representatives of the Municipal Tramways Association, the Tramways and Light Railways Association, and the National Transport Workers' Federation, on the question of wages, was held in London on February 21st. The 48-hour week had already been agreed upon, but the men demanded that the wages, which the employers wished to reduce, should remain unchanged. At the close of the conference, the chairman (Mr. J. B. Hamilton, of Leeds) stated that, in view of the national effect of any stoppage in the industry, the facts would be laid before the Minister of Labour. He wanted to see that the matter was considered further before any definite steps were taken, and before negotiations were broken off.

The National Transport Workers' Federation issued a circular stating that negotiations had reached a critical stage, and it was therefore incumbent upon its officials and members throughout the country to "prepare for action." A national conference of the employers and workers of the tramway and omnibus undertakings is to be held at Birmingham to-day, in the hope of arriving at a solution before negotiations are broken off.

TELEGRAPH AND TELEPHONE NOTES.

Cable Breakdowns.—It is officially stated that three more Amsterdam-London cables have become defective, leaving only four out of twelve for the whole of the extensive traffic between Holland and Great Britain and the greater part of the world, and even two of these threaten to fail. Unless the British can speedily repair the cables, commercial and other relations between the two countries are threatened with serious disorganisation. One or two important commercial bodies have already memorialised the British and American Ministers at The Hague regarding the present long telegraphic delays. The immediate prospect of improvement is, in any case, very gloomy.—*Daily Telegraph.*

In a letter to *The Times* of Wednesday, Mr. Godfrey C. Isaacs, managing director of the Marconi Wireless Telegraph Co., Ltd., referring to this subject, says that his company could open a wireless telegraphic service with Holland practically within a few hours, and with France, Belgium, Italy, Spain and Portugal almost immediately, and that the company would be willing to establish a permanent commercial service.

Cable Censorship.—From Monday last the Danish censorship of foreign telegrams was abolished.—*The Times.*

Telephone Cables Damaged.—Some of the Post Office telephone cables were recently damaged in London by the breakage of a hydraulic main. The repairs required the re-jointing of 1,406 circuits, but the work was completed in 140 hours, and no crosses or other faults were introduced.

Telephone Call Delays.—Mr. Illingworth explains in the Parliamentary Papers that the priority to calls of Government Departments has now been withdrawn in a large number of cases. The P.M.G. says that a sufficient supply of candidates for training as operators in the London telephone service is now forthcoming, and it is expected that the service will in consequence gradually show improvement.

It is urged that certain private firms should not be allowed to retain priority rights on telephone trunk lines granted to them in exceptional circumstances, and that a check should be applied to the abuse of Government priority telephone and cable messages. It is stated that the Eastern Telegraph Co. recently received in a lump 96,000 words of Government messages in unabbreviated form, with every "the" and "and," the cables being in consequence closed to commercial messages for 30 hours.

A Press correspondent writing on this subject states that the Postmaster-General has asked the Treasury for £8,000,000, to be spent this year on the construction of new telegraph lines, telephone exchanges, and the like. This is the minimum amount required, and, if granted, the new work can be begun in about six months' time. Turning to Government priority telephone calls, it is said that between London and Glasgow 86 per cent. of the total number of trunk calls are Government priority; London to Manchester, 85 per cent.; London to Southampton, 74 per cent.; London to Sheffield, 64 per cent.; London to Bristol, 65 per cent.; Bristol to Salisbury, 90 per cent., and so forth. In spite of official abuses of the system, it is regarded as impossible to abolish priority altogether.

Wireless Telephony.—A New York Press message announces that Secretary Daniels on Saturday last held a wireless telephonic communication with President Wilson over a distance of about 1,000 miles.

The Secretary spoke into an ordinary telephone set installed in his office at Washington, and the s.s. *George Washington* was 800 miles off shore at the time of the conversation. The President was unable to reply, because the liner was not equipped with proper sending equipment; but a radiogram announced that the conversation was heard perfectly.—*The Times.*

Wireless and wire telephone systems can be linked so that the waves will travel through the air and then along the wires, according to a paper presented at the American I.E.E. Transferring sound from wire to air can be accomplished by a device not more complex than is the repeater now used in long-distance telephoning. It is held that wireless telephony would be a supplement, not a rival, to wire systems, and that the lack of secrecy in wireless telephony in a city would prevent competition.—*American Wireless.*

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. (January 31st.)

Melbourne.—Commonwealth. March 4th. P.M.G.'s Department. Copper jointing sleeves, schedule 1,511.

March 11th. Covered and braided wire, schedule 1,510; telephones and diaphrams, schedule 1,505.

March 18th. Bronze and copper wire, schedule 1,509.

Specifications from Room 405, Australia House, Strand, W.C. See "Official Notices" to-day.

Queensland.—March 26th. P.M.G.'s Department. Telegraph and telephone material, schedules 447/451 and 453. Specification from Australian Commonwealth Offices, Room 405, Australia House, Strand, W.C. (February 21st.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Aylesbury.—Corporation Electricity Department. One 1,000-kw. generating set complete; two 500-kw. rotary converters.

March 10th. Laying cable and wiring infirmary for the E.L. for the B. of G. Workhouse Master.

Barrow-in-Furness.—March 3rd. Corporation. 12 months' supply of electrical stores, meters, joint boxes, &c., for the electricity department. Borough Electrical Engineer.

Belfast.—March 12th. Electricity Department. Six or 12 months' supply of stores, including electrical items. (See this issue.)

Birmingham.—March 5th. Tramways Committee. Additional rolling stock. (February 7th.)

Dublin.—March 3rd. Electricity Supply Committee. Extra-high-pressure and low-pressure cables. (February 21st.)

East Ham.—March 6th. Corporation. Six double-deck top-covered tramcars for the tramway department. Mr. W. C. Ullman, Engineer & Manager, Tramway Offices, Nelson Street.

King's Lynn.—March 3rd. Corporation. One 1,000-kw. turbo-alternator, one 400-kw. rotary converter or motor-generator, and one 400-kw. transformer and switchgear. (Feb. 7th.)

Lincoln.—March 5th. Corporation. Four water-tube boilers with stokers, &c., complete; two 3,000-kw. turbo-alternators with condensers, &c.; extension of E.H.T. switchboard, &c.; two 750-kw. rotary converters, &c.; two 2,000-k.v.a. three-phase transformers, &c. Specifications from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. (February 7th.)

Leeds.—March 1st. Installation of motor and power for blowing of organ at All-Hallows Church. Tenders to Rev. A. B. Fisher, All-Hallows Vicarage, Leeds.

London.—Hammersmith.—March 12th. B.C. Stores for the electricity department for 3, 6 or 12 months. (See this issue.)

Islington. March 19th. Corporation of London. Electrical work at the Metropolitan Cattle Market. (See this issue.)

Manchester. — March 11th. Tramways Committee. Supply, &c., of (*a*) permanent-way special track work; (*b*) permanent way points, tongues, and hardened steel centres. Mr. J. M. McElroy, general manager.

March 11th. Tramways Committee. Stores, including several electrical items. (February 21st.)

Macclesfield.—March 17th. Six months' or one year's supplies of electrical goods for Cheshire County Asylum, Parkside. Mr. G. F. Tingay, Clerk of Asylum.

Mansfield.—Corporation Electricity Committee. 1,250-1,500-kw. turbo-alternator, condensing plant, 500-kw. rotary converter, transformer, and switchgear. (February 14th.)

Portsmouth.—March 4th. Tramways Committee. Tramway stores for six months. (February 14th.)

Rhondda.—March 5th. U.D.C. Electricity Department. Twelve months' supply A.C. meters, cable, joint boxes, compound, cut-outs, &c. (February 14th.)

Rochdale.—March 13th. Tramways Committee. Stores for one year. Particulars from Mr. G. Webster, General Manager, Tramway Offices, Mellor Street.

Stockton-on-Tees.—March 12th. District Fund, Gas and Electricity Committees. Articles and stores for six months. (See this issue.)

Taunton.—Electricity Department. One 500-kw. steam turbine generator, travelling crane, cables and meters. (Feb. 14th.)

CLOSED.

Government Contracts.—The undermentioned contracts were placed during January, 1919:

War Office.

Spares for dynamos.—Mawdsley's, Ltd.

Post Office.

Battery boxes.—W. Duncan, Tucker & Sons, Ltd.
Telegraph and telephone cable.—Connolly Bros., Ltd.; Johnson & Phillips, Ltd.; Union Cable Co., Ltd.; Western Electric Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Ducts.—Albion Clay Co., Ltd.; Sharp, Jones & Co., Ltd.
Glass jars.—South Wales (Siemens Patent) Glass Mfg. Co., Ltd.
Telephone lamps.—Edison Swan Electric Co., Ltd.
Distribution cable plugs.—B.I. & Helsby Cables, Ltd.; Siemens Bros. and Co., Ltd.
Jointing sleeves.—C. M. Powell Bros.
Bronze wire.—T. Bolton & Sons, Ltd.; B.I. & Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co. (incorporated in the London Electric Wire Co. & Smiths, Ltd.).
Battery zincs.—Siemens Bros. & Co., Ltd.
Laying conduits in Huddersfield and Dalton.—O. C. Summers.

India Office, (Store Department).

Copper tubing and wire.—T. Bolton & Sons.
Copper wire.—R. Johnson & Nephew; Elliotts Metal Co.; Shropshire Iron Co.
Distributors.—Elliott Bros.
Electrical fittings.—Stone & Co.
Motors.—Lancashire Dynamo Co.
Transmitters.—Creed & Co.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—(Midland Section).—Friday, February 28th. At 8 p.m. At the University, Birmingham. Paper on "The Boys' Welfare Movement," by Mr. T. Lewis.

Royal Institution of Great Britain.—Friday, February 28th. At Albemarle Street, W. At 5.30 p.m. Lecture on "Ether and Matter," by Sir Oliver Lodge, F.R.S.

Physical Society of London.—Friday, February 28th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Ordinary meeting.

Rugby Engineering Society.—Friday, February 28th. At Benn Buildings. At 7.30 p.m. Lecture on "The Panama Canal," by Mr. R. H. Simpson.

Salford Technical and Engineering Association.—Saturday, March 1st. At the Royal Technical Institute. At 7 p.m. Lecture on "Steel (Illustrated by Photomicrographic Lantern Slides)," by Mr. W. Hardy.

Junior Institution of Engineers (N.E. Section).—Tuesday, March 4th. At 7.15 p.m. At the Mining Institute, Newcastle. Paper on "Electrical Disturbances in Supply Systems," by Mr. L. C. Grant.

Royal Society of Arts.—Tuesday, March 4th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "Water Powers and Scientific Development in Canada," by Prof. J. C. McLennan, F.R.S.

Wednesday, March 5th. At John Street, Adelphi. At 4.30 p.m. Paper on "The Rubber Industry, Past and Present," by Mr. B. D. Porritt, Chief Chemist, North British Rubber Co.

Industrial and Reconstruction Council.—Wednesday, March 5th. At the Saddlers' Hall, Cheapside, E.C. Lecture on "Industrial Changes caused by the War," by Prof. A. W. Kirkaldy.

Greenock Association of Engineers.—Thursday, March 6th. At 22, West Stewart Street. At 7.45 p.m. Junior night and general meeting.

Institution of Electrical Engineers. Thursday, March 6th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Lecture on "Dielectrics in Electric Fields," by Mr. G. L. Addenbrooke.

(South Midland Centre).—Wednesday, March 5th. At the University, Birmingham. At 7 p.m. Paper or papers on "The Co-ordination of Research in Works and Laboratories."

(Students' Section).—Friday, March 7th. At Faraday House, Southampton Row, W.C. At 7 p.m. Paper on "The Design, Manufacture and Operation of Transformers," by Mr. W. G. C. Jackson.

British Industries Fair, 1919. (Closes March 7th.) From 10 a.m. to 6 p.m. At the London Dock, Pennington Street Warehouse, E., near Mark Lane Station (District Railway).

Manchester Association of Engineers.—Saturday, March 8th. At the Grand Hotel. At 6.30 p.m. Paper on "Automatic Machines," by Mr. H. E. Thomas.

Birmingham and District Electric Club.—Saturday, March 8th. At the Grand Hotel. At 7 p.m. Paper on "Electric Welding as a Commercial Proposition," by Mr. H. W. Wolton.

National Foremen's Association of Engineering and Allied Trades (West London Branch).—Saturday, March 8th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Below we give a list of further contributions received in response to the appeal made by Mr. Hunter:—

	£	s.	d.
A. J. C. de Renzi	1	1	0
Callender's Cable, &c., Co., Ltd.	26	5	0
H. Bevis	5	5	0
Foote & Milne, Ltd. ...	2	2	0
Ferranti, Ltd.	4	15	0
(This brings their total subscriptions for the year to £10.)			
E. Badham Thornhill ...	2	0	0
Mavor & Coulson, Ltd.	10	10	0
H. Mugford		10	6
Universal Elec. Sup. Co.	1	1	0
W. B. Clarke	1	1	0
R. L. Booth		10	6
J. G. Bomford		10	6
Booth & Bomford	1	1	0
G. R. Peers	1	1	0
Watson & Swan	3	3	0
A. Barr	10	10	0
London Electric Wire and Smiths, Ltd.	3	3	0
Metallic Seamless Tube Co.	2	2	0
S. G. Leach & Co., Ltd.	5	5	0
A. Berkeley	1	1	0
F. B. Hellon	2	2	0
T. W. Jefferson	1	1	0
Wright & Beyer	2	2	0
Bournemouth and Poole Elec. Supply Co., Ltd.	2	2	0
Cable Makers' Association	25	0	0

NOTES.

British Industries Fair.—This year's British Industries Fair, organised by the Board of Trade, was opened last Monday, and will remain open until Friday, March 7th. The Fair is being held once again in the Pennington Street premises of the London Dock, and a special service of motor-omnibuses between Mark Lane Station and the Fair is provided. The Fair is again restricted to the same four trades as last year, but about 150 more firms than in 1918 are exhibiting. The total number of exhibitors is 570, and 50 more were too late to obtain space. During the last two years very few foreign buyers were able to visit the Fair, but this year it is anticipated that a considerable number of firms in oversea countries will avail themselves of the opportunity of gaining first-hand information regarding the very important developments which have taken place in many industries in this country during the last four years. The Fair is a strictly trade event, and admission is confined to trade buyers, at the invitation of the Board of Trade, which has already issued over 80,000 invitations to firms and individuals in the United Kingdom interested in the trades covered by the Fair. Firms that have not yet received an invitation and are anxious to visit the Fair, should apply to the Director, British Industries Fair, 10, Basinghall Street, London, E.C. 2. According to the figures supplied by the exhibitors at the close of the last Fair, the total orders booked during the eleven days amounted to over a million and a half sterling, but much of the business commenced at the Fair was not completed till long afterwards, and many of the orders placed at the Fair were only sample orders.

As was the case last year, electrical goods are again confined to such articles as portable electric appliances, pocket lamps, dry batteries, electrical novelties, &c., of which exhibits are made by the British Ever-Ready Co., Ltd., London; Ward & Goldstone, Manchester; Surrey Electrical Co., Ltd., London; Rose Bros., London; the Remoline Co., London; the Efandem Co., Wolverhampton; Hudson, Scott & Sons, Ltd., Carlisle; W. A. Jacobs and R. J. Jacobs, Ltd., London; A. Chase & Co., Ltd., Teddington; Minton, Hollins & Co., Stoke-on-Trent; and A. J. Wilkinson, Ltd., Burslem. Included in the stoneware exhibits by Joseph Bourne and Son, Ltd., Derby, are battery jars and insulators, while the exhibits of the British Glass Wool Co., Ltd., London, and the Sheraton Glass Manufacturing Co., Ltd., London, which include electric lamp bulbs, are interesting.

Electric Furnaces in the Laboratory.—The article on this subject, which appeared in our issue of February 14th, has attracted a good deal of attention, and it may be of interest to mention that the furnaces were photographed in the Metallurgical Department and Laboratory of Messrs. Petters, Ltd., the well-known oil engine manufacturers, at their Westland Works, Yeovil where the author (Mr. G. Castle) is the chief metallurgist.

National Electricity Supply and the Miners' Threatened Strike.—In the course of the meeting between the Prime Minister and the Executive Committee of the Miners' Federation last week, the president of the Federation, Mr. R. Smillie, said that up to the present only 10 to 15 per cent. of the value of the coal produced had been utilised, whereas it was possible to obtain three times that amount, with the result that raw materials would be cheapened, and the atmosphere purified; the captains of industry in this country should turn their attention in that direction, rather than keep down the wages of the miners. The Coal Conservation Sub-committee, of which he was a member, had reported that by the central carbonising of coal they could produce electricity at great centres.

Mr. Lloyd George remarked that that was part of the scheme of the Government; it was one of the reasons why they were going in for such economies. The Cabinet had been considering it on the previous evening.

Mr. Smillie expressed a fear that the Government would let the matter drift into private hands again, but Mr. Lloyd George replied that a special Ministry was being set up, which would undertake the development on behalf of the State. They had been considering the draft of a Bill to that end, and had passed it.

The Manchester Strike.—The semi-skilled men belonging to the Electrical Trades Union employed at the works of Messrs. Ferranti, Ltd., Hollinwood, and the British Westinghouse Co., Ltd., Trafford Park, numbering about 250, were on strike for several days last week, and on Sunday last, at a mass meeting of the union, it was decided to take an immediate ballot in the Manchester district to discover whether the members were prepared to give a week's notice to cease work in order to support the men already on strike. In view of the fact that the issues of the strike affect workers other than members of the E.T.U., it was also decided to ask for the support of the Manchester Committee of the Federation of Engineering and Shipbuilding Trades.

The Manchester district of the E.T.U. is a large one, embracing Oldham, Bolton, Warrington, Stockport, and Stalybridge, besides all the smaller towns in between. The union has in this district some 3,000 members.

The dispute in the electrical manufacturing works is concerned with the minimum wage of the transformer winders and other workers, who are described by the union as semi-skilled men. There had been prolonged negotiations with the firms before the men struck with the consent of their Executive. At the outset a minimum of 39s. was sought, but at a later stage this was lowered to 35s. a week. The employers have declined to consider this, and on their behalf it has been pointed out that the men employed on transformer work are engaged purely on semi-skilled operations of the simplest repetitive character, upon which in the past it has been the custom of the firms to employ labourers. The union is now endeavouring to establish the payment of the fully skilled rate for semi-skilled operations, together with the institution of a term of apprenticeship for such work. The Employers' Association maintains that a vital principle is at issue. Mr. J. Rowan, the general secretary of the union, says the apprenticeship system part of the application has been withdrawn, and they are not claiming the fully skilled rate for semi-skilled workers. At present these men are earning from 25s. to the full 39s. They want to establish 35s. as a minimum. As to the degree of skill required in their work, he says it is too late for the employers to say they are fighting against recognising these men as other than labourers, because they have already agreed in negotiations, both local and national, to rates of pay which are above those of a labourer. The ballot of the E.T.U. will take about a fortnight or three weeks to complete, but no general strike can come into operation without a majority of three-fourths of the members being in favour.

A strike at the Gorton works of Crossley Motors, Ltd., is in progress. About 3,500 employés are affected.

Royal Mint Report.—The report of the Deputy Master and Comptroller of the Royal Mint recently issued, for the year 1916, shows that 266 million coins were struck—an increase of nearly 52 millions over the previous highest total. Practically the whole of this number was for Imperial silver and bronze coinages, the demand for these issues being very heavy. The excess of receipts over expenditure for the year reached a total of 4½ million pounds, the greater part of which sum consisted of profit on silver coinage. Sir Edward Rigg, superintendent of the operative department, in his memorandum refers to the erection of a No. 10 Alldays Empire positive blower, driven direct by a 20-H.P. variable speed motor. Five other motors were added, making the total number now installed 131, and their aggregate H.P. 1,004½. High-power incandescent lamps were increasingly used, their number rising during the period under review from 29 to 74, and an approximately corresponding reduction in the number of arc lamps was made. The mint generating plant averaged 51,609 units per month, as compared with 42,269 in the previous year. The Deputy Master of the Ottawa Branch Mint reports an important extension to the refinery. The branch was called upon to refine gold in much larger quantities than usual, and an entirely new building was erected, within a period of two months, under the supervision and to the designs of Mr. R. Pearson, the assayer. The chlorine process is employed. Two of the four gold cells in the old refinery were used, however, for deposits suspected of containing platinum, namely, jewellers' and dentists' scrap, &c. Five silver cells were also continually in operation, depositing silver from anodes obtained from button produced by running down the silver chloride with carbonate of soda to free it from gold. These buttons, which average 30 to 40 per cent. gold, are melted and cast direct into silver anodes for the silver cells. Six wooden tanks were erected, also, in which the silver chloride produced in chlorination (after gold has been extracted) is washed free from copper chloride, &c., with boiling water, and reduced with iron plates to metallic silver. These tanks are used in series of two. In the first the silver chloride cakes are washed free from copper chloride, &c.; in the second tank they are then reduced to metallic silver with iron plates. The copper is precipitated with iron plates at the ends of each washing tank, taken out, dried, ground, sieved, and sold as copper sweep. Each washing tank holds 48 cakes of silver chloride averaging 260 ounces each, or 12,480 ounces silver chloride per tank, yielding approximately 6,000 ounces fine silver.

The Professional Workers' Federation.—This federation, which was established in May last, now comprises a number of well-organised professional bodies, including the National Union of Teachers, Incorporated Association of Assistant Masters, Customs and Excise Federation, Second Division Clerks' Association, Association of Assistant Mistresses, &c., representing in all some 174,000 workers who have never before been organised jointly to protect their special interests as citizens and consumers. Experience has already shown the value of the Federation in providing a common meeting ground for these workers, and it has therefore been decided to open the organisation to individual professional, technical or clerical workers by the formation of an individual Members' section. The Federation is paying particular attention to the question of the reform of the income tax, which is regarded as pressing with undue hardship on that section of the community to which these workers belong, and is urging the Chancellor of the Exchequer to receive at an early date a deputation in support of its policy. Other important matters on which the Federation is taking action are various aspects of the work of reconstruction, the shortage of middle-class houses and increase of rents, the securing of a definite share in the determination of their conditions of service for all employés, and reduction of railway fares. The Federation is not attached to any political party, and men and women of all shades of opinion join actively in its work. Requests for information should be addressed to the hon. secretary, Mr. F. H. Norman, 49, Bedford Street, Strand, W.C. 2.

Lamp Breaking Epidemic.—In prosecuting a number of boys at the South-Western Police Court for breaking street gas lamps in the borough of Battersea, Mr. Paul Caudwell, borough solicitor, stated that since last November there had been an epidemic of lamp breaking in the district, and damage to gas lamps to the extent of about £30 had been done by gangs of boys. The epidemic grew in extent whilst the snow was about. In addition, some of the lamp fittings had been stolen. In another case, in which an electric lamp was broken, Mr. Thwaites, chief clerk at the Battersea Council electric lighting station, said that the value of the broken lamp was 9s. About £50 worth of damage had been done to electric lamps within a month or two. The magistrate inflicted fines in all the cases.

Auction Sale of Timber.—By order of the B. of T. (Timber Supply Department), Messrs. Chaloner & Co., A. Dobell and Co., and Farnworth & Jardine, will sell by auction on March 13th, at Liverpool, a large assortment of American oak and ash, &c. See advertisement pages to-day.

The Ministry of Ways and Communications.—On Wednesday last the Government introduced a Bill in the House of Commons to establish the new Ministry which has been foreshadowed, and which will be entitled the Ministry of Ways and Communications. To this Ministry will be entrusted the control of railways, tramways, roads, bridges, canals, and the supply of electricity, and Sir Eric Geddes will be at its head. The Bill to constitute a Ministry of Health received its second reading on the same day. Introducing the Bill, the Home Secretary emphasised the great importance of transport, which affected industry, housing, and agriculture very materially; transport would probably be the most important customer for electricity, and the industrial prosperity of the country would react upon the transport service, hence the power supply should be under the same control.

Gilling v. Epsom U.D.C.—This action was before the King's Bench Division, on Tuesday, upon a special case referred to Justice Bray upon points of law as to the liability of the Council to pay Mr. A. C. Gilling, its electrical engineer, salary during his absence in the Army, in accordance with a resolution passed by the Council subsequent to his enlistment. His Lordship said that the resolution did not amount to a contract which was binding upon the defendants so far as plaintiff was concerned. He gave judgment for the defendants, with costs. Our report of the case is held over owing to pressure upon our space

The I.E.E. Electrical Appointments Board.—The Electrical Appointments Board has on its register applications for employment from a considerable number of members of the Institution at present serving in H.M. Forces and expecting early demobilisation, or recently demobilised. The Board desires to impress upon all employers the strong claims of these members in regard to priority of employment and it will be glad to receive particulars of vacancies in the electrical industry. On receipt of particulars the Board will submit to the employer the names of applicants possessing qualifications similar to those desired. No fees are charged. Communications should be addressed to the Secretary, electrical Appointments Board, 1, Albemarle Street, W. 1.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Thursday last week Mr. G. L. Addenbrooke delivered the first of his lectures on "Dielectrics in Electric Fields." Referring to tests on cables, he pointed out the disadvantages of expressing the results in terms of power factor ; the energy stored in the dielectric and the energy dissipated were two independent quantities, of which the important one was the latter, and, at constant pressure, the most significant measurement was that of current. His electrostatic instruments lent themselves well to this class of investigation. Owing to the cost of experiments on cables, he had found it necessary to use dielectrics on a small scale. The losses in dielectrics had been attributed to dielectric hysteresis, but he found that they were wholly due to the presence of moisture, and not to any molecular change in the material or to chemical action. The heating effect was cumulative up to the point of breakdown, which took place owing to the expenditure of energy in the dielectric, *i.e.*, to local heating ; that this was the case was proved by obtaining the same phenomena when the substance was heated by external means. There was no difference (except in degree) between the phenomena at low pressures and near the point of breakdown. Heat could not readily escape through the dielectric ; the highest temperature was attained near the inner side of the dielectric, and thus weakening took place from the inside towards the outside. The process was studied with the aid of Mansbridge condensers, which broke down first in the middle, where charring took place. In 1909 the power factor of condensers was 1·4 per cent. ; Helsby condensers of later make had a power factor of only 0·2 per cent., and had no appreciable temperature rise.

The President, in announcing that the meeting on the 27th inst. would be devoted to the paper by Drs. S. F. Barclay and S. P. Smith, due to the illness of the author of the paper on "Co-ordination of Research in Works and Laboratories," stated that the latter was Mr. H. R. Constantine.

Association of Mining Electrical Engineers.—The Yorkshire Branch of this Association, on February 22nd, visited the Lofthouse Colliery, near Wakefield, and made a tour of the works, extending over three hours' duration. The members were afterwards entertained to tea by Mr. Eley, the manager. The after proceedings consisted of a meeting, at which the chief mechanical and electrical engineer (Mr. J. R. Haigh) read a paper on "Electrification of Old Collieries," which provoked a good discussion.

In his recent presidential address before the Lancashire, Cheshire, and North Staffordshire Branch of the Association Mr. W. T. Anderson offered what he described as "some few points of constructive criticism which might prove helpful both to the framers of the Regulations and to the manufacturers of plant, in view of *post-bellum* conditions," touching chiefly upon the latest practice and experience in the use of cables. Mr. Anderson said that since the introduction of the new Rules, mining electrical engineering appeared to have followed, rather than to have materially benefited by, the course of evolution previously covered in the development of public electricity supply undertakings. Speaking generally, A.C. generators had superseded D.C., while concentric systems had been distinctly on the decline. Pressures (at motors) would appear to have become standard at about 500 volts, while 3,300 volts would seem to be the generally accepted limit at which H.T. work was actually taken into pits. The general armouring of cables and the total enclosure of switchgear, &c., had, of course, become compulsory. Much room for improvement, however, still existed both with regard to organisation and equipment, and in the former category there was at least one item—namely, the status of the colliery electrician—in which it would appear that the Association might be the means of rendering considerable assistance to the Home Office.

Nottingham Society of Engineers.—Mr. E. G. Phillips, M.I.E.E., engineer to Messrs. Boots, Ltd., gave a lecture before this Society, on the 19th inst., on "Electricity for the Million."

Royal Institution.—The Friday evening discourse on March 7th, at 5.30 p.m., will be delivered by Prof. H. C. H. Carpenter on "The Hardening of Steel." On Saturday, March 8th, at 3 o'clock, Prof. Sir J. J. Thomson will give the first of a course of six lectures on "Spectrum Analysis and its Application to Atomic Structure." Prof. Hele-Shaw's lectures on "Clutches," announced for March 4th and 11th, are unavoidably postponed until after Easter.

Birmingham Electric Club.—The Club, founded 13 years ago, on Saturday evening held the eighth annual dinner, at the Grand Hotel. Mr. W. H. Varnon presided over an attendance which included the whole of the borough electrical engineers of the Midlands. The toasts honoured included the "Electrical Industries," and it was urged that Birmingham's future prosperity was closely allied with that of the electrical industries.

Royal Society of Arts.—Dr. J. A. Fleming on Monday concluded his series of Cantor Lectures with an account of the thermionic and crystal detectors, which have taken an important part in the war. He explained how the radiant point, from which wireless messages were sent, could be determined by angles taken from two receiving stations, so that the exact position of ships and Zeppelins could be ascertained ; and the means whereby electric oscillations could be detected through the telephone in an aeroplane above the sound of the engines. Thermionic detectors had been enormously developed. Two currents being coupled and exalting each other made an exceedingly sensitive detector, and the lecturer remarked that this might be tested by placing the receiver and transmitter of a telephone together, when all the little noises in the room were picked up and a whistling sound was produced. Thus, with the modulation of the waves to the human voice, the problem of radio-telephony was solved, and great developments were to be expected.

National Foremen's Association of Engineering and Allied Trades.—The West London Branch of this Association is holding a meeting on Saturday, March 8th, as announced in our "Forthcoming Events" to-day. Prospective members are invited to communicate with the General Secretary, at 81, High Holborn, London.

The S.A. Institute of Electrical Engineers.—According to the *South African Mining Journal*, Mr. E. A. du Pasquier has been elected President of the S.A. Institute of Electrical Engineers for the present year. At the meeting held in January, Prof. Dobson delivered his valedictory address, covering the whole range of electrical developments in South Africa during the past year.

ELECTRIC WELDING.—At a meeting of the Newcastle-upon-Tyne Branch of the Association of Engineering and Shipbuilding Draughtsmen, on the 14th inst., Mr. J. H. Patterson, D.Sc., delivered a lecture upon electric welding. Dealing with the problem whether it would be an economical proposition to weld instead of rivet, he stated that in the case of small articles there was no doubt about the possibility of reducing the cost of manufacture by as much as 50 per cent. ; but in the case of large constructional undertakings the cost of punching and riming holes and riveting did not bear so large a proportion to the whole cost, and it was not so readily discernible that electric welding would pay. The cost of an electrically-welded job depended primarily on cost of labour, speed of working, and the cost of electrodes. At present the first was high—and as to electrodes, it might be stated, without going into details, that electrodes which cost more than 60s. per cwt. of metal in them could not be used with much hope of economy instead of riveting. This placed all the slag-covered electrodes known to the author out of the question at once.

Appointments Vacant.—Electrical engineer and manager (£350), for the Fleetwood U.D.C. electricity undertaking ; Director (£1,000), for the Electrical Development Association ; shift engineer (£3), also plumber-jointer, for the Colne B.C. Electricity Department ; two assistants (£200 to £300, £150 to £175), for the Department of Electrical Engineering, Royal Technical College, Glasgow ; electrician, for King's College Hospital, Denmark Hill, S.E. ; meter superintendent for the Loughborough Corporation Electricity Department. See our "Official Notices" in this issue.

Educational.—The annual examinations at Faraday House Electrical Engineering College for a Faraday Scholarship of 50 guineas per annum, tenable for two years in college and one year in manufacturing works, and for a Maxwell Scholarship of 50 guineas per annum, tenable for one year in college and one year in works, will be held at Faraday House on April 15th, 16th and 17th. Exhibitions may also be awarded to candidates who acquit themselves creditably in the above examinations. Particulars can be obtained from the Secretary, Faraday House, Southampton Row, London, W.C. 1.

Correction.—On p. 201, fig. 4 should have been described as "Shift Performance Chart."

Electrolytic Disinfectant.—The distribution of electrolytic disinfecting fluid in Poplar has proved of great benefit during the influenza epidemic. The fluid is distributed free, and during the first three weeks of November 5,370 gallons were given out. The fluid contains common salt and hypochlorite of magnesium ; it is alkaline and stable, and is tinted with permanganate of potash. The cost works out at about ½d. per gallon. The fluid is used for rinsing the mouth, throat, and nose, and it is claimed that it either kills the germs or prevents their growth. Representatives of other municipalities have visited the borough, and propose to apply the scheme to their own areas.

Parliamentary.—The *London Gazette* of February 25th contains notice of application of the Workington Corporation for powers to generate and supply electricity within the borough.

X-Rays in Industry.—Major J. Hall-Edwards, addressing the Birmingham and Midland Scientific Society on "The X-Rays in the Service of Man" emphasised the value of the application of X-rays to the examination of metal castings. Radiographs of aero engines had made defects plainly visible. He hoped that the X-rays would be used by manufacturers in the future for testing their work. During the war more than 40,000 radiographs were taken in hospitals in and around Birmingham, and thousands of lives had been saved by their use.

Summer Time.—It is announced that Summer Time will come into force this year on the morning of Sunday, March 30th, and will continue until the night of Sunday-Monday, September 28th-29th.

The E.T.U. and the E.P.E.A.—We have received from Mr. W. J. Webb, secretary ot the Electrical Trades Union, London District, a copy of a letter which he has addressed to Sir Robert Horne, Minister of Labour, with regard to Award 2,772 of the Committee on Production. The Minister's attention is drawn to an application made in November last to Sir George Askwith, Chief Industrial Commissioner, for a rehearing ot the claim of the E.T.U. in respect of basic rates of wages and working conditions for charge engineers, who were excluded under Clause 10 of the award, the employers agreeing that they would not enter into negotiations with the Electrical Power Engineers' Association pending a hearing of the said claim. In the meantime, a letter has been circulated by Mr. J. W. Beauchamp, secretary of the Joint Standing Conference of Electricity Supply Associations, which is considered by the E.T.U. to be a breach of faith on the part of the employers, and on behalf of his committee, Mr. Webb enters an emphatic protest against the claim of the E.P.E.A. being heard before the claim made on behalf of the E.T.U. Mr. Webb also points out that the E.P.E.A. has already made a threat to withdraw the whole of its members from the power stations unless its conditions are complied with, yet it was prepared a week later to "act the part of jackals for the Government and blackleg their fellow trade unionists, who, by the way, had not even threatened such drastic action." In conclusion, he presses for an immediate hearing of the claim made in December. Mr. Webb encloses a copy of the letter issued by Mr. Beauchamp, which relates to the claim of the Electrical Power Engineers' Association for an advance in salary of 20 per cent. and £90 per annum, dated October 11th, 1918. The gist of this letter was embodied in the report on p. 224 of our last issue. The E.P.E.A. agreed to suspend the notice of withdrawal and to agree to arbitration provided that the power companies and certain municipalities which had already assented to the claim should pay it forthwith, and that the award of the arbitrator should be given within 21 days from the date of the agreement (January 30th). The letter was signed by Mr. W. B. Woodhouse, chairman of the Joint Standing Conference, and Mr. J. W. Beauchamp, hon. secretary.

Licensing of Electricians.—The Johannesburg Municipal Council reports that the Board of Examiners appointed by the Council in terms of the By-laws for the Licensing and Regulating of Electricians within the Municipality of Johannesburg commenced its sittings on July 15th, 1918, with the general manager of the Gas, Electric Supply, and Tramways Department as chairman. Since that date the Board has met practically every week, dealing with 232 applications for licences. The applications approved number 151. Arrangements are now being made to hold an examination under the auspices of the South African School of Mines and Technology for others desiring to obtain an electrician's licence through the medium of such examination. After the result of the examination is known, rigid adherence will be made to the by-laws, which preclude any person, unless duly licensed, from performing any electrical wiring work for the installation, alteration or repair of any system of wiring connected with any municipal works for the supply or distribution of electrical energy.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

Central Station Officials.—Hackney B.C. Electricity Committee recommends that Mr. J. F. Heathman, chief clerk in the electricity department, be promoted to the first grade of clerks at a commencing salary of £210 per annum.

Mr. E. B. Barlow, A.M.I.E.E., of the Urban Electric Supply Co., Hawick, has been appointed chief engineer and manager of the Berwick-on-Tweed electric supply.

Mr. F. H. Brandreth, resident engineer and manager of the Stamford electricity works, has been demobilised by the War Office, and has returned to the town.

Weymouth T.C. has increased the salary of Mr. G. Nicolson, whilst acting as electrical engineer, from £300 to £325 a year.

Lincoln T.C. has advanced the salary of the electricity station superintendent to £300 a year, rising by £25 per annum to £350.

Mr. A. J. S. Waddell has resigned his position of senior shift engineer at the Nechells power station of the Birmingham Corporation electric supply department, having been appointed shift engineer at the Stuart Street generating station of the Manchester Corporation.

Mr. W. G. Hurst, for five years engineer and secretary for the Ingleton Electric Lighting & Power Co., Ltd., has been appointed resident engineer and secretary to the Burnham & District Electricity Supply Co., Ltd. (Somerset).

Major F. Barritt Hills, D.S.O., R.G.A., who was mobilised at the outbreak of war, has now resumed his duties as engineer and manager with the North of Scotland Electric Light & Power Co., Ltd. Major Hills saw considerable service with the R.G.A. in France, notably in the first and second battles of the Somme and the third battle of Ypres. He has received two "mentions in dispatches" and the D.S.O., and was wounded during the withdrawal from St Quentin in March last.

Mr. W. H. Miller, A.M.I.E.E., the electrical engineer to the Fleetwood Urban District Council, has resigned his appointment, owing to ill-health

General.—Major H. Clifford Palmer, manager of the publicity organisation of the General Electric Co., Ltd., is expected to be back at his old post very shortly, after a prolonged absence with the Forces in many parts of the world.

Mr. John Cooper, works manager of the Longton Branch of Messrs. Taylor, Tunnicliffe & Co., electrical porcelain manufacturers, Hanley, has been the recipient, from the staff and workpeople, of a gold pin and silver cigarette case on leaving the Longton works to take up his duties at Hanley.

Mr. H. J. Fell, late manager of the dynamo and motor manufacturing department of Messrs. Crompton & Co., Ltd., of the Arc Works, Chelmsford, has been presented by his colleagues and friends with an inscribed case of cutlery.

The Society of Chemical Industry, U.S.A., has presented the Perkin Medal to Dr. F. G. Cottrell, chief metallurgist of the U.S. Bureau of Mines, in recognition of his "most original and valuable work in applied chemistry," especially the electrical precipitation of dust and fumes. Acknowledging the honour, Dr. Cottrell gave an account of the method by which helium is extracted from "natural gas, at a cost of 10 cents per cubic foot." When the Armistice was signed the first consignment of 147,000 cu. ft. of 93 per cent. helium was ready for shipment to Europe, for use in aircraft; at pre-war prices this would have cost £50,000,000. Helium is incombustible, and has nine-tenths of the lifting power of hydrogen.

On the occasion of his departure from the service of the Falkirk Iron Co., to take up duty in London, Mr. W. B. Scourfield, foreman of the electrical department and the foundry, was presented with a French clock, also a silver cigarette case suitably inscribed, from the foremen and heads of departments and the office staff.

The *Canadian Electrical News* states that Mr. E. F. Seixas, who for the past 19 years has been general manager of the Niagara, St. Catharines & Toronto Railway, has been appointed general manager of the Monterey Railway, Light, Heat & Power Co., at Monterey, Mexico. The same exchange reports that Mr. H. H. Couzens, general manager, Toronto hydro-electric system, has been elected a Board of Trade representative on the Canadian National Exhibition Board.

Mr. Alfred S. E. Ackermann has resigned his appointment with the Air Group, where he advised the Controller of National Aircraft Factories on engineering matters, and has resumed consulting practice at his old address, 25, Victoria Street, Westminster. Previously he was with the Controlled Establishments' Division inspecting plant and machinery, and recommending the C.E. Division what part of the cost of this the controlled owner should be allowed to write off from his excess profits.

Lieut. V. H. H. McMahon, R.A.S.C., M.T., of Cheetham, Manchester, was married to Miss Alice Winifred Hodson, of Fairfield, Manchester, on February 19th.

Roll of Honour.—Major W. H. Hunstone, Staff Embarkation Officer, who was formerly on the staff of the electrical engineering department of the Great Central Railway Co. at Nottingham, has died at Newcastle from pneumonia, following influenza.

Gunner J. Chadwick, R.F.A., who has died whilst a prisoner of war in Germany, was employed by Messrs. Ferranti, Ltd., Hollinwood.

Signaller J. C. Berry, South Lancashire Regiment, who has died of pneumonia whilst on leave from France, was an employé of the St. Helens Cable & Rubber Co., Ltd., Warrington.

Sub-Conductor A. Holmes, who was previously employed on the Warrington Corporation electricity staff, and who possesses the Mons ribbon, has been awarded the Meritorious Service Medal for work in Italy.

Private J. Crawford, Royal Berkshire Regt., previously reported wounded and missing, is now reported to have died of wounds whilst a prisoner of war. He was formerly employed by the Lancashire Dynamo & Motor Co., Ltd., Trafford Park.

Obituary.—Mr. H. R. Mott.—We regret to hear that Mr. H. R. Mott, the electrical engineer and electric inspector to the City of London Corporation, died on February 13th from cancer. Mr. Mott entered the service of the Corporation in 1903, and was appointed to the above position in 1911. He was a Member of the Institution of Electrical Engineers, and an Associate of the City and Guilds Institute. Before he went to the Guildhall he was in the test-room of the Metropolitan Electric Supply Co., Ltd. Although Mr. Mott had been in failing health for some time, it was not realised by his colleagues that he was suffering from such a serious disease. He was 43 years of age.

Herr P. Falkenstein.—The death is announced from Berlin, at the age of 47 years, of Herr Paul Falkenstein, a leading German electrical engineer, for many years connected with the Deutsche Electricitatswerke, of Aix-la-Chapelle.

Mr. George Cooke.—The death occurred in London, on February 18th, at the age of 76 years, of Mr. George Cooke, late Superintendent of the Telegraph Department at the G.P.O., Dublin.

Lieut. H. H. Hirst.—We deeply regret to record that Lieut. Harold Hugh Hirst, 21st Manchester Regiment attached R.E. Signal Service, died at his home, 5, Weymouth Court, Portland Place, London, of pneumonia, following influenza, on February 24th. Born at Hampstead in 1893, he was the only son of Mr. Hugo Hirst, chairman and managing director of the General Electric Co., Ltd. He was educated at Charterhouse (1907 to 1912), after which he spent two years abroad, preparatory to entering the service of this company. At the outbreak of war he was in France. Returning to England he fell seriously ill. Immediately on his recovery in October, 1914, he joined the Inns of Court O.T.C., and was stationed at Berkhampstead till March, 1915, when he received a commission in the 21st Manchester Regiment. After acting as Divisional Signal Officer to the 30th Division in England, in February, 1916, he proceeded to East Africa with the No. 1 East African Special Visual Signal Company. Owing to malaria and dysentery he was invalided home towards the end of 1916. After a long and protracted illness he recovered, and in June, 1917, was transferred to the Wireless Service, in which he acted as Instructor. He proceeded to France in the summer of 1918, and took an active part in the general advance preceding the armistice. The strain of the campaign, combined with the effects of gas, broke down his health again, and he was invalided home at the end of October. He had not fully recovered when he fell a victim to influenza, followed by pneumonia. In May, 1917, he married Carol Iris, the daughter of Mr. and Mrs. Lindon, of Sussex Square. He leaves one child, a daughter. We are sure that a large number of our readers will desire to join with us in tendering to Mr. and Mrs. Hirst our sincere condolences in their severe loss.

Sir Guy Calthrop.—The death of the Coal Controller, whilst engaged with such marked ability in the national interests, and at the early age of 48 years, will be deplored by a very large number of men and organisations with whom and which he has been brought into close touch by his official duties. Sir Guy fell a victim to influenza, which in its latest wave seems to be involving more men of the forties than occurred with the waves of last year. He had been suffering for a fortnight when pneumonia supervened, with results which rpoved fatal on the 23rd inst. Sir Guy Calthrop was a railway expert of world experience. He became general manager of the L. & N.-W. Railway in 1914. He was selected by the Board of Trade for the responsible duties of Coal Controller in 1917, and the honour of knighthood conferred upon him was probably as well deserved as any gained by public officials during the war.

Mr. W. D. Perrott.—We regret to record the death on Friday, February 21st, at the age of 43, of Mr. William Denston Perrott, who had been assistant engineer at Great Yarmouth electricity works since 1898. He was previously with Messrs. Crompton & Co., Ltd., of Chelmsford. His genial nature made for him a host of friends, as was evidenced at the funeral, which was attended by the staff and employés from the works, and many others representing associations with which he was connected.

Will.—Mr. W. H. Brown, a director of the London United Tramways, and the Metropolitan District Railway, left £297,954 gross, with net personalty £266,244.

NEW COMPANIES REGISTERED.

G. V. Syndicate, Ltd. (153,083).—Private company. Registered February 11th. Capital £50,000 in £1 shares. Manufacturers and repairers of, and dealers in, engines, generators, motors, batteries, controllers, tires, and vehicles and their parts, &c. The subscribers (each with one share) are:—H. Smith, Hay's Wharf, Tooley Street, S.E., one of the proprietors of Hay's Wharf; H. B. Renwick, Moorgate Court, E.C., managing director, County of London Electricity Supply Co., Ltd. First directors: V. W. York, C. H. Smith, and H. B. Renwick. Solicitor: W. G. F. Nelson, 6, Laurence Pountney Hill, E.C.

B. S. Marshall, Ltd. (153,166).—Private company. Registered February 16th. Capital, £5,000 in £1 shares. Garage proprietors, manufacturers and repairers of motor vehicles and accessories, electric motors and electric appliances, cycles, engines, chassis, bodies, aircraft, &c. The subscribers (each with one share) are:—G. H. Hemingway, 29, Styvechale Avenue, Coventry, engineer; B. S. Marshall, 10. Castlenau Mansions, Barnes, S.W. 13, motor engineer. Managing director: B. S. Marshall. Registered office: 17, Hanover Square, W. 1.

Marpole & Frisby, Ltd. (153,256).—Private company. Registered February 19th. Capital, £1,000 in £1 shares. Electricians; electrical and mechanical engineers and manufacturers, manufacturers of electrical and other advertising signs, &c. Permanent directors:—F. Marpole, Rives Cottage, Shepperton, electrical engineer (managing director); and A. N. Frisby, 9, The Avenue, Watford, electrical engineer. Secretary: A. N. Frisby. Registered office: 118-120, Wardour Street, W.

Picketts, Ltd. (153,273).—Private company. Registered February 20th. Capital, £25,000 in £1 shares. Wood, metal, and glass workers, and manufacturers of and dealers in articles of this description, electric bells and machinery, and to acquire a factory in Mortimer Road, Hove, Sussex. Directors:—F. V. Pickett, Sorrento, 6, Wilbury Villas, Hove, engineer; R. Cuguet, 5, Coleherne Road, S.W. 10, gentleman.

Warrington Electric Co., Ltd. (153,285).—Private company. Registered February 20th. Capital, £5,000 in £1 shares. Electrical, mechanical, and automobile engineers, &c. The subscribers (each with one share) are:—C. J. B. Barlow, 90, Manchester Road, Warrington, electrical engineer; E. Downs, 82, Saukey Street, Warrington, accountant. Table "A" mainly applies. Solicitor: W. D. Jeans, Jun., 17, Bolt Street, Warrington.

Patents Mart & Trade Agency, Ltd. (153,237).—Private company. Registered February 18th. Capital, £500 in £1 shares. To deal in patents and copyrights either as principals or agents, to obtain and supply information, to promote British trade, and to publish trade periodicals. First directors:—R. J. Sutcliffe, 20, St. Albans Road, Highgate Road, N., barrister-at-law; P. R. Thornton, Wayside, Woldingham, solicitor. Registered office: 115, High Holborn, W.C.

Enamelled Wires, Ltd. (153,192).—Private company. Registered February 17th. Capital, £3,000 in £1 shares. Electrical and mechanical engineers, manufacturers of insulating and other enamels, varnishes, compounds, wire and cable manufacturers, &c. Agreement with A. Costar. The subscribers (each with one share) are:—W. J. Chester, 24, Regent Road, Wallasey, Ches., manager; A. Costar, Grasmere, Eccleston Park, Prescot, Lancs., electrical engineer. First directors:—A. Costar, W. W. Lloyd, and W. J. Chester. Registered office: 51, Fancleugh Lane, Liverpool.

Dalton Auto Engineering Co., Ltd. (153,169).—Private company. Registered February 13th. Capital, £2,000 in £1 shares (600 6 per cent. cum. pref.). Manufacturers of and dealers in electrical, steam, gas, oil, and other engines for motor vehicles, aircraft, boats, ships, railways, or tramways, &c. The subscribers (each with one share) are:—J. H. Jones, 49, Richmond Grove, Manchester, engineer; J. V. E. Isherwood, 8, Lulworth Road, Birkdale, Southport, cotton spinner. First directors:—G. E. Leaming, J. Isherwood, J. H. Jones, L. P. B. Elliott, and J. V. E. Isherwood. Solicitor: H. T. Hose, Market Street, Heywood, Lancs.

Ferguson, Pailin, Ltd. (153,137).—Registered February 13th. Capital, £100,000 in £1 shares. To take over the business of switchboard manufacturers and general electrical engineers carried on by Ferguson, Pailin & Co., Ltd., at Manchester. First directors: Sir Kenneth I. Crossley, Bart., Mobberley Hall, Mobberley, Cheshire; J. Pailin, Glengarry, Queen's Road, Hazel Grove, near Stockport; S. Ferguson, 7, Broadway North, Fairfield, Manchester; G. Pailin, 1,472, Ashton Old Road, Higher Openshaw, Manchester. Registered office: Edward Street, Higher Openshaw, Manchester.

Viceroy Dynamos & Motors, Ltd. (153,161).—Private company. Registered February 14th. Capital, £2,500 in 2,100 6 per cent. preference shares of £1 each and 8,000 ordinary shares of 1s. each. To carry on the business indicated by the title and that of mechanical and electrical engineers and contractors, boiler makers, launch and ship builders, metal workers, &c. The subscribers (each with one share) are: D. J. Edmonds, 14-15, Coleman Street, E.C., solicitor; W. H. E. Godolphin, 15, Granley Gardens, Wallington, Surrey, solicitor's clerk. Subscribers appoint the directors. Registered office: 25, Victoria Street, S.W.

Newington Electrical Co., Ltd. (153,157).—Private company. Registered February 14th. Capital, £10,000 in £1 shares. To take over the business of the Newington Electrical Co. carried on by J. D. Caig, at 16, Newington, and 24, Bolton Street, Liverpool, and to carry on the business of electrical and mechanical engineers, motor car and aeroplane builders and repairers, &c. The subscribers (each with one share) are: A. Lloyd, Springwood, Aughton, Lancs., contractor; J. D. Caig, 16, Newington, Liverpool, electrical engineer; W. Beckett, 5, Bold Street, Liverpool, accountant. Permanent directors: A. Lloyd and J. D. Caig.

Metal Tubes & Fittings, Ltd. (153,087).—Private company. Registered February 11th. Capital, £1,000 in £1 shares. Manufacturers of steel and iron conduits, gas, steam, water, and brass tubes, tube fittings and accessories, and the like, electricians, &c. First directors: J. T. Forrester, 46, Fenchurch Street, E.C. (3), engineer; H. Wood, 46, Fenchurch Street, E.C. (3), accountant. Registered office: 1, Plantain Place, Crosby Row, Borough, S.E.

Matt, Jennison, Ltd. (152,072).—Private company. Registered February 10th. Capital, £10,000 in £1 shares. To acquire the business of an electrician and electrical engineer carried on by Matt, Jennison, at Dial Square, Grimsby; also to carry on the business of automobile and motor cycle manufacturers, &c. The subscribers are: M. Jennison, 217, Hainton Avenue, Grimsby, electrical engineer, &c., 1,100; M. W. Jennison, Clumber Lodge, Welholme Road, Grimsby, retired fish merchant, 1. First directors: M. Jennison (managing director), M. W. Jennison (chairman), and C. H. Jennison. Registered office: Dial Square, Grimsby.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Premier Lamp & Engineering Co., Ltd.—Debenture for £7,500 dated January 24th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: R. A. Wilson and O. D. Hamer, both of Park Row, Leeds.

International Electric Co., Ltd.—Charge on the company's undertaking and property, present and future, including uncalled capital (if any), subject to prior charge to secure £25,500 (including £13,500 owing on a mortgage dated February 8th, 1917). Holders: Barclay's Bank.

Barbados Electric Supply Corporation, Ltd. (104,367).—Capital, £60,000 in 40,000 pref. and participating and 20,000 ordinary shares of £1 each. Return dated January 3rd, 1919. 35,172 pref. and 20,000 ordinary taken up; £34,672 paid on 34,672 pref.; £20,500 considered as paid on 20,000 ordinary and 500 preferred. Mortgages ond charges: £12,000.

Bastian Electric Co., Ltd.—Land registry charge on 47, Stamford Hill, London, dated January 21st, 1919, to secure £3,500. Holder: Mrs. M. Stephens.

Brooker Manufacturing Co., Ltd.—Debenture for £4,000 dated February 7th, 1919, charged on leasehold premises at Ilford and the company's general assets. Holders: J. S. Phillips and W. H. Gillett.

Blackpool & Garstang Electric Light Railway Co., Ltd. (62,150).—Capital, £10,000 in £5 shares. Return dated January 3rd, 1919. 361 shares taken up; £4 per share called up; £1,707 paid (including £323 received on application for further shares not allotted). Calls unpaid amount to £60. Mortgages and charges: Nil.

Anti-Rust & Metal-Deposition Co., Ltd.—Particulars of £5,000 debentures created and all issued January 14th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital. Commission, allowance, or discount, 20 per cent.

Hodgson Hartley (1909), Ltd.—Particulars of £2,000 debentures, created January 21st, 1919, and all now issued. Charged on land and buildings at Hunsworth, Yorks., and the company's general assets. Trustees: V. W. Wanklyn and R. Kenworthy.

Bullers, Ltd. (62,020).—Capital, £400,000 in 20,000 ord. and 20,000 pref. shares of £10 each. Return dated January 1st, 1919. 15,000 ord. and 15,000 pref. shares taken up; £150,070 paid on 7 ord. and 15,000 pref.; £149,930 considered as paid on 14,993 ord. Mortgages and charges: Nil.

CITY NOTES.

Yorkshire Electric Power Company. The net profit for 1918, after payment of mortgage and other interest, was £46,536 (as against £33,258 for 1917 and £29,112 for 1916), plus £4,392 brought forward. A dividend of 6 per cent. per annum on the preference shares requires £11,124, and one of 7 per cent. on the ordinary shares £14,579, while £15,000 is put to general reserve (making it £59,000), leaving £10,224 to be carried forward. The company continues to make substantial progress. The dividend of 7 per cent. compares with 5 per cent. for 1917, and 3 per cent. for 1916. The report refers to further heavy increases in labour, coal, and other costs. Local authorities show a growing tendency to co-operate with the company in the supply of electricity in the West Riding.

Under the provisions of the Yorkshire Electric Power Act, 1918, an agreement has been made with the Mexborough Urban District Council to form a Joint Electricity Board with the object of providing additional generating plant to supply the southern portion of the company's area. Agreements for supply have also been made with the Urban District Councils of Elland and Spenborough.

Arrangements made for association with the Bradford, Sheffield, and Rotherham Corporations have already been reported. Previous to August, 1914, energy was being supplied to the Corporations of Brighouse, Dewsbury, and Pudsey, the Urban District Councils of Heckmondwike, Mirfield, Sowerby Bridge, and Whitwood, and the Rural District Councils of Halifax, Pontefract, and Tadcaster, and to the undertakers supplying in the Borough of Pontefract.

The districts in which supply to Electrical Distribution of Yorkshire, Ltd., has been agreed are Ardsley, Birstall, Calverley, Castleford, Darton and district, Farsley, Featherstone, Garforth, Gomersall, Goole and district, Greetland, Hipperholme, Horbury, Horsforth, Liversedge, Ossett, Otley, Penistone, Rawdon, Rothwell and district, Selby and district, Stanley, Sowerby Bridge and Wombwell, and Worsborough.

The above arrangements mark substantial progress towards one of the principal objects for which the company was formed—the concentration of very large units of generating plant in power stations, with a resultant economy of coal and a co-ordination of supply in the whole area of the company.

The Government appreciation of the importance of the electricity supply industry has been recently indicated, and when definite proposals are forthcoming they will receive the careful consideration of the directors. The continually increasing demands for supply which must be met will shortly require the issue of further capital. The whole of the issue of £71,640 of 6 per cent. cumulative preference shares authorised in September, 1916, has been taken up.

At the annual meeting on February 18th, Mr. A. G. Lupton said that while the whole of the plant and mains had from the first been steadily repaired and kept in working order out of revenue, the amount at which they stood in the capital account, some £860,000, was far below what they would cost if purchased at present prices. The company was achieving success after a tedious period of probation; the original shareholders had had long to wait for a reasonable return on their capital, but the faith which induced them to form the company was now being justified, and if the company was allowed to continue the work with which it was originally entrusted without further legislative interference, it would continue to grow and to render steadily increasing services to the West Riding, which it was constituted to serve. Last year he told them of the very large further demands which were being made for increased supplies of current, and of the Ferrybridge station which they were preparing to develop in order to meet these demands. Since that time fresh legislation had been threatened, involving the whole future of electrical supply throughout the country, and the directors felt that until this was defined new departures on a large scale must be deferred unless the Government would give such assurances as would enable the company to go forward. They were taking every means in their power to impress upon the Government the urgent need for speedy decision as to the future of the industry so far as generation was concerned, and negotiations had been entered into which they hoped might lead to a satisfactory solution of the difficulty, and prevent the deadlock which must otherwise result. To construct a station such as they contemplated at Ferrybridge was a matter of years, and the demands for power were so immediately urgent that delay in putting the buildings in hand and placing orders for plant was more grievous than could be easily realised, and the effect of the delay would, in any case, be felt for several years to come, whilst if the organisation suggested in the Board of Trade Report had to be created and waited for, the matter would be still more serious. In the meantime they had to carry on; there were mains to be laid for new customers who were waiting for their current, and there were loans to be repaid which had enabled them to supply customers who were now connected, and upon which they were already earning a good revenue, and to meet these payments they would require this year at least £100,000 of fresh capital, which must be provided by the further issue of ordinary shares. In the past they had had to make extensions in order to tap new and undeveloped portions of their area, and so to create a demand for their current, but the capital for which they now asked was on a different footing, as these mains were for the supply to customers already connected, or who were awaiting supply, and the capital would therefore be immediately remunerative. Over £60,000 of capital in their ordinary shares had been taken up by consumers in order to help the company to bring its mains into their works. Application forms for the further capital would shortly be sent to all shareholders. The mutual supply arrangements which they had been able to carry through with Bradford, Mexborough, Rotherham, and Sheffield were of importance. The large additions to the stations at Thornhill and Barugh were almost completed, and the large-sized units of plant were giving great advantage in economy and efficiency. In regard to the legislation which was foreshadowed for nationalising the supply of electricity, taken as a whole the Board of Trade Report was a thoroughgoing confirmation of the principles on which their company was established. Whether the proposed advance could be best attained by the entire separation of generation from distribution, as suggested in the Board of Trade Report, and whether it would be wise to put under State management an industry of so complex a nature, and which was so rapidly changing and developing, was a matter in which there was room for grave doubts. The speaker went on to allude to the report of the Institution of Electrical Engineers, and stated that the suggestion made therein seemed to be a practical one which, if adopted, would free the industry from the leading-strings in which it had so long been strangled, and would be a far wiser solution than to hand over the industry to a State Department. They had all had personal experience, and had seen and learnt a good deal during these last years of the difficulties inherent in State management, and of the want of elasticity that was entailed by the constant reference of all decisions to an over-weighted central body, which could not know or appreciate the details of each particular case. Time, temper, and opportunity were alike lost, by no fault of officials, who were doing their best to run an impossible system.

Fife Tramway and Power Co. At the tenth annual meeting, held in Edinburgh, the adoption of the annual report, which recommended a dividend of 7 per cent., was moved by Mr. Wm. Low, O.B.E., of Blebo. The year, he said, had been one of very great anxiety to all concerned. Notwithstanding all the difficulties, the results of the tramways might be regarded as highly satisfactory. The Power Co. also continued to make rapid progress. The consumers connected at December, 1918, numbered 2,238, as compared with 1,402 in 1917, and 892 in 1916. The figures for 1917 and 1918 included houses at Rosyth, which in 1918 numbered 1,238. During the year considerable cable extensions were carried out, an extension being laid from Crossgates to Burntisland, and at the present time a further extension had been authorised from Burntisland through Kirkcaldy to connect up to the existing line from the power station to Wemyss, so as to duplicate and supplement the service to that district, and this should be in use within a month or two. After paying the dividend on the ordinary shares of 7 per cent., less tax, there is transferred to reserve £15,000, and carried forward £5,094.

London and South-Western Railway Co. The annual general meeting of this company was held at Waterloo Station on Friday last. Brig.-Gen. H. W. Drummond, C.M.G., chairman, in moving the adoption of the report and accounts, said that during the past year the total expenditure on capital account had amounted to only £86,500, which was £10,000 below the figure for the previous year, when less was spent on capital account than in any year since 1844. There seemed every probability of the Waterloo station enlargement scheme being brought to a conclusion next year. An escalator was being provided from the platform level to the city tube line, and it was hoped to have it in running order next month. With regard to the traffic in the recently electrified area, it had exceeded all expectations. In the year 1913 the number of local passengers carried in the suburban district was 25 millions; in 1915, before electrification, the number had fallen to 23 millions; in 1916, during which year the electric services were being gradually brought into operation, the number had increased to 29 millions; in 1917 the number was 33 millions; and last year the total number carried was 40 millions, an addition of no fewer than 17 millions compared with the year 1915, or an increase of 74 per cent. The miscellaneous receipts, which did not come within the Government guarantee, showed an increase of £58,200 as compared with last year's figures, and they were therefore able to increase the dividend on the ordinary stock from $5\frac{1}{2}$ to $5\frac{7}{8}$ per cent. The fund for depreciation, renewal, &c., had gone up from $1\frac{1}{4}$ millions to just over two millions. There was a further increase of £275,000 in the steamboat depreciation and insurance fund.

London Electric Railway Co. Lord Farrer presided at the annual meeting on February 21st. He referred to the great difficulty experienced in coping with the increased rush of traffic. The remedy consisted of the provision of additional rolling stock and the necessary staff for its operation, also additional platform staff to accelerate the loading and unloading of trains. The rolling stock ordered in 1914 was now being pushed to completion as rapidly as possible, but the manufacturers could not promise delivery before the end of the year. The new rolling stock would have more and larger doors, which would accelerate the service. They could not modify the present cars without producing structural weakness. They were now anxious to get on with the more important items in their large programme of improvement, and to do so they must secure additional capital powers. Owing to the present high price of material and labour, only vitally important work could be undertaken with any hope of securing an adequate return on the capital expenditure. They had no intention of embarking on any elaborate new schemes at present, but their stations and equipment must be sufficiently extended. They had to look forward to higher operating expenses. The outlook was too uncertain to permit of any optimistic conclusions being drawn from it at present.

German Companies.

The Bergmann Elektrizitats Unternehmungen A.G., of Berlin, whose paid capital of £300,000 is held by the Bergmann Electricity Works, Co., succeeded in 1917-18 in extinguishing the debit balance of £14,000 from the previous year, leaving £950 to be carried forward.

The Elektrische Licht und Kraft Anlagen A.G., of Berlin, which has paid 5 per cent. in each of the four previous years, proposes to make no distribution for 1917-18, although the profits would have permitted of the payment of a dividend. Having regard to present conditions, however, the directors have devoted the net profits to depreciation, chiefly in regard to the large investments held in Russian undertakings.

The Ernst Hein Geist, Elektrizitats A.G., which was forced into liquidation by the keen competition of the large firms, closed the year 1917-18 with an undiminished loss of £24,000. At the recent meeting it was decided to sell the works, machinery and equipment to the Colonia Electricity Co. for £18,700, which already has a lease of the property.

The directors of the *Telephon Fabrik A.G. vorm J. Berliner, of Hanover,* recommend a dividend at the rate of 10 per cent. for 1917-18 on the old capital of £250,000, as compared with 25 per cent. in the preceding year, and 5 per cent. on the new capital of £125,000. It is explained that special care had to be taken in preparing the balance sheet owing to the general conditions which arose after the end of the financial year, particularly the labour question and transition from war to peace work.

The Elektro-Osmose A.G. (Graf. Schwerin Co.), of Berlin, reports receipts from licences and analyses account amounting to £82,000 in 1917-18, as against £30,000 in the previous year. After meeting general expenses and depreciation there remains a small surplus which reduces the debit balance from 1916-17 to £39,000. The report states that the company's process for the treatment of ores and graphite had been completed, and the electro-osmotic leather tanning process had been so far developed that it could now be introduced into large tanneries.

French Companies.

P. Viel et Cie is the style of a new firm recently formed (Paris and Rennes) to undertake installations of transport by motive power, transformer stations, travelling bridges, and elevators, and to carry out repairs to all systems of motors.

Among companies raising additional funds are the Société d'Applications Industrielles (from 10 to 20 million francs); the Compagnie Générale de Travaux, d'Eclairage et de Force (Clemançon) (1,200,000 francs); the Société des Forces Motrices de la Vienne (from 2 to 6 million francs); the Constructions Electriques et Méchaniques de Suresnes (from 4,500,000 to 6,000,000 francs, and the issue of 6,000,000 francs of bonds); the Société des Forces Motrices de l'Agoret (issue of 5,000,000 francs of bonds); and the Société des Accumulateurs Electriques A. Dinin (1,500,000 to 3,000,000 francs).

Northampton Electric Light and Power Co., Ltd.—During 1918 the business was conducted with a greater measure of success than had been anticipated. The Riverside generating station will be in full operation shortly. New connections are equal to 28,099 lamps of 32 watts, making the total 288,346. Motors increased from 5,475 to 6,289 H.P., of which 3,911 H.P. are let out on hire. Maximum winter load 2,922 KW. Total units sold, 6,233,019. The Household Fuel and Lighting Order caused a reduction of 5½ per cent. in current sold for lighting; power consumption increased 2½ per cent. £8,500 has been added to depreciation and £1,500 to reserve. After paying 5 per cent. on the preference shares and 6¼ per cent. for the year on the ordinary, £2,543 is to be carried forward.

Blackpool & Fleetwood Tramroad Co.—At the annual meeting held at Manchester, Mr. J. Greenwood, the chairman, said that that was the last general meeting of the company. If Parliament ratified the agreement of sale to the Blackpool Corporation they might be able to make the transfer during the current year. In round figures the receipts exceeded those of the previous year by £15,000, and the outgoings exceeded those of the previous year by £10,000, due to increased taxes and wages. The usual dividend of 4½ per cent. (making 6½ per cent. for the year) was declared, carrying forward £18,743, subject to excess profits duties.

City of London Electric Lighting Co., Ltd.—Dividend on the preference shares 12s. per share (6 per cent. per annum), on the ordinary shares 16s. per share (8 per cent. per annum). These figures include 6s. per preference share and 6s. per ordinary share paid in September, 1918. After payment of the dividends, less income tax, and providing for other appropriations, about £20,000 will remain to be carried forward.

Smithfield Markets Electric Supply Co., Ltd.—Sir H. S. Leon presided at the annual meeting, on February 20th. He said that in the revenue account, the expenses of production and distribution showed a substantial decrease, but not sufficient to set off the reduction in revenue. Under normal conditions these expenses would have been considerably smaller, but the price of fuel was now more than double its pre-war figure, and there was no evidence of any immediate return to it. The increases in wages and war allowances represented over 100 per cent. advance on the rates ruling in 1914. Sales of current had fallen off by £3,500. Considering the complete change in the conditions of trade in the markets, which had practicaly eliminated competition amongst the tenants, the wonder was that they had done as well as they had. It was not yet possible to say when the official control would be removed and the tenants be again in possession of their stalls, but it must be a gradual process, during which the company would also, he hoped, rapidly recover its position. The year had been one of considerable anxiety to the directors. It was not easy to prophesy what the future had in store. The proposal to control the whole of the electrical supply in the country, the uncertainty of the outlook both in regard to wages and hours of labour, the cost of fuel and other commodities, were all important factors which must affect the industry in general, and their company in particular, and would certainly render a return to the old conditions impossible. It was equally certain that they could not again supply current at the old rates without incurring heavy loss.

Metropolitan District Railway Co.—Lord George Hamilton presiding at the meeting held last week, said that the railway had just celebrated the fiftieth anniversary of its opening. The report was more satisfactory than for many years past. The ordinary stock was still receiving no return, but for the first time since the electrification all the charges down to the ordinary stock were being met, and the financial position was thoroughly sound. The enormous increase in operating costs had made absolutely necessary very considerable fare advances, and further increases would be necessary in consequence of the adoption of the shorter working day. They must look forward to even higher operating expenses for 1919. The speaker referred to the extraordinary difficulties under which the railway had suffered. They were prohibited from adding to the rolling stock, and the old stock had deteriorated and the perpetual overcrowding make a great strain upon it which necessitated exceptional expenditure to maintain it in working order. They had accumulated reserves for bringing up to the old standard of efficiency the permanent way, for replacing old and obsolete rolling stock, and for station improvements, but labour conditions were very uncertain, and the future was difficult to forecast.

Chatham & District Light Railways Co.—The revenue for 1918 was £67,342; expenses, £38,546. Rent of Rochester Corporation lines, £3,744; interest charges, £1,987; depreciation reserve, £6,000; maintenance reserve, £1,000; balance brought forward, £3,644. Preference dividend, 5 per cent.; dividend on ordinary, 4½ per cent. for the year; 10 per cent. of net profits to directors "after payment of 5 per cent. dividend on the ordinary share capital for the year," £489. Carried forward, £3,802. Revenue increased by £822 and expenses by £1,463, as compared with 1917. The addition to maintenance reserve account is for repairs to track and rolling stock to be undertaken after the war. £10,000 debentures have been purchased and redeemed, and none are now outstanding. Passengers carried increased from 13,904,963 to 14,015,124; traffic receipts from £66,160 to £66,819; average fare increased from 1.14d. to 1.15d.; car mileage fell from 936,849 to 790,799.

Telegraph Construction & Maintenance Co., Ltd.—The report for 1918 shows a net profit of £111,600, after charging interest on debentures; £108,336 was brought forward, making £219,936. An interim dividend of 5 per cent. was paid in July. A further dividend of 10 per cent. is recommended, together with a bonus of 12s. per share, free of income-tax, absorbing £67,230. To reserve £20,000 (making £175,000). £110,296 is carried forward. According to the *Financial Times* the £140,000 4 per cent. debentures having been repaid on January 1st last, the directors consider it is advisable to briug the share capital of the company more into accord with the capital employed in the business. They therefore propose to double the share capital, and to issue to shareholders one new fully paid-up ordinary share of the nominal value of £12 for each £12 ordinary share held.

Underground Electric Railways Co. of London.—For the year ended December 31st last the net income from investments, &c., after deducting general expenses, income tax, loss on foreign exchange and proportion of commission and discount on 5 per cent. notes, and adding balance from last account, amounted to £709,750. The income from investments, &c., amounted to £760,265, an increase of £153,534. This increase is mainly derived from the increased dividends of the various transportation companies of London in which the company is interested, and the reports of which appeared in our last issue.

Isle of Thanet Electric Tramways & Lighting Co., Ltd.—Year ended September, 1918: Loss, £4,818. A credit balance of £3,825 was brought forward. Dobit balance to date, £992.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved:—

Advert Publicity Co., Ltd.
British Gas Traction Co., Ltd.
British Steel & Wire Co., Ltd.
Gas Economising & Improved Light Syndicate, Ltd.
Grindell-Matthews Wireless Telephone Syndicate, Ltd.
Kelvin, Ltd
Meldrum Bros., Ltd.
Prested Miners' Gas-Indicating Electric Lamp Co., Ltd.
Rapid Road Transit Co., Ltd.
S. Brill & Co., Ltd.

Companies to be Struck Off the Register.—The following are to be struck off the Register within three months unless cause is shown to the contrary:—

Bergasse Rotary Engine (Parent Co.), Ltd.
Electrical Watch Cases Works, Ltd.
Industrial & Engineering Trust, Ltd.
Launa British Electrical Co., Ltd.
Nottingham Boiler Scale Dissolving Co., Ltd.
Power & Traction, Ltd.
Railway & Tramway Trust, Ltd.
St. Luke's & Holborn Electro-Plating Co., Ltd.
Wall Power Unit Co., Ltd.

British L. M. Ericsson Manufacturing Co., Ltd.—The report for 1918 states that the accounts are very satisfactory, that the position of the company is strong, and is gaining strength each year. The prospects for the future are excellent. Net profit, after charging £11,838 for depreciation, £12,868 for income-tax, and £2,500 for debenture interest, is £62,332, plus £30,070 brought forward. The preference dividend absorbs £5,999; 8 per cent. and 2 per cent. bonus (free of tax) on the ordinary shares requires £10,001; £10,000 is placed to reserve; £5,000 is put to reserve for extra depreciation; and £61,402 is carried forward, subject to excess profits duty. Annual meeting: March 12th.

Tyneside Tramways & Tramroads Co.—The report for the last half of 1918 states that after paying 5 per cent. preference dividend and 5 per cent. on the ordinary for the year, a bonus is to be paid on the ordinary at the rate of 2s. per share, less tax. The traffic receipts show an increase of £3,374, as compared with the corresponding half-year of 1917, and for the whole year there was an increase of £9,528.

Rushden & District Electric Supply Co., Ltd.—The directors report a large and increasing demand for industrial power. The consumers, chiefly industrial, number 179; motors, 605½ h.p., of which 348½ h.p. is let out on hire. Units sold, 599,035; maximum load, 319 kw.; revenue from sale of current increased from £4,181 to £5,264. £550 has been put to depreciation and £100 written off preliminary expenses. Dividend, 5 per cent., carrying forward £99.

Liverpool Overhead Railway Co.—The report for 1918 gives the following results: Gross revenue receipts, £143,361; working expenses, including reserve, £113,234; passengers carried, 20,880,235, against 16,609,337 in 1917; interest on debenture stock, £6,755; including £6,929 brought forward, £30,301 is available for dividend; preference dividend, 5 per cent.; ordinary dividend for the year, 3¼ per cent.; leaving £6,120 to carry forward.

Tramways Light & Power Co., Ltd.—Profit for 1918 £42,321. After paying debenture and preference interest, and putting £12,000 to reserve, £5,806 is carried forward. The properties owned by the company have continued to make moderate progress. As soon as more settled conditions prevail, active developments in connection with the power undertakings will be taken in hand. Many large consumers are pressing for a supply.

North Wales Power & Traction Co.—The accounts for the year ended June 30th, 1918, after including the debit balance of £83,142 brought forward, and the payment of interest on the loan and on "B" debentures, show a debit balance of £86,379, which includes the interest accrued on the second debentures from July 1st, 1917, but not paid.—*Financier.*

Stock Exchange Notice.—Application has been made to the committee to allow the following to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—259,980 additional 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 340,001 to 599,980.

Mersey Railway Co.—For 1918 the total amount available for interest is £48,079, of which £26,775 goes in interest on new first perpetual debenture stock. In addition 4 per cent is paid on the 1886, 3 per cent. on the 1871, 3 per cent on the 1882-3-5, and 1 per cent on the "B" debenture stock, leaving £25 to be carried forward.

National Boiler & General Insurance Co., Ltd.—A dividend of 16s. per share, making, with 12s. per share paid in August, 28s. per share (14 per cent.) for the year; £5,451 carried forward. For 1917 25s. per share was paid, £6,748 was transferred to investment reserve, and £1,383 carried forward.—*Financial Times.*

Traction & Power Securities, Ltd.—Net revenue £27,883, plus £9,908 brought forward. Dividend 6s. 6d. per share, leaving £10,033 to be carried forward. The company has advanced £90,000 to the Clyde Valley Electrical Power Co. under the loan agreement.

Greenwood & Batley, Ltd.—Interim dividend on the ordinary shares, 5 per cent., less tax.

Chelsea Electricity Supply Co., Ltd.—Final dividend of 3 per cent. on the ordinary shares, making 3 per cent. for the year. £16,118 is put to depreciation and £1,100 carried forward.

Newcastle-upon-Tyne Electric Supply Co.—Dividend on ordinary shares for 1918, 8 per cent.

Vulcan Boiler & General Insurance Co., Ltd.—According to the *Financial Times*, the directors have now brought the dividend cum bonus for 1918 up to 25 per cent., less tax.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—Final dividend, 3½ per cent. on the ordinary shares, making 6 per cent. for the year.

South London Electric Supply Corporation, Ltd.—Subject to final audit, dividend on the ordinary shares at the rate of 5 per cent. per annum for 1918.

Bournemouth & Poole Electricity Supply Co., Ltd.—Final dividend of 5 per cent., less tax, on the ordinary shares, making 5 per cent. for the year.

Mather & Platt, Ltd.—Net profits £181,014, plus £95,000 brought forward. There is put to income tax equalisation £30,188. Dividend and bonus, 17½ per cent., free of tax. Carried forward, £120,828.

F. Braby & Co., Ltd.—Interim dividend on the ordinary shares 2½ per cent., free of tax.

Oxford Electric Co., Ltd.—Final dividend 2½ per cent., making 5 per cent. for the year.

STOCKS AND SHARES.

Tuesday Evening.

Budget uncertainties are beginning to form a factor in Stock Exchange markets. There is some anxiety expressed as to a possible rise in the income-tax; there is a confident assumption that the Excess Profits Duty will be replaced by another shape of taxation, less stifling to enterprise and thrift, less encouraging to extravagance and *laissez-faire*. Investors look with a kindly eye upon the 4 per cent. tax-compounded War Loan. They are urgent to know when cheap stock comes into the market for cable shares upon which the dividends are paid without deduction of tax. Even Consols, paying 4¼ per cent. on the money, find favour with those people who are out for a low-yielding security with good future prospects of advance.

Suitable investments are not easy to find, spite of all things. Those which appear attractive are often found to be in no supply, and the prospective buyer has to look for something else. It may be of use to set out half-a-dozen securities which are actually on offer in the market, and we take a selection as follows:—

Stock or Share.	Div.	Payable.	Price.	Yield p.c.
General Elec. Cum. Pref.	6½	Jan.-July	10¼	£6 6 10
Melbourne Elec. Cum. Pref. ...	7	Mar.-Sep.	5½xd	6 7 6
Newcastle-on-Tyne Elec. Part Pref.	5	Apl.-Oct.	1	5 0 0
North Metropolitan Cum. Pref. ...	6	May-Nov.	19/6	6 7 6
Siemens Deb. Stock	4½	Jan.-July	85	5 5 0
Tees Power Station 1st Mort. Debs.	6	Apl.-Oct.	101	6 0 0

The Newcastle-on-Tyne shares in this list are participating up to 8 per cent. after the ordinary have received 8 per cent.; thereafter both classes rank equally for dividend. The ordinary shares received 8 per cent. last year.

Home Rails, Undergrounds included, are a better market on the idea that, notwithstanding the miners' ballots, a national strike will be averted. Interest on Underground income bonds and stock is due on Saturday in this week, and the tax-free payment on the former has led to a demand that rallied the price to 95½. Districts, after falling to 25, recovered to 26. With an immediate addition of 100 vehicles to the fleet of the London General Omnibus Co., it is held that receipts (and profits) will expand, benefiting the whole of the group. The overhauling announced for the City and South London Railway can hardly be too soon taken in hand. Travellers unlucky enough to be obliged to use the line are in daily amazement at the physical capacity of the rolling stock to bear the traffic which it carries.

Mexico has suddenly achieved a position of keen interest by reason of the influential and capable committees just appointed for the protection of British, French, and American capital sunk in that country. With such men as those who constitute the committees, it is felt that at last something will really be done towards setting in order the affairs of the Mexican financial house. Rises of one to three points have been secured by Government bonds, railway stocks, and utility securities, these following upon the improvements of last week. Mexican Electric Light, Mexico Tramways, Pachuca, Monterey, Mexican Light & Power issues are all higher, and, the prospects considered, it is natural that stockholders should be chary of selling at the present time. Many of the Mexican bond issues defaulted in 1914 and 1915 on their interest payments, and some scheme of arrangement for funding these debts will have to be found. At the same time, it cannot be forgotten that new capital is required to re-establish some of the properties, and whoever puts up fresh money will doubtless demand such terms as will entail sacrifice from proprietors of existing stocks. Most of which proprietors will probably retort that financial sacrifices (in Mexico) can carry few further terrors for their patient passbooks.

The market for electric lighting shares is firm, in spite of a few dividend declarations which cannot be regarded as good. The only company in the list to pay an increased ordinary dividend so far is the St. James' & Pall Mall, which declares 10 per cent., as against 9 per cent. a year ago, while the London Co. is to distribute 6 per cent. on its preference shares, as against 5 per cent. for the previous twelve months. The City of London and South London dividends show no change, but Chelseas 3 per cent. goes against 5 per cent., while the Kensington and the Westminster companies pay 1 per cent. less than the 1917 dividends. The only fall in the list, however, is one of 5s. in Chelsea, while rises of ⅛ have been secured by City Ordinary, Metropolitans, and St. James'. The manufacturing group is also firm, Siemens hardening to 6 5/16.

The principal feature amongst manufacturing shares, however, is a jump of no less than 5½ in Telegraph Constructions. The company repeats its usual 20 per cent. dividend, but in addition proposes to distribute a bonus of one new share of £12 for each share at present held. The fine bonus that this represents came as a surprise, and it is extremely difficult to get hold of shares. Callenders Preference are ⅛ up at 5½, and improvements are shown by the Eastern Telegraph group. Marconis eased off to 4⅜ for lack of interest.

The rubber share market is better. The profits that have been made in oil speculations are being turned into the rubber market, where prospects are more alluring than present dividends. The armament group is good, with Vickers conspicuously so, on rumours that a forthcoming share issue may involve a bonus. There is nothing much doing in base-metal issues.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Feb. 25, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	9	10	7⅜	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref...	4½	4½	3⅜	—	6 13 4
Chelsea	8	5	3¾	— ¼	4 1 1
City of London	8	8	12¼	+ ⅛	6 6 6
do. do. 6 per cen Pref. ..	6	6	10⅛	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref...	4	5	4	—	6 5 0
Metropolitan	8	4	8⅛	+ ⅛	6 8 0
do. 4½ per cent. Pref. ..	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	8	9	7⅜	+ ⅛	6 15 7
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	21/-	—	6 13 4
Westminster Ordinary	7	9	6¾	—	6 13 4

TELEGRAPHS AND TELEPHONES.

	Dividend 1916.	Dividend 1917.	Price Feb. 25, 1919.	Rise or fall.	Yield p.c.
Anglo-Am. Tel. Pref.	6	8	98½	—	8 1 10
do. Def.	1½	1½	21⅞	—	7 13 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	10¾	—	*6 10 4
Eastern Extension	8	8	15¾	+ ¼	*6 1 7
Eastern Tel. Ord.	8	8	159½	+1	*5 0 4
Globe Tel. and T. Ord.	7	7	14¼	+ ⅛	*4 19 1
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	24	22	82	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	4⅜	— ⅛	4 9 0
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7¾	—	*5 1 7
West India and Panama	6d.	1/3	1 1/16	—	*8 14 6
Western Telegraph	8	8	16⅜	—	*4 16 3

HOME RAILS.

	Dividend 1916.	Dividend 1917.	Price Feb. 25, 1919.	Rise or fall.	Yield p.c.
Central London Ord. Assented ..	4	4	65½	—	6 2 2
Metropolitan		1	29½	+1	4 5 6
do. District	Nil	Nil	26	—	Nil
Underground Electric Ordinary..	Nil	Nil	3½	—	Nil
do. do. "A" ..	Nil	Nil	10/-	—	Nil
do. do. Income ..	6	4	95½	+ ½	*5 4 9

FOREIGN TRAMS, &c.

	Dividend 1916.	Dividend 1917.	Price Feb. 25, 1919.	Rise or fall.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	6	4¾	—	6 6 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	3 11/16	—	—
do. do. 2nd Pref. ..	5½	—	3½	—	—
do. do. 6 Deb... ..	6	6	71½	—	6 19 10
Brazil Tractions	—	—	54	—	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	65½	—	7 12 8
do. do. Preferred	Nil	Nil	46	—	Nil
do. do. Deferred	Nil	Nil	42	—	Nil
do. do. Deb. ..	4½	4½	62	—	6 17 8
Mexico Trams 5 per cent. Bonds..	Nil	Nil	64	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	53	—	Nil
Mexican Light Common	Nil	Nil	39	+2	Nil
do. Pref.	Nil	Nil	51	+1	Nil
do. 1st Bonds.. ..	Nil	Nil	69	+2½	—

MANUFACTURING COMPANIES.

	Dividend 1916.	Dividend 1917.	Price Feb. 25, 1919.	Rise or fall.	Yield p.c.
Babcock & Wilcox	15	15	3⅞	—	3 17 5
British Aluminium Ord.	10	10	38/3	—	5 4 5
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref. ..	7½	7½	2½	—	6 0 0
Callenders	20	25	10¾	—	5 16 3
do. 6½ Pref.	5	5	5½	+ ⅛	5 2 4
Castner-Kellner	22	20	3 5/16	— ⅛	6 1 3
Edison-Swan, "A"	—	—	18/9	—	—
do. do. 5 per cent. Deb. ..	4	4	74½	—	6 14 3
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10¼	—	5 6 10
do. Ord.	10	10	17½	—	*5 14 3
Henley	25	25	2 7/16	—	5 8 2
do. 4½ Pref..	4½	4½	4	—	5 12 8
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord...	10	—	6 5/16	+ 1/16	*7 18 6
Telegraph Con.	20	20	54½	+5½	*4 8 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, February 26th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/5	..
a	Ammoniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	,,	£78	..
a	Bisulphide of Carbon	,,	..	..
a	Borax	,,	£43	..
a	Copper Sulphate	,,	£50	..
a	Potash, Chlorate	per lb.	1/9	..
a	,, Perchlorate	,,	1/9	..
a	Shellac	per cwt.	£13 10s.	..
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers ..	,,	£83	..
a	,, Lump	,,	£25	..
a	Soda, Chlorate	per lb.	11d.	..
a	,, Crystals	per ton	170/-	..
a	Sodium Bichromate, casks ..	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	1/0⅝	1d. dec.
c	,, Tubes (solid drawn) ..	,,	1/2¾ to 1/3	¾d. dec.
c	,, Wire, basis	,,	1/1	1d. dec.
c	Copper Tubes (solid drawn) ..	,,	1/4½	1½ to 1¾ dec.
g	,, Bars (best selected) ..	per ton	£122	£10 dec.
g	,, Sheet	,,	£124	£10 dec.
g	,, Rod	,,	£122	£10 dec.
d	,, (Electrolytic) Bars ..	,,	£90	£10 dec.
d	,, ,, Sheets ..	,,	£161	..
d	,, ,, Wire Rods	,,	£100	£10 dec.
d	,, ,, H.C. Wire	per lb.	1/0½	1⅛d. dec.
f	Ebonite Rod	,,	8/-	..
f	,, Sheet	,,	2/6	..
n	German Silver Wire	,,	2/6	..
h	Gutta-percha, fine	,,	11/-	..
h	India-rubber, Para fine	,,	2/5½	½d. dec.
i	Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l	,, Wire, galv. No. 8, P.O. qual.	,,	£40	..
g	Lead, English Pig	,,	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small ..	per lb.	9d. to 4/6	..
e	,, ,, ,, medium	,,	5/- to 10/-	..
e	,, ,, ,, large ..	,,	12/6 to 25-/& up.	..
d	Silicium Bronze Wire	per lb.	1/4	3d. dec.
r	Steel, Magnet, in bars	per ton		..
g	Tin, Block (English)	,,	£224	..
n	,, Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a	G. Boor & Co.	g	James & Shakespeare.
c	Thos. Bolton & Sons, Ltd.	h	Edward Till & Co.
d	Frederick Smith & Co.	i	Bolling & Lowe.
e	F. Wiggins & Sons.	l	Richard Johnson & Nephew, Ltd
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	n	P. Ormiston & Sons.
		r	W. F. Dennis & Co.

Electric Vehicle Costs.—The Midland Railway Co. employs battery vehicles, with capacities ranging from 15 cwt. to 5 tons. It is estimated, says the *Railway Gazette*, that each of the large vans replaces about 1¼ pair-horse vans, many of which require more than one team per day. The 15-cwt. vans are substituted for one-horse vans, but displace more than a single horse per day. Exclusive of drivers' and attendants' wages, the cost per mile on a 10,000 gross basis—excepting the 15-cwt. size, which is given a 5,000 gross mileage basis—is stated to be as follows :—15-cwt. van, 4·61d. ; 30-cwt., 3·95d. ; 2-tons with Ironclad-Exide batteries, 5·73d. ; 2-tons with Edison battery, 5·3d. ; 3½-tons with Ironclad-Exide battery, 6·74d., and with Edison battery, 6·76d. Tire upkeep for the same gross mileage averages per vehicle, £6 8s., 15-cwt. van ; £16 5s., 30-cwt. van : £22 10s., 2-tons van ; and £32 for the 3¼-tons vehicles. Repairs in the same order are assessed at : £9 11s., £16, £20, and £25, and maintenance and attention to batteries, £4 6s., £4 6s., £10 (Edison battery 2-tonner), and £11 (Ironclad-Exide 2-tonner), and £11 (Edison battery 3½-tonner), and £12 (Ironclad-Exide battery 3½-tonner). As there is a disparity in the above prices relative to battery upkeep, the Midland Co. reports that either type can be relied upon to give satisfactory results.

Standardisation in Australia.—At a conference convened by the Victorian State Committee of the Advisory Council of Science and Industry to consider the question of engineering standardisation, on December 12th, it was unanimously resolved that in view of the importance of standardisation of engineering materials and methods, it was desirable that such standardisation should be considered for Australia as a whole ; that in view of the fact that great progress had been made in Great Britain and the United States of America in such work of standardisation, it was desirable to accept such standards as had already been arrived at, provided they were satisfactory for Australian conditions ; that in cases where British and American standards were equally applicable to Australia, it was desirable to select the Briitsh standards ; and that it was desirable to establish in Australia a representative authoritative body to take the matter in hand, as a branch of the British Engineering Standards Association. Similar resolutions had been carried at conferences in New South Wales and Queensland.

THE ORGANISATION OF SCIENTIFIC RESEARCH.

At a meeting of the Royal Society of Arts, on February 12th, Sir Frank Heath, K.C.B., secretary of the Department of Scientific and Industrial Research, read a paper on the subject of "The Government and the Organisation of Scientific Research." He emphasised the fact that the original researcher could not be controlled—he must have freedom to follow any line of investigation that appeared to give promise of fruitfulness—and put the question whether the State could take action so as to stimulate pure research without interfering with it; a further question was whether the State could effectively organise applied research. He described the formation of the Advisory Committee of the Privy Council, to which was entrusted the duty of spending public funds on the encouragement and organisation of scientific research, and pointed out that the novel feature was the delegation of the responsibility for thinking out the policy to a permanent body of experts who were not civil servants, and giving them the services of the permanent staff of the department. That principle had been followed in all the proposals made by the Advisory Council, which began by assisting a number of researches conducted by scientific bodies which were languishing as a result of the war, and worked out a systematic procedure in consultation with university professors and industrial leaders, which had been adopted in essence by the Dominions, and by America, France, and Japan.

The plans recommended by the Advisory Council for the extension of research work would increase the demand for trained workers, and would help those who showed capacity for original investigation; the annual expenditures on this account during the past three years had been £3,500, £7,500, and £10,000 respectively, and the outlay would probably exceed £30,000 next year. There were no scholarships; the amount of the grant was determined by the circumstances of each case, and the choice of workers was decided by the personal recommendation of professors and other authorities—a plan which had worked well. Grants were made to students for maintenance, to independent workers devoting their whole time to research, for assistance to teachers engaged in research, and in special cases to establish research lectureships. With regard to the encouragement of research in the industries, the Council concluded that the most hopeful course was co-operative action by the firms in each industry, and brought into existence the scheme for co-operative research associations, to which assistance would be given—at first pound for pound, but it was anticipated that when the value of research had been proved no financial encouragement would be necessary. Each association had full control of the whole of its income, and all the results of the research were the sole property of the association. The department asked to be kept informed, acted as the go-between when an association desired to sell its results to another association, and reserved the power to prohibit the communication of results to foreigners, but interfered no further. The appointment of a responsible technical officer as director of research, and the representation of science, capital, management, and skilled labour on the board of directors, were strongly urged by the Council, as well as the limitation of the associations in each case to firms whose interests were sufficiently homogeneous to induce them to pool their resources for the purposes of research. One association of each kind was contemplated for the whole of the United Kingdom—not a number of local associations. Four associations were already at work, 15 were coming into existence, and 11 were in course of formation. A fund of one million sterling had been provided by Parliament for the assistance of approved research associations.

With regard to the organisation of national research—work to be done by and for the State—the establishment of a great central bureau had been considered, and decisively rejected, but a central clearing-house of information was necessary and was being organised, a confidential register of researchers and their work was being constructed, an inventory of Government apparatus no longer required for war purposes was being prepared, and a technical library was in course of formation. In order to co-ordinate the work of the department with that of other departments of State, each of the latter was invited to appoint one or more assessors to the Advisory Council, who had the right to attend the meetings and receive the minutes. This plan had had the happiest results; overlapping had been prevented, and the close understanding reached with other departments had led the latter to request the Research Department to carry out a number of important investigations. The Advisory Council invited the Government department concerned to nominate one of its technical officers to serve on any committee it might appoint to conduct such researches, but never appointed an administrative officer to a research committee or board.

"Research boards" were research committees appointed for extended investigations of a national character, with a more independent status than an ordinary research committee; the first was the Fuel Research Board, to which were added the Food Investigation Board, the Industrial Fatigue Research Board, and the National Physical Laboratory. Research boards were directly responsible to the Minister himself.

The research boards and committees were executive bodies; the Advisory Council dealt with general policy. The procedure was to delegate authority to bodies of experts, who, as might have been expected, did their own work better than others could do it for them. The attempt to give each class of work to the appropriate type of worker had not only secured the strenuous assistance of the man of science and the man of business, but had greatly strengthened the position of the civil servant whose business was administration, because it limited his responsibility to the matters which belonged to his kingdom.

Discussion.

In the discussion, the Chairman (the Marquis of Crewe) said that so far as he was aware this was the only country in which a Government Department of Research existed. In the United States, which had gone far ahead in scientific research, the National Council of Research was a purely voluntary body, unsupported by public funds.

Sir J. J. Thomson, F.R.S., said it was most important that immediate steps should be taken to promote the interests of pure science. It was impossible to control the researcher in pure science, but the Government could encourage such men. It was in the universities of the country that for the most part all the advances in science had taken place, yet to-day the universities, to which they must look for new ideas, were in a desperate state. They existed to a very large extent on endowments, but the value of money had been cut in half, and the cost of apparatus was two or three times what it was formerly. The result was that the universities could not carry on under present conditions. Universities were going to be more popular after the war than they ever were before, and unless something was done to assist them in their work, he was quite sure it would be a grievous blow to research in this country, and indirectly to the work of the advisory committee.

Sir Robert Hadfield, F.R.S., said he did not agree with the author that the Germans had been more zealous in their pursuit of science than any other nation. The Germans had been very ready in copying other nations. They watched very carefully what had been done in other countries, and by their system of organisation they were able to apply that knowledge. At Sheffield they went to their university for help, whether on the pure science or the applied science side, and he could not imagine any better system of working together than they had at Sheffield. Whilst during the war Government interference was necessary, the sooner it could be got rid of, the better. He hoped the idea of forming research associations would not in any way interfere with the dissemination of knowledge. He strongly dissented from wrapping up information or keeping it back. The more information was disseminated, the better for the nation, and supposing some other nation did benefit, was it not far better that it should, so long as we in this country led the way, which he hoped we always should do?

Sir Herbert Jackson said that research work carried out in some industries was not sufficient to ensure national prestige and prosperity, and therefore they could not leave everything to individual enterprise; some degree of Government supervision was necessary. He did not think the Research Associations would have any effect in the direction of hampering the worker in pure science. His own view was that the Research Associations would find it necessary continually to ask the aid of the pure science researcher in the universities, and to leave him entirely unhampered.

Lord Gainsford, who, as Mr. Joseph Pease, was President of the Board of Education when the research scheme was founded, said that they had now reached a stage when the country should realise that that Government department was a really live one, ready to help all those who were going into research work, with a view to helping the enormous peace projects to which their efforts must be directed in the immediate future. Hitherto they had paid their chemists and scientific men much too little, and it was only by the Press helping the department forward in this great work that it would be possible to succeed in directing the attention of the country to this matter, including the capitalists and the industrial concerns.

Sir Robert Morant said that if the Exchequer was to find more money for this work it would want to have a say as to how the money was spent. It was useless to say that they must get rid of State control, and simultaneously ask for more State money. The urgency of the problem of research could not be exaggerated.

Sir William McCormick, chairman of the Advisory Committee, assured Sir Joseph Thomson that there were signs that the Government was beginning to realise the extreme urgency for giving assistance to the universities. If public funds were to be expended on such work as this, the community had the right to ask how those funds were being expended. It was impossible to get away from that.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Welder's Mask.

An interesting mask and body protector for arc welders is extensively used by Messrs. Cammell, Laird & Co., Ltd., in their works at Birkenhead. Its general character may be seen from the illustration (fig. 1) which we reproduce. The ear pieces may be opened or closed at will, and the protecting cloth—which is fireproof—hanging down over the body can be raised or lowered as required to permit the worker to see or to speak. A welder wearing one of these masks has the free use of his hands, even when working in an awkward position, for the mask is attached to his head, and the fireproof protecting cloth to his overalls. There is the further advantage that where men wearing the device are working side by side at a bench, they are protected from the flash of other electrodes. Where hand screens are used this is a prolific cause of trouble. If necessary, a fireproof cloth cap can be fitted over the top, as well as straps, in order to protect the head from flying sparks from the arc when welding is being done overhead. The patent rights in the mask and body protector belong, it may be added, to Messrs. Cammell, Laird & Co., Ltd., and Mr. E. V. Jones, M.B.E., assistant shipbuilding manager at Birkenhead.

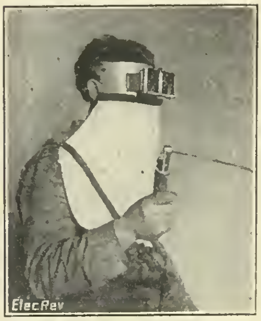


Fig. 1.—Welder's Mask and Body Protector.

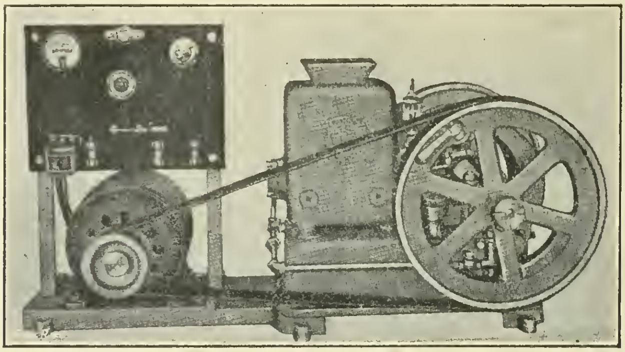


Fig. 3.—Farm-Lighting Set.

The "Rawlplug."

The "Rawlplug" is a tube of stiffened fibres which takes the place of the ordinary wooden plug for fixing tubing or casing to walls, instruments to slate or marble slabs, &c.; when an ordinary wood screw is driven into the tube, the fibres are expanded, and grip the wall so firmly that the screw is immovable. One of the greatest advantages of the plug is the very small size of the hole that is required; as shown in fig. 2, the plug is tubular, and its outer diameter is less than twice that of the screw. What this means in saving of time and labour, and still more in appearance when the plug is not concealed by the casing or fitting which is fixed over it can only be realised by those who have had practical experience in such work. The patentees—the Rawlplug Co., of Lenthall Place, Gloucester Road, London, S.W.—have devised some handy tools for the purpose of making these small holes, two of which we illustrate in fig. 4. The screw head itself completely covers the plugged hole, and for fixing sheathed wiring on finished surfaces which must not be damaged—the purpose for which it was originally invented—the plug is ideal. It will hold well in plaster, and in holes drilled in metal without tapping. For fixing very large screws a special type of Rawlplug, made of wood, has been patented.

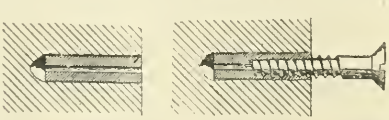


Fig. 2.—The "Rawlplug."

Sections showing the plug in position, and the compression of the fibres as the screw enters the hole.

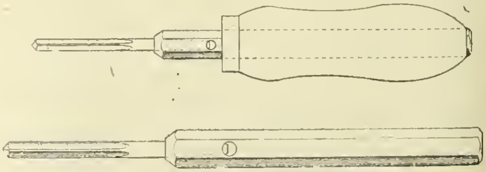


Fig. 4.—"Rawlplug" Tools.

The makers have submitted the plugs to tests, and find that the force required to withdraw a No. 10 screw from a hole about ¾ in. deep in metal is 600 lb.; in hard brick, 450 lb.; in hard plaster, 140 lb.; in moderately soft plaster, 55 lb.; and in a 1½-in. hole in stock brick, 500 lb. These are direct pulls; for indirect pulls the figures would, of course, be much greater. The device is extremely simple, and the holding power obtained is surprisingly great.

An American Farm Electric Lighting Set.

As was mentioned in a recent issue, electrical engineering concerns in the United States would appear to be devoting increasing attention to the requirements of farmers in the direction of compact electric lighting sets. Among the firms which are specialising in this department is the Kewanee Private Utilities Co., of Kewanee, Ill., which is turning out no less than 28 different types and sizes. The accompanying illustration, fig. 3, depicts one of the standard sets which, as will be seen, comprises a horizontal oil or spirit engine, belt-driven generator, battery and switchboard. The engine is of the slow-running type, the normal speed being 500 r.p.m. The fuel is fed to the carburettor by pump from an outside tank, and as the sub-base to the engine is of heavy cast iron, no special concrete foundation is required. Two large counterbalanced flywheels are provided, while the current for ignition is supplied from the storage battery. The generator, which is of the shunt-wound type, is mounted on a sliding base, so that the tension of the driving belt can be regulated, and the pulley of the generator is flanged to prevent the belt from coming off. Purchasers are given an option of either a lead or Edison battery, while as regards the switchboard, this is equipped with a field rheostat to regulate the charging rate of the battery; an ammeter to indicate the charge and discharge of the battery; starting and stopping switch to control the engine, and an automatic circuit breaker to disconnect the generator and battery when the engine stops.

THE FUNCTIONS OF THE ENGINEER: HIS EDUCATION AND TRAINING.

At Cardiff, on January 27th, Bt.-Lieut.-Col. W. A. J. O'Meara's paper (an abstract of which appeared in our last issue) was read and discussed before the Western Centre of the Institution of Electrical Engineers.

Mr. H. I. Rogers (President), in opening the discussion, said the paper was most suggestive in many directions, and came at a most opportune time to all engineers. He was in sympathy with the question raised by the author regarding commercial training. It would appear that they were getting an unnecessary dose of technical work at colleges which would be of very slight value to the individual in after life. He did not think the small amount of time allotted to the different subjects by the author was sufficient.

Mr. W. A. Chamen thought that one of the things which were so disappointing, particularly to electrical engineers, was that nearly all the chief positions were occupied by commercial men and not by engineers. The author had shown why that was so. Colonel O'Meara's remedy was the right one, and he hoped the points raised would sink deeply into their minds in order that the status of the engineer, particularly the electrical engineer, might be improved.

Dr. J. Wertheimer agreed very largely with the paper, and hoped that it would get into the hands of the engineering training organisations, both professional and manufacturing. He was very much struck with the necessity of business training in connection with the education of an engineer. At Bristol, they had rather anticipated some of Col. O'Meara's points, as they had a class in connection with the faculty of engineering, but unfortunately it was not compulsory. He considered the defects of university courses were not entirely due to the professors, but to the engineers themselves. Engineering employers in England wanted trained men at much too early an age. The normal course in most of the English universities extended over three years, whereas in Germany and the United States a period of four years was insisted upon. At Bristol they had a "sandwich" scheme which was working very well. He thought they should not attempt to introduce too much into the course, as too much theory was dangerous. It was an absolute necessity that an engineer should have a knowledge of foreign languages. There was no need to know the rules, but every technical man should be able to render into English the sense of French or German engineering publications.

Principal Coles was of opinion that the education of the engineer must be broadened to include administration and social work. In these days of strikes and industrial unrest it was absolutely essential that the engineer should know all about sociology. The whole question would, however, depend very largely upon the relationships between employers on the one hand, and schools and colleges on the other. Business men in South Wales were considering a scheme which would enable the future engineer to obtain the advantages of one of the finest systems of education in the whole country. He hoped the co-operative system mentioned in the paper would be very largely adopted in this country, as the part-time education of the engineer at evening schools, after long, laborious hours during the day, was to be deprecated.

Prof. David Robertson was in full agreement with the author's plea for the inclusion of commercial and economic instruction in the courses of training laid down for the engineer. For some years he had felt the desirability of it, but had been deterred from making any proposals because he did not feel able to make sufficiently definite statements of what was required, or of where a suitable teacher could be obtained. Col. O'Meara's paper, with its schedule of time and detail of the courses, was a very great help indeed towards overcoming the first difficulty. If one hour per week were set aside for the purpose they would have about 30 hours during the session. If this were done for two sessions, and half the course were covered in each, all the lectures being attended by students in both the third and second year's courses, they would get 60 hours. Neither of these would very seriously interfere with the technical training at present given. Perhaps the greatest difficulty would be that of obtaining a really good teacher. On the one hand, the best men would be too fully occupied with commercial work to afford the time, and, on the other hand, instruction by a second-class man might prove of only doubtful value. He was not acquainted with the "co-operative courses" mentioned in the paper, but thought that such a scheme would be more suitable for training craftsmen and works managers than for giving the much wider study required by the engineer. Any attempt to keep the scholastic instruction within the limits of the problems encountered in the works during the preceding week must restrict it to a very limited range, and must tend to make it of a very discursive kind. Manufacturers did not appreciate the value of a college education, with the result that they got left behind in many directions. How many electrical manufacturing firms had been able to manufacture induction motors without first importing from the Continent, either the designs themselves, the men to make them, or the machines from which to copy them? Even so late as at the outbreak of war, what proportion of their designers of electrical machinery (he did not include draughtsmen and understudies) were of British origin? This condition of affairs must be "never again," but it would be inevitable unless they trained a very much larger number of men very highly on the theoretical as well as on the practical side. They would not get those men unless manufacturers offered sufficient inducements to attract them away from less useful, but more remunerative, careers. The engineer had to work with his brain rather than with his hands. His value to the community arose not from what he himself made, but from the work performed by many others acting under his direction, which work they would not be able to accomplish by themselves without that direction.

Prof. Saxby expressed warm appreciation of the paper, and was in hearty agreement with the main points raised, and also with the sentiments expressed by Principal Coles. He agreed that the study of modern languages was of great importance, especially to the electrical engineer, in view of the important problems which of late had been developed in Germany.

Mr. R. McIlroy suggested that the schedule which detailed the length of time to be allotted for the study of the different subjects should be revised, as undoubtedly it was too short. The study of foreign languages was, in his opinion, the most important point raised in the paper. He considered that in order to bring the applications of Col. O'Meara's paper to those who could not afford to pay the necessary fees, the old method of apprenticeship would have to be resorted to.

Bt.-Lieut.-Col. W. A. J. O'Meara, in reply, said that he did not for one moment suggest that all the subjects could be adequately taught in the short period mentioned in the paper. It was quite clear that it would not be possible for one lecturer to cover all the subjects. Even in provincial towns there were young accountants, young solicitors, and young barristers who would be quite prepared to give valuable lectures which would be of considerable assistance to students. As to fees, he anticipated that quite a small fee only would be expected.

ELECTRIC WELDING.

The adjourned discussion on Mr. T. T. Heaton's paper (an abstract of which appeared in our issue of February 7th) was resumed on Friday last at the Institution of Mechanical Engineers.

Mr. S. G. Martlew explained that conscientiousness and sound judgment, combined with wide knowledge of metals, were absolute essentials of the all-round operator. Dark mica cut off heat rays very effectively, but its opacity obscured the vision, so that the eyes were better guarded by combinations of glass capable of nullifying injurious emissions. In the case of rays of the electric arc, the ultra-violet were absorbed by dark green, the infra-red by deep ruby, and the shield should be completed with smoked lead glass, protected by plain. These four layers of glass should be arranged in the order named, counting from the worker's eyes. The skin of the operator and of those near to extensive welding jobs should be thickly covered with heat- and current-resisting material. The object to be welded should always be earthed, thus lessening the chances of shock. In the welding of vessels subject to pressure and heat changes, his experience inclined him to favour the electric process. He instanced a fractured steel valve body for superheated steam, which was several times oxy-acetylene welded, but subsequent pressure tests disclosed oozing; soundness was finally attained by employing the electric arc. A defective superheater header, $\frac{3}{4}$ in. thick, was successfully treated with Low Moor iron pencils bearing a D.C. of 450 amps. at 175 volts. After passing a hydraulic test to 255 lb. per sq. in., this had for months been under a daily working pressure of 170 lb. per sq. in. Remarkable results with somewhat similar apparatus were reported from Canada, in the shape of repairs to furnace-tube cracks, which were actually accomplished while the boiler was carrying 125 lb. per sq. in. steam pressure. By careful working of the electrode, a thin skin was first laid over the leak, and the water thus being stopped, the weld was built up in the ordinary way. The speaker then showed slides illustrating the Equipment and Engineering Co.'s plant which he had recently tried.

Mr. R. C. Macdonald said that whilst the papers did not claim any advantage for one system over another, his experience had been that in every instance in which he used the oxy-acetylene process for the welding of locomotive, land, and marine boilers, they failed. With electric welding he had had no such failures, although he admitted that his experience with the electric process had not been so great as with the other. He would like a little more information on the welding of copper; he had been trying to weld cracks in copper fire-boxes, and had not been successful.

Sir Henry Fowler did not at present see how building up, apart from welding, could be done with copper, because, owing to the heat conductivity of the copper, the heat got away too quickly. That had been experienced in experiments.

Mr. John Adamson pointed out that the electric welding process could more quickly be learned by an unskilled workman than the oxy-acetylene process. Another difference was that the electric process was more local in its effects, and did not give the same trouble due to oxidation of the parts which were being welded together as was the case with the other system. The arc process was also more suitable for thicker plates than acetylene welding. The question of testing welds was very important, and a method was wanted by which inspectors could judge whether the weld had been properly made or not. The papers did not give a clear guide as to the best voltage; then there was the question of alternating *versus* direct current. Welding was very adaptable to many processes of manufacture which could not otherwise be carried out by previously known processes. There would, however, have to be a period of trial and error. For the moment he could only endorse the author's view that it was desirable to put only experienced operators on to important work.

Mr. F. C. Hibberd's opinion was that the development of welding, which would be on a very large scale during the next few years, would be more in the direction of electric than acetylene welding. Reference was then made to the welding of the damaged parts of the German vessels interned in the U.S.A. In his opinion, the whole secret of success with electric welding depended upon temperature. For every kind of weld there was a critical temperature which was the correct one, and a variation in the current of 15 amperes was quite sufficient to cause a bad weld. If the temperature was too high, there was a segregation of carbon, which led to slag spots and imperfect work, whilst, on the other hand, if the temperature was too low there were holes in the weld, which were equally disastrous. The whole process depended upon being able to maintain automatically, if possible, the correct temperature. Another point was the extreme importance of the electrodes being of suitable metal, so that they were not adversely affected by the heat of the arc. In this connection, an excess of manganese to compensate for the loss in the electric arc was necessary. The composition of the electrodes should also be uniform, and makers should periodically test them to ensure reliable results.

Mr. T. T. Heaton briefly replied to a few points raised at the previous meeting. With regard to electrically welding high-speed steel tips to tools, the shanks of which were of mild steel, he said he could not give definite figures of the limits of temperature. The correct temperature varied for different classes of steel, but with a little experience the operator was able to judge whether the temperature was correct. No flux was required.

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

At Newcastle-upon-Tyne, on February 10th, Prof. Miles Walker's paper (an abstract of which appeared in our issue of December 13th, 1918) was read and discussed before the North-Eastern Centre of the Institution of Electrical Engineers.

Mr. Rosen, in opening the discussion, said that he had found three-phase furnaces installed all over the country, and he believed the users were more than favourably impressed with them, both in design and in operation. It was suggested that for furnace work single-phase was better when the furnace was near to the generator; but the speaker preferred three-phase. With regard to the use of auxiliary machinery, too, single-phase was the more complicated.

Mr. Beard thought they should feel proud that an English engineer had designed an apparatus of this description, because, in this country, they had not so much inducement to produce such apparatus as was the case in the States. It appeared to him that almost the most important part of the paper was a brief statement that with an ordinary machine 20 per cent. of single-phase could be used without any danger. In that district they had more than 100,000 kw. running on the same system, and taking a large number of single-phase loads without additional apparatus. He cited a case where quite a large steel furnace was run on single-phase for a considerable time without any disturbance of the system, and it was proposed at the present time to take on a single-phase furnace of 1,000 kw., and they were quite certain that no trouble would arise. Then for single-phase traction they had to give about 2,000 kw., and he did not think they would have any difficulty in supplying it without any special balancing arrangement. He wondered whether the author's balancer could run, as it were, inverted. In America attempts had been made to get locomotives taking single-phase current to use polyphase motors; and if the machine could be run to produce that effect, there might be a good future before it.

Mr. Carr suggested that the term "balancer," which was very freely used, was a wrong one for that machine; elsewhere he saw that it was called a "rotating, balancing transformer," and that was the right name. He was disappointed to find that it was a machine designed for a special purpose—to keep the power constant for a furnace, and that for traction or similar purposes the machine could not be used.

Mr. Clothier, referring to the supply of a single-phase current from a three-phase machine, said there was a large system of furnaces in the Midlands, and there the current was taken from all the three phases. It was part of the switching problem to run an equal number of furnaces on each phase, and thereby obtain a balance without any apparatus.

Mr. Ellis said that at South Shields they had a single-phase system for lighting purposes, at 2,100 volts, transformed to 110 and 220 volts; they had for power 550 volts d.c. A few years ago he attempted to work the single and the three-phase on the same machine. He had the single-phase machine rewound, and it was now an exact double of the three-phase. He then put them on to one set of bus-bars, and took a single-phase supply from that for the lighting load. As the three-phase worked with earthed neutrals, he introduced a transformer between the bus-bars and the system.

Mr. Jackson thought the value of the balancer was not so great near a large power-station or system, but that it might allow of electric furnaces being developed in a more remote district, or at the end of a feeder.

Prof. Walker, briefly replying to the discussion, said he could not there discuss the relative values of single-phase *versus* three-phase furnaces. He was brought into the matter because of an objection to single-phase, and it was his part to remove that objection. One point he mentioned in favour of the system was the economy in the consumption of carbons as compared with the three-phase system.

THE EMCOL D.C. MOTORS.

In our issue of January 11th, 1918, we fully described the "Emcol" system as applied to a.c. motors. The designers, Messrs. P. A. Mossay and H. C. E. Jacoby, have now developed this patent for application to d.c. motors, and we recently inspected a 50-h.p. d.c. motor built under this patent, which is illustrated herewith, the view being taken from the commutator end. The arrangement is of extreme simplicity; as shown in the accompanying sectional drawings, tunnels or ducts, I and E, are cast in the magnet ring, which surrounds the motor, or in other words, the yoke is cast in two annular rings held together by a number of distance pieces D D, which form the walls of the tunnels. Each ring carries half the flux. Alternate tunnels, I I, break through into the inside of the motor. The end covers are made with half as many holes as there are tunnels in the body, so that those tunnels which have passages P into the body are blocked to external air; the remaining half form holes straight through the yoke, through which air from a fan F is passed.

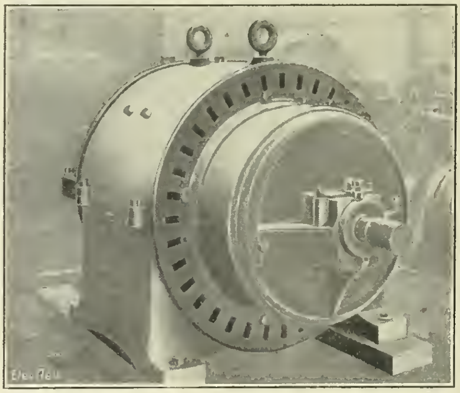


Fig. 1.—Totally-enclosed Emcol d.c. 50-h.p. Motor.

The internal hot air circulates through the tunnels in a complete closed circuit, passing through the motor and back through the tunnels, as indicated by the arrows.

The motor is totally enclosed, that is to say, no air can pass from the outside to the inside of the motor. The cooling air, passing through the alternate tunnels in the yoke and out again, does not enter the motor, but merely cools the carcase. By this arrangement the effective cooling surface of the motor is greatly increased, and it is claimed for the invention that the output of the motor when totally enclosed by the "Emcol" method is the same as that of the standard open-type motor of the same size and design of armature and fields. The only extra material required is the material used by the walls of the tunnels, and the addition of a fan; this material, in the case of a 50-H.P. motor running at 640 R.P.M., weighs about 3 cwt.

As proof of this a standard 50-H.P. Westinghouse motor was chosen, and a new body and end covers were fitted to it. The armature, fields, and poles were not in any way altered, and this motor is the one which, after alteration, we illustrate in fig. 1. The motor was fan-ventilated before alteration to the "Emcol" type, so that it formed one of the most difficult cases to deal with.

The power taken by the fan is very small; light-load measurements made with the fan on, and also with the fan taken off, gave .48 KW. for the power absorbed by the fan, that is, approximately 1 per cent. of the input. By the use of a more efficient fan this could be reduced to the negligible figure of ½ per cent.

We give below (fig. 3) the results of a 6-hour test, which show that the motor when converted to "Emcol" type will give 50 H.P. within the limits allowed by the British Standardisation Rules.

The armature of this motor was not the best suited for the "Emcol" type, because there was very little ventilation either to the inside of the core or to the armature coils; the armature was covered to prevent the dirt which is carried into the motor when fan-ventilated from collecting in the interstices of the winding. This cannot happen in a totally enclosed motor, and the designers claim that by ventilating the armature referred to above, the output when arranged as an "Emcol" motor could be increased to 60 or 70 H.P. within the temperature limits of 50 deg. C.

The success of these tests shows that it is possible to produce totally enclosed motors up to 60 H.P. at a manufacturing cost not more than 5 per cent. above the cost of the open type. Enclosed motors up to 200 H.P. can be produced commercially, which is an enormous advance. Before the introduction of the "Emcol" patent it was generally considered that 50 H.P. was the limit of the totally enclosed motor for commercial production, as above this output the size and cost became prohibitive.

Although motors have been mentioned throughout, it is obvious that the invention is equally applicable to generators. The system admits of indefinite expansion, and the inventors claim that by an elaboration of the method provided for in the patents, dynamos of 500 H.P., or even more, can be built totally enclosed on a commercial basis. From our observations, we consider that a real advance has been made in dynamo design, perhaps the most notable since the introduction of interpoles.

Inquiries respecting the patents should be addressed to the Enclosed Motor Co., Ltd., 40-44, Holborn Viaduct, E.C.1.

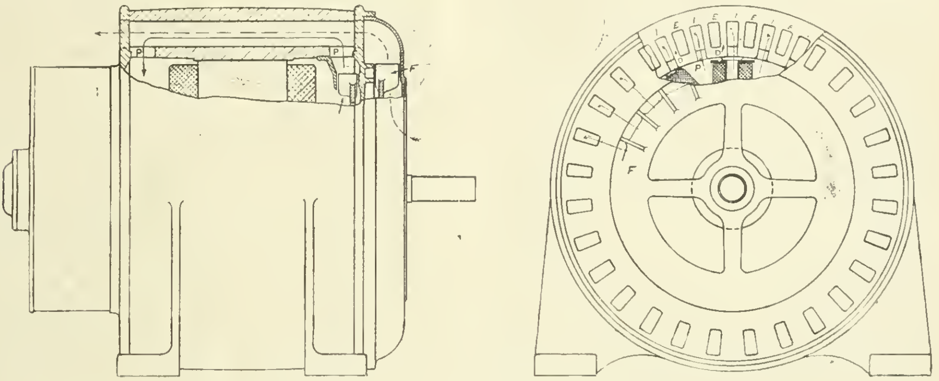
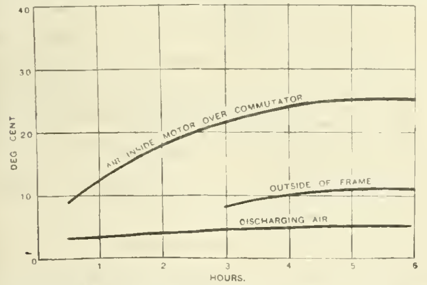


Fig. 2.—Arrangement of Air Circulation of Emcol D.C. Motor.



Average input 480 v., 88·5 a. Final temperature rise: commutator 43°; shunt 47°; interpole 48°; armature winding 50° F.

Fig. 3.—Temperature-rise Curves of 50-h.p. Motor.

ELECTRICITY SUPPLY IN AUSTRALIA.

We are indebted to the courtesy of Mr. H. R. Harper, city electrical engineer, Melbourne, for a copy of a Bill relating to the constitution of a body of Electricity Commissioners, and the powers and duties thereof, in connection with the State of Victoria, which will be of interest to our readers in view of the recommendations in the Report of the Committee appointed by the Board of Trade to consider the question of electric power supply in Great Britain, providing for the appointment of five electricity commissioners to regulate the generation and distribution of electricity.

The Bill is the outcome of a careful investigation of the possibility of utilising the immense brown coal deposits in the State for the production of power on a large scale. The Bill, which became law in December last, will enable the Government to appoint Commissioners to proceed on national lines with the utilisation of these coal resources, and the distribution of electricity throughout the State. The construction of a power house on the brown coal fields, and the necessary overhead lines to Melbourne at 110,000 volts, a distance of 90 miles, will involve the expenditure of about 2 millions sterling, inclusive of the cost of opening up the mine.

An Advisory Committee on Brown Coal in Victoria, which consisted of Messrs. Clements, Harper, Stone, and Herman, reported in September, 1917, to the then Government and advised the establishment of a power house at Morwell, capable of generating a large supply of electricity, and transmitting it to Melbourne. The Committee made certain estimates of the cost at which this power could be supplied, and these costs were all lower than the costs of the Melbourne City Council or the Melbourne Electric Supply Co. for producing power for their own consumers.

The Committee estimated that the demand in the Metropolitan area to be provided for by the year 1921 would be approximately 50,000 KW. (exclusive of the Railway demand). Of this quantity, about 26,000 KW. could be supplied by the City Council and Melbourne Electric Supply Co. without additions to their present generating capacity. It was evident that if these suppliers could obtain electricity at a lower rate than it would cost them to generate, they would immediately become bulk consumers for the balance from the State power house at Morwell, with the strongest probability of taking, sooner or later, all their supply from the Morwell plant.

It is estimated that by 1925 the demand will have grown to 97,000 KW., assuming the electrification of the cable tramways. The demand would probably amount to between 80,000 and 90,000 KW., excluding railway and tramway load.

The Advisory Committee pointed out that limitations of space, cooling water, coal carriage, and storage facilities, &c., made it undesirable that the Melbourne City Council or the Melbourne Electric Supply Co.'s power houses should be further extended.

In Victoria, in the Metropolitan area alone, there are four different systems of supply. The Melbourne City Council has a three-phase and single-phase A.C. 50-cycle system, as well as direct current; the Melbourne Electric Supply Co. has a single-phase 50-cycle system; the railway power house at Newport will have a three-phase 25-cycle system; the North Melbourne and Essendon scheme has a direct-current system. There are various small systems of electric supply in various portions of the country districts, and many of these show the same diversity that exists in the city of Melbourne. Any of these may be a nucleus round which may grow up a comparatively large new system.

The new Act creates a body to be called "The Electricity Commissioners," who will have supervision of all electrical undertakings; be charged in particular with the work at Morwell, and have such other powers as will enable them to remedy, as far as practicable, and to prevent any further development of waste, inefficiency, and such anomalies as have been pointed out.

The Electricity Commissioners will also have power to consider other schemes, such as the Kiewa River scheme, and to prescribe the conditions under which they should generate power. They will have power to investigate all questions relating to the development of existing and the creation of new electrical generating stations and supply undertakings, authority to approve or reject them, and authority to require that such proposals conform to standards laid down by them. The encouragement of the use of electricity will also be one of their chief functious.

The Act provides for the resumption by the State of all land in the neighbourhood of the proposed power house, and within a substantial radius thereof, and for the taking of such land as is required for transmission lines and substations.

It appears that immediate action is imperative to provide for the growing requirements of electrical energy in the Metropolitan area. The Melbourne City Council has practically reached the limits of its generating capacity on its present site. The Melbourne Electric Supply Co. is in much the same position, yet new consumers are constantly demanding to be connected; and the need for establishing a power scheme on a large scale is thus apparent. The Electricity Commissioners will have power to have plans and specifications prepared immediately they are appointed. These plans and specifications will then be submitted to the most competent electrical expert in the Empire for overhaul and such revision as he thinks necessary.

There are 75 electricity supply undertakings operating in Victoria (including the Metropolitan area), with 72 generating stations, having an average size of 568 KW. There are three systems of generation, but only one frequency; five D.C. and 4 A.C. generating voltages, and eleven distributing voltages.

The Act is confined to the constitution of the body of three commissioners and the definition of their powers and duties, with incidental amendments in the law relating to electric light and power. Their tenure of office is limited to seven years, but any commissioner may be reappointed. Provision is made for the removal from office of any commissioner for absence from duty, &c. The Commissioners are to administer the Electric Light and Power Act, 1915, to deal with the Morwell scheme, to set up standards and organise electricity supply throughout Victoria, carry out surveys of coal and water power, promote the use of electricity (especially for industrial purposes), recommend legislation, erect and work electrical undertakings, supply electricity in bulk or to individuals, and carry on ancillary businesses, take land by agreement or compulsorily at Morwell and (with the approval of the Governor in Council) for other undertakings, make rules for the examination and licensing of wiremen, and recommend to the Governor regulations with regard to the use of electricity and the working of electric tramways. Ample powers are provided for taking wayleaves, altering water-courses, &c., and penalties are prescribed for obstruction offered to or interference with the work of the Commissioners. The clauses of the Act are very detailed and comprehensive, and it will be seen that the Board of Commissioners is armed with the widest administrative and executive powers, as contemplated in the report of the Committee on Electric Power Supply of the Board of Trade, and the Electrical Trades Committee.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

2,641. "Electric ignition apparatus for internal-combustion engines." H. W. F. Ireland & H. Lucas. February 5th.

2,846. "Devices for varying point of ignition in electric ignition apparatus." Akt. Ges. Brown, Boveri et Cie. February 5th. (Germany, February 5th, 1918.)

2,875. "Dynamo-electric machines." H. P. Amphlett. February 5th.

2,882. "Means for securing electric conducting wires to their insulators." H. Marsicano. February 5th.

2,886. "Dynamo-electric apparatus for car lighting, &c." H. Coates and C. A Martin. February 5th.

2,901. "Intermittent rotary motions of electric motors for actuating feed motions on planing machines, &c." E. Stirk, G. Stirk, J. G. Stirk & R. Stirk. February 6th.

2,916. "Electric storage batteries or accumulators." Fuller Accumulator Co. & T. Johnson. February 6th.

2,920. "Control of ignition of internal-combustion engines." J. A. Cole and Humber, Ltd. February 6th.

2,922. "Dynamos and magnetos." M. S. Conner & C. C. Puckette. February 6th.

2,923. "Floating electric generating plant." G. H. Bennett, W. Gaunt and W. Gotch. February 6th

2,928. "Apparatus for notching or punching core-plates for dynamo-electric machines, &c." Lancashire Dynamo & Motor Co. and R. S. McLeod. February 6th.

2,962. "Iron cores for induction coils." J. S. Mollerhoj. February 6th. (Denmark, February 6th, 1918.)

2,966. "Electric beaters or radiators." A. Pritsker. February 6th.

2,967. "Combined electric fixture support-coupler and electric connector therefor." G. Lacey (administratrix of I. H. Steven). February 7th.

2,976. "Rotating contacts." A. G. Ionides. February 6th.

2,983. "Electrical ceiling, &c., fittings." H. J. Bein. February 7th

2,984. "Memoranda or writing appliance for telephones." J. M. Hattersley. February 7th.

2,987. "Fittings for temporarily mounting or connecting electric lights." J. Bein. February 7th.

2,993. "Electric push switches." R. J. H. Hill & M. J. Railing. February 7th.

3,024. "Storage batteries for electricity." G. F. Cooke. February 7th.

3,035. "Electric switches." E. N. Bray, and Bray, Markham & Reiss. February 7th.

3,039. "Interrupting electrical circuits." J. C. R. Marks (Splitdorf Electrical Co., U.S.A.). February 7th.

3,047. "Electron discharge devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 7th.

3,061. "Shades or reflectors for incandescent electric lamps." Britannia Lamp & Accessories Co. & R. Cox. February 7th.

3,076. "Dynamo-electric machines of variable pole number." F. Creedy. February 7th.

3,078. "Electric lampholders." A. White. February 7th.

3,087. "Electrically-operated water meter." A. W. Empson. February 7th.

3,113. "Sparking plugs." L. E. Sutherland. February 8th.

3,136/7. "Starting and synchronising synchronous dynamo-electric machines." R. E. Grime and Mather & Platt. February 8th.

3,142. "Electrical steering gear." J. MacIntosh & M. Walker. February 8th.

3,154. "Electrical device for determining winners of sports events." H. Duggan & W. H. L. Dyer. February 6th.

3,158. "Telephone instruments." V. Amberg & Western Electric Co. February 8th.

3,161. "Telephone systems." E. A. Laidlaw and Siemens Bros. & Co. February 8th.

3,168. "Current collectors for street cars." A. B. Upham. February 8th.

3,181. "Magneto-electric machines for internal-combustion engines." M. S. Conner & C. C. Puckette. February 10th.

3,187. "Sparking plug." A L. Redrup. February 10th.

3,190. "Carrier for shades of electric lamps." W. J. Gormly. February 10th.

3,212. "Holders for gas or electric lamp shades or reflectors." J. Brown. February 10th.

3,218. "Electric tramcar apparatus." K. Matsumoto. February 10th.

3,222. "Electrophones." L. P. Langton. February 10th.

3,223. "Dynamo-electric machines." Enclosed Motor Co., H. C. E. Jacoby & P. A. H. Mossay. February 10th.

3,226. "Device for breaking electrical connection." R. Manning. February 10th.

3,231. "Electrodes for vacuum discharge devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 10th.

3,247. "Electric arc lamps." H. B. Grylls & W. Heape. February 10th.

3,251. "Device for varying point of ignition in electric ignition apparatus." Akt. Ges. Brown, Boveri et Cie. February 10th. (Germany, February 9th, 1918.)

3,252. "Devices for varying point of ignition in electric ignition apparatus." Scintilla. February 10th. (Germany, February 9th, 1918.)

3,253. "Electromagnetic heating apparatus." Soc. des Moteurs Salmson (Système Canton-Unné). February 10th. (France, December 18th, 1918.)

3,263. "Electric motor-control systems." R. F. Bellamy. February 10th.

3,280. "Electrode and fastner." E. E. Greville. February 11th.

3,286. "Method for making buttons of electric light switches, &c., luminous." W. H. Atkinson. February 11th.

3,301. "Electric step-by-step mechanism." C. L. Walker. February 11th.

3,355. "Receiving circuits for wireless telegraphy." H. J. J. M. de Regnauld de Bellescize. February 11th. (France, June 26th, 1917.)

3,361. "Machine for electric welding." A. Faure. February 11th. (France, February 11th, 1918.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

15,837. Electrical transformers. F. E. Berry. October 30th, 1917. (122,431.)

17,017. Contact-breaking device for magneto ignition. G. A. Chailliey. June 5th, 1917. (116,879.)

1918.

579. Electric apparatus for purifying and disinfecting air. W. J. Calder. (August 10th, 1918.) (112,438.)

776. Electro lifting magnets. Steel, Peech & Tozer and H. E. Bowen. January 14th, 1918. (122,239.)

839. Electric batteries. A. B. Conolly & C. C. Ellison. January 15th, 1918. (122,240.)

1,047. Earthing devices for electric oil-break switches. A. Reyrolle and Co., F. Coates & J. Mirrey. January 18th, 1918. (122,443.)

1,101. Magneto driving arrangements for internal-combustion engines. A. W. Wall. January 19th, 1918. (122,452.)

1,329. Railway train controlling systems. McKenzie, Holland & Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) January 23rd, 1918. (122,471.)

1,330. Railway signalling controlling systems. McKenzie, Holland and Westinghouse Power Signal Co. (Union Switch & Signal Co., U.S.A.) January 23rd, 1918. (122,472.)

1,376. Cooling of dynamo-electric machines. P. A. H. Mossay, H. C. E. Jacoby & Enclosed Motor Co. January 24th, 1918. (122,478.)

1,407. Electric igniter for combustion motors. K. Jaeggi. January 24th, 1917. (112,949.)

1,621. Starting apparatus for use with internal-combustion engines and other power shafts. A. I. Odier. January 28th, 1918. (122,494.)

1,896. Electric furnaces. A. E. White (Industrial Electric Furnace Co., U.S.A.). February 1st, 1918 (122,282.)

2,348. Switch apparatus for use more especially with the lighter kinds of electric appliances, such as electric hand lamps and the like. Efandem Co. & A. H. Williams. February 9th, 1918. (122,511.)

2,394. Electrical apparatus for the heating of liquids. H. C. Sanders. February 11th, 1918. (122,288.)

2,549. Centrifugal type of mercury cut-out for dynamo-electrical machines. B. N. E. Dufty. February 13th, 1918. (122,290.)

2,676 Electric conductors. Fuller's Wire & Cable Co. and G. Fuller. February 14th, 1918. (122,295.)

3,013. Enclosed electric bells. J. B. Eder & British Agencies, Ltd. February 20th, 1918 (122,520.)

3,395. Speed regulators for electric motors. British Thomson-Houston Co. (General Electric Co., U.S.A.) February 26th, 1918. (122,305.)

3,577. Method of generating pressure. Westinghouse Electric & Manufacturing Co. March 31st, 1917. (114,627.)

3,656. Lamp mountings for electric light projectors. Steward-Warner Speedometer Corporation. June 19th, 1917. (117.804.)

3,842. Apparatus for the electrical separation of suspended particles from gaseous bodies. Huntington, Heberlein & Co. and H. C. Bingham. March 5th, 1918. (122,534.)

5,094. Control of lamp circuits used on motor cycles, motor cars, and the like. A. H. Midgley & Vandervell & Co. March 22nd, 1918. (122,088.)

5,560. Electric switches. H. Lucas & W. C. Turner. March 30th, 1918. (121,885.)

THE
ELECTRICAL REVIEW.

VOL. LXXXIV. MARCH 7, 1919. No. 2,154.

ELECTRICAL REVIEW.

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OFFICE :—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 [illegible]s. [illegible]d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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AUCKLAND N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE TRANSPORT BILL.

RARELY has a Government Bill been so anxiously awaited, and, when published, so little appreciated, as that which provides for the establishment of a new Ministry—the "Ministry of Ways and Communications, and for purposes connected therewith"—which was introduced into the House of Commons on Wednesday last week. The Bill is designed "for the purpose of improving the means of, and the facilities for, locomotion and transport," and empowers the Minister to take over all powers and duties of any Government Department relating to railways, tramways, waterways, roads, harbours, and—the supply of electricity! Apart from the repetition of the foregoing statement in the same paragraph, this is, we believe, with one exception, the only direct reference to electricity supply in the text of the Bill. Of all the diverse interests immediately affected by the Bill, only one has expressed approval of its aims—the Waterways Association, the champion of a forlorn hope—whose only prospect of achievement certainly lies in State ownership. Bitter opposition is being organised by the motor-vehicle interests, Manchester Ship Canal, and the Mersey Docks and Harbour Board, and there is a general fear lest the proposed Minister—Sir Eric Geddes—being a railway man, shall subordinate the interests of his other cares to those of the railways. The Bill is regarded as a long step in the direction of the nationalisation of the railways, a process which could apparently be completed by an Order in Council, and the prospect is regarded with universal alarm—except, perhaps, by the socialistically inclined. The powers conferred upon the Minister are of the most arbitrary and autocratic description, practically without limit, except in respect of municipal tramway undertakings, which cannot be acquired by compulsion. Rates, fares, &c., can be altered by the Minister at will, in spite of existing statutory provisions; money can be lent or granted to any undertaking, subject only to the consent of the Treasury.

The electrical industries are, of course, intimately affected by the Government's proposals in almost every aspect, either as manufacturers of plant for use in the working of the railways, docks, &c., or as users of transport facilities; but at the moment the paramount consideration is the question of national electricity supply: what is being done by the Government to carry out the scheme supported by the Board of Trade, and referred to so frequently by the Prime Minister? To what draft Bill did Mr. Lloyd George allude last week, when he told Mr. Smillie, with reference to the more efficient utilisation of coal, that the Cabinet had just passed the draft? To what Bill did other remarks refer which we have reported from time to time? To *this*?—If so, there is indeed but little wool to show for so confident a cry.

We believe, however, that this is not the case; the real Electricity Bill is in course of preparation, and will shortly be introduced into Parliament. In the meantime, in the absence of even a shred of detail, and of any indication of the Government's real intentions, it is impossible to comment on the matter to any useful purpose. All that we can say is that if the electricity scheme is to be handled in this way—subjected to the control of a Department which is not yet organised, and which will be charged with immense responsibilities having little or nothing in common with electricity supply—we may bid farewell to the hopes of reform which we had cherished, and resign ourselves to the inevitable stagnation which must follow. If our fears are justified, not only the electrical industries, but the national interests, will suffer a disastrous set-back by the inclusion of electricity supply in this gigantic scheme—an undertaking which can only be tackled successfully by a Heaven-born genius, a superman, such as this century has not seen.

It is true that the railways, when electrified, will be amongst the most important consumers of electrical energy, and that they afford convenient routes for transmission lines; also that the extension of the railless trolley system along the country roads offers by far the most promising solution to the problem of transport for agricultural products and passenger traffic; and it is alleged that the Government seriously contemplates great developments in the electrification of main-line railways. But all this will take years to accomplish, and the matter is of the most pressing urgency—extensions of electricity works and new power stations are being put in hand, and the huge accumulation of arrears in electrical development must be worked off as quickly as possible. We earnestly hope, therefore, that no more time will be lost in giving definite form to the national scheme, and especially that the appointment of the Board of Electricity Commissioners, with adequate powers, will be carried through as quickly as possible.

I.E.E. Informal Meetings.

In our "Notes" to-day we give particulars of the arrangements which have been made for the first of the "informal meetings" which were recently mentioned by the President as being in course of organisation. It has always been observed that at the ordinary general meetings of the Institution the speakers are drawn mainly from the ranks of the older members of the profession, the younger men, though often invited to share in the discussions, preferring to act the part of listeners. Whether their silence be due to diffidence or to inexperience, it is unquestionably regrettable that the juniors should hang back, and, in order to remedy this failing, the Council decided to inaugurate these informal meetings, at which the junior members will be encouraged to air their views and to practise the art of debate. Their elders may, indeed, attend the meetings, but their presence is not particularly desired; the arrangements will be entrusted to a committee of juniors, who will select the papers and occupy the chair in rotation.

We understand that between the paper and the discussion, there will be a short interval for light refreshments and conversation, a novel departure which will add variety to the proceedings. From the interest and enthusiasm which have already been manifested in the scheme by those most directly concerned, there is every reason to expect that this practical effort to supply the needs of the large body of members comprised between the Student class and the full-fledged professional men will receive a hearty welcome, and will prove successful from the start.

It will be noted that with the inauguration of "informal meetings," yet another of the many proposals outlined by Mr. Wordingham in his Presidential address in 1917 takes practical shape. The list is by no means exhausted, and the most important item of all—the obtaining of a Royal Charter—appears to hang fire. But in view of the remarkable successes which he has already attained in carrying his programme into effect, we shall continue to hope that this may yet prove to be, as we said 16 months ago, "the crowning achievement" of his period of office.

The Functions of a Trade Journal.

We note with interest in our lively young contemporary *l'Electricité* the following editorial remarks:—"Several readers have expressed their astonishment at seeing described in *l'Electricité* only apparatus of foreign origin. On the other hand, others have thanked us for providing them with the heating elements—metaphorically speaking—which have enabled them to contend with the horrors of the terrible winter that we have just passed through." The Editor goes on to say that he would gladly have described French apparatus first of all, but, unfortunately, he finds it difficult to extract the necessary information from French manufacturers, whereas British and American firms have immediately placed at his disposal full particulars of their products, and have even sent him actual samples. The reluctance of the French makers to accept publicity appears to be a complaint of long standing, due to their fear of supplying information to competitors; we are glad to see that our own manufacturers are divesting themselves of this erroneous idea, against which we have often fought in the past. That it is erroneous was amply demonstrated by the success which attended the efforts of our German competitors before the war—they were always ready to impart information with lavish completeness.

But at the moment we are concerned, not so much with the attitude of manufacturers towards the media for publicity which are open to them, as with the question of the functions of such a medium—a trade journal such as our own. Should its pages be open only to home products? or should it describe also the manufactures of foreign rivals? We have often considered this question, and have no doubt as to the correct reply.

In our opinion, it is our duty to keep our readers as fully informed as possible on every development in, or associated with, electrical engineering throughout the whole world. That is the only policy which conduces most efficiently to progress in our own industries—the fact is undeniable. The dissemination of up-to-date information is one of the most important functions of a trade journal, in order that inventors and manufacturers may know what they are up against, what are the requirements in foreign markets, and in what direction the trend of progress lies. Not only is this knowledge necessary in order to develop export trade, it is equally necessary to retain control of the home markets, for what is found successful abroad will soon be introduced at home, if not by our own firms, then by their rivals. Hence, every progressive manufacturer is anxious to know what his competitors are doing, in order that he may go one better; and it is for that reason that we keep a watch upon the foreign technical Press and publish descriptions of new apparatus and installations of alien origin.

But, it may be urged, if we derive useful information from the foreign technical Press, shall we not do well to withhold such particulars from our own Press? There is the old fallacy again. Granted that there are some details of manufacture that should not be revealed—we do not wish to publish *them*; there remains an abundance of material, the publication of which will afford no assistance to the rival, while it will be of immense benefit to the maker of the goods. Again we draw attention to the practice of our enemies—not only before the war, but, in neutral countries, during the war; the keynote of their policy was PUBLICITY. It paid them handsomely, and it will pay us still better in the times that are before us.

Publicity is the watchword of the successful manufacturer; and it is one of the principal functions of the trade journal to assist him in securing it, in the right way and in the right quarters.

ELECTRICITY SUPPLY AT BIRMINGHAM.

For some years before the war, the load supplied by the Birmingham Corporation Electric Supply Department had increased at a regular and satisfactory rate, and additional generating plant had been installed from time to time to supply the increased demand. Just prior to 1914 the equipment of the principal generating station at Summer Lane was completed by the addition of two 5,000-kw. B.T.H. turbo-alternators, and work had already been commenced upon the foundations of a proposed new generating station at Nechells, which was designed for an ultimate capacity of 100,000 kw. Immediately upon the outbreak of war, however, all further work in connection with the new generating station at Nechells was stopped at the request of the Government, which at that time could not have foreseen the phenomenal increase in the load which soon afterwards took place at Birmingham, due to the demands of factories engaged on the manufacture of all kinds of munitions of war.

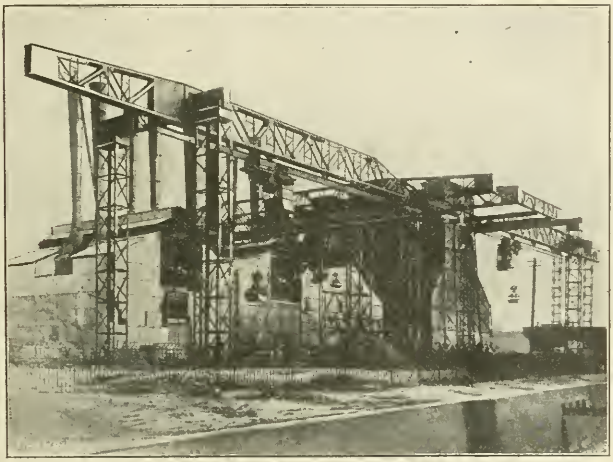

Fig. 1.—Electrically-driven Telphers at Nechells.

Faced with a rapidly-increasing load, which in the national interest had to be supplied, and without accommodation for further plant in the existing generating stations, the Electric Supply Department decided at the beginning of 1915 to proceed with all haste with the erection and equipment of a temporary generating station, which was to have a plant capacity of 10,000 kw. This temporary station was got to work in 1915 in record time (within nine months), but proved quite inadequate to meet the ever-increasing demand for power, and extensions bringing the total plant capacity of this temporary station up to 22,000 kw. were taken in hand, this being the maximum amount of plant which could be accommodated on the site chosen. These extensions were completed in 1916-17, and since that date the Birmingham Corporation has been compelled to make other temporary arrangements for supplying the further heavy increases in load due to the war.

The site chosen for the temporary generating station adjoins the site of the large permanent station, work upon which is now again being commenced, at Nechells in the north-eastern portion of the city. The site had much to recommend it; immediate use could be made of the railway sidings already constructed to serve the permanent station; it fronted on to the Birmingham and Warwick Junction Canal; ample coal storage accommodation, and an excellent ash dump, could be found on the adjacent site, whilst at a later date the feeders connected to this temporary station could be lengthened at small cost and reconnected to the new permanent station. Further, the station was near to the centre of gravity of the load to be supplied, whilst a considerable distance separated it from the nearest dwelling houses.

The land, however, was "made ground," chiefly dust-destructor clinker on sand, with a stratum of running sand some 10 ft. below the surface. As rapidity of construction and strict economy of capital expenditure were essential, it was decided to construct a solid concrete raft on the surface of the land, and to erect the buildings and machinery on this, no basement of any sort being arranged for.

The buildings themselves consist of a framework of rolled steel joists and angles, the roof and walls being formed of corrugated asbestos sheets, and the whole making a thoroughly substantial, weather-tight structure with a minimum of dead weight.

The power station as it exists to-day really consists of two distinct and separate stations adjoining one another, the first station containing 10,000 kw. of plant (the amount which was originally assumed would amply meet the war needs of Birmingham), and the second containing 12,000 kw. of plant, which was afterwards found to be urgently required, and which in turn proved insufficient to supply the whole of the additional load.

The general lay-out of the station is shown in fig. 3, p. 256.

Nos. 1 and 2 boiler houses each contain six Babcock & Wilcox marine-type, water-tube boilers, with superheaters, each boiler being fitted with mechanical chain-grate stokers, and having a normal full-load duty of 35,000 lb. of steam per hour at a pressure of 200 lb. per sq. in. gauge, superheated to a total temperature of 700° F.

Two "Prat" chimneys with induced-draught fans, together with the necessary dampers, are provided for each set of three boilers, the normal draught at the base of the chimneys being 1·1 in. of water. No economisers are installed, but feed-water heaters connected to the exhaust of the station auxiliaries raise the temperature of the feed water to 180° F.

Overhead coal bunkers with chutes discharge into the boiler hoppers, and the bunkers in each boiler house are supplied by two electrically-driven telphers made by Messrs. Herbert Morris, Ltd., which run out over the railway track and canal to a coal store on the opposite side of the canal. These telphers are fitted with ½-ton grabs, and can each deal with 20 tons of coal per hour.

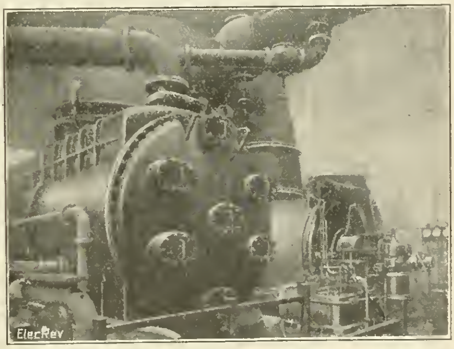

Fig. 2.— Surface Condensers.

An external view of the boiler house, showing the overhead telphers, is shown in fig. 1.

Two reciprocating and four turbine-driven feed pumps, each having a capacity of 25,000 gallons per hour, are installed at one end of the boilerhouse alongside of a Permutit

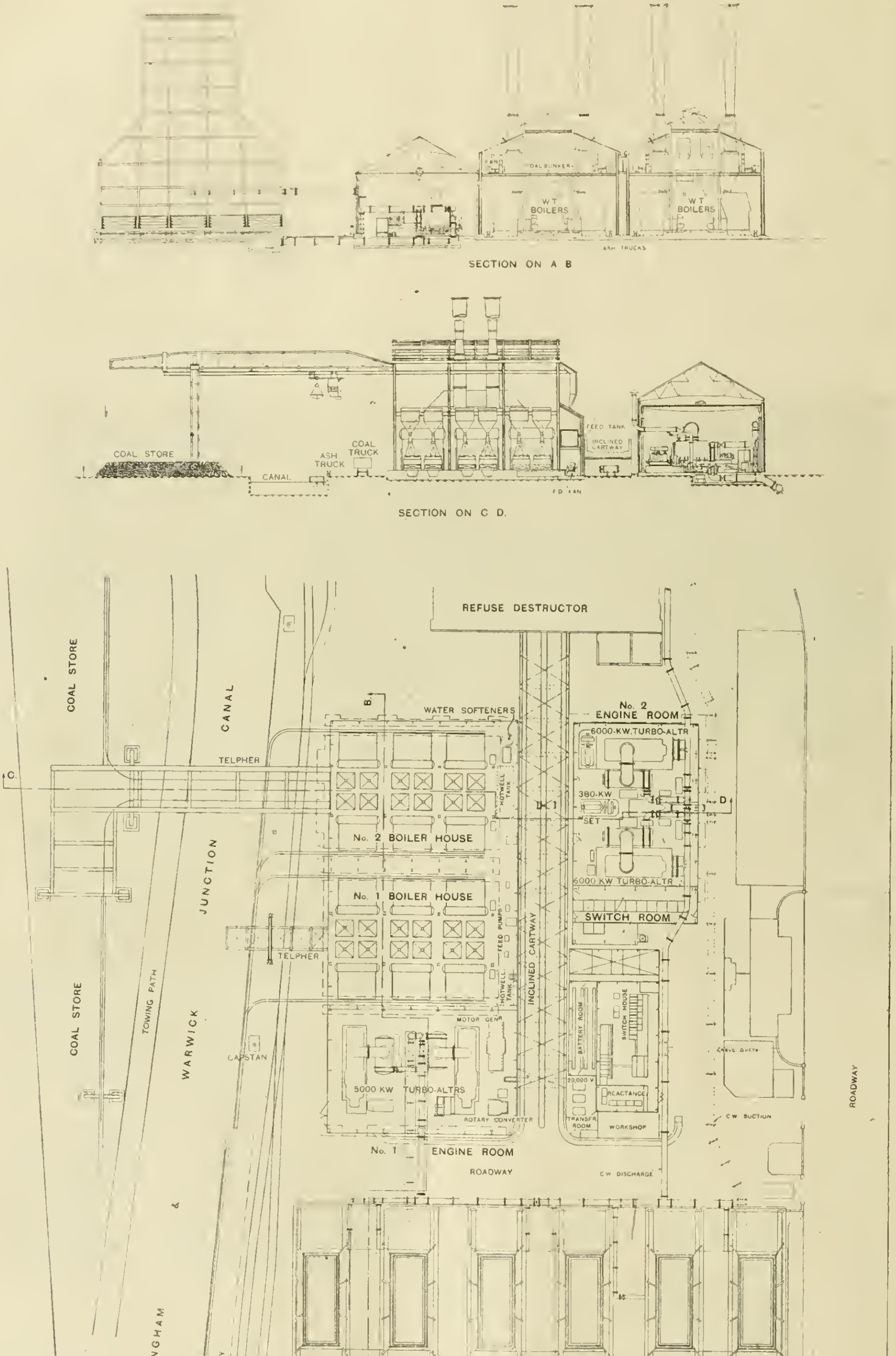

Fig. 3.—Elevations and Plan of Nechells (Temporary) Power Station.

water-softening plant, whilst the feed tanks are erected immediately overhead.

No. 1 engine room contains two 5,000-KW. Westinghouse turbo-alternators, and No. 2 engine room contains two 6,000-KW. B.T.H. turbo-alternators. Each of these sets runs at 1,500 R.P.M., generating three-phase current at 5,000 volts between phases, and 25 periods per second, and they are complete with surface condensers, turbine-driven circulating-water, air, and condensate pumps, together with wet air filters for the alternators.

The unusual side-by-side arrangement of the condensers and turbines, with overhead main exhaust pipe, is shown in figs. 2 and 4. This was necessitated owing to the absence of a basement.

Two Belliss-Phœnix 380-KW. D.C. steam dynamos, one 300-KW. motor-generator, and one 300-KW. rotary-converter are installed to supply the induced-draught fans, telphers, stoker motors, station lighting, &c.

Nine natural-draught wooden cooling towers, supplied by the Davenport Engineering Co., are erected above two large circulating-water reservoirs adjacent to the station. The make-up water for the towers is supplied partly from an artesian well operated by a motor-driven air compressor, partly from the town mains, and partly from purified sewage effluent from the filter beds which adjoin the site. The use of this effluent was decided upon after careful experiment. It has proved to be eminently suitable for condensing purposes, tending to prevent the formation of scale in the condenser tubes and to keep them clean. No offensive odour can be detected, and the aeration of the water in the towers effectually sterilises any germs that may be introduced.

The battery room contains a small Tudor battery of 115 cells, having a capacity of 200 ampere-hours. This is used chiefly in connection with the electrically-operated switchgear, but it also supplies a number of emergency lights in the station.

A large part of the main E.H.T. switchgear installed in Nos. 1 and 2 switch houses is electrically operated, and all the gear is controlled from No. 1 switch house, where all the A.C. and D.C. control panels are erected. The E.H.T. switchgear was supplied by the British Thomson-Houston Co., Ltd., and is enclosed in moulded stone cubicles. The oil switches are chiefly of the firm's well-known motor-operated type.

Each of the alternators is protected by circulating-current relays, so arranged that should a fault occur on any part of the alternator stator or its E.H.T. connections, the alternator main switch operates and disconnects it from the bus-bars, whilst, at the same time, the exciter field circuit of the alternator is broken.

The operating panel for the alternator is also fitted with a small switch for controlling the governor speeder motor, whilst in front of each of the alternator panels is mounted a Chadburn telegraph for signalling to the men in charge of the engine-room plant.

The whole of the ten trunk feeders supplied from this station are of the split-conductor type, of various sections; the cables used are six-core with the cores equally spaced, the two split conductors forming one phase not being arranged concentrically, as is usually the case.

One of the trunk feeders which runs to a distant substation is connected to a bank of three 1,250-K.V.A., single-phase, step-up transformers, supplied by Messrs. Ferranti, Ltd., and is run at a pressure of 20,000 volts between phases. The others are run at 5,000 volts between phases.

The ring mains are standard type, 5,000-volt, three-core, 0·15 sq. in. cable, and are protected by overload inverse time-limit relays.

The whole of these trunk feeders and ring mains were supplied and laid by Messrs. Callender's Cable and Construction Co., Ltd.

The planning, erecting and setting to work successfully of a station such as this, within a period of about nine months, must have meant a very great deal of hard work and anxiety for the city electrical engineer, Mr. R. A. Chattock, who not only had some specially difficult engineering problems to solve, but who was also working against time.

The Electric Supply Committee is to be congratulated upon the bold and patriotic manner in which it confronted and dealt with the grave question of supplying the great munition works in the city with all the electrical energy they required during a period of national emergency.

Our thanks are due to Mr. Chattock for placing the foregoing particulars and illustrations at our disposal. As will be seen from a paragraph in our "Lighting and Power Notes" to-day, he is at present engaged upon plans for a further extension scheme of still larger dimensions, involving the erection of a power station on an entirely new site.

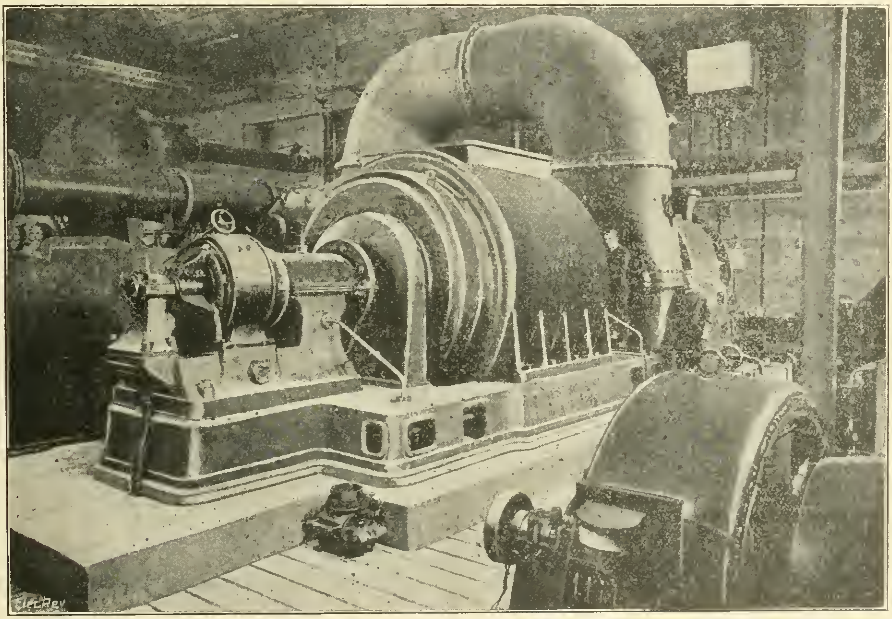

Fig. 4.—Turbo-Alternator, Showing Arrangement of Overhead Main Exhaust Pipe.

THE MANAGER OF SIEMENS-SCHUCKERT ON THE SITUATION.

The Germans have found it convenient at all times to possess short memories, and the existence of the Armistice has served to accentuate this circumstance, with the additional consideration that they would like the Allies also to forget the past, particularly the past four years. This reflection has been evoked by a perusal of a report of an interview, published in a recent issue of the Paris *Matin*, between an officer in one of the Allied Armies and Herr Henrich, manager of the Siemens-Schuckert Works. The interview may be divided into three parts, namely, politics, Labour and Bolshevism, and the revival of German export trade.

Dealing with the first problem, Herr Henrich is reported to have stated that it was an error to believe that German industry had had an influence on the external policy of the Empire, and that, contrary to what was supposed abroad, there was no industrial party in Germany; industry was scarcely represented in the (late) Reichstag, and was but little occupied with politics, and industrialists knew nothing of the then impending war. It is quite true, as the manager asserts, that no industrial political party existed, at least openly, and that German manufacturers directly participated to an insignificant extent in the former Imperial Parliament; but they intend, if possible, to take a strong hand in politics in the future. The influence of the industrial interests, however, was brought to bear all the same by indirect methods—through the Central Verband Deutscher Industrieller (Central Union of German Manufacturers) and the Bund der Industrieller (Federation of Manufacturers), which are the greatest combinations of manufacturers in Germany, which have just been amalgamated for the presentation of a united front on political and economic questions, and in which the interests of the electrical industry were, and are, represented. If the industrialists, through these and other associations, never exercised any influence upon the foreign policy of the country, how is it possible otherwise to explain the sabre-rattling of some years ago—the threat of war at that time—in connection with iron-ore concessions in Morocco and the Mannesmann Brothers? A second instance takes us back still further—about 15 years ago—when the Imperial Chancellor made serious threats towards Sweden in the event of the Swedish Government placing an embargo on, or considerably reducing, the exports of the low-phosphoric iron ores of which certain of the large works in Rhenish-Westphalia were then, and are now, in great need. Had there been no indirect pressure on the part of the iron and steel industries in these two cases, no menaces would have been uttered towards Sweden, and no sabre-rattling would have taken place in regard to France and Morocco. So much, then, for the German theory, which could be further exposed from German private documents which have gained publicity during the war concerning the influence exerted by the great manufacturing and agricultural Associations on the Government in the past four years, of no interest being taken by industrialists in external politics.

We pass over the now time-worn legend that "the German nation rose to defend its frontiers," and come to the question of Bolshevism. In this connection, Herr Henrich now admits—but only now that conditions are changed—that the Brest-Litovsk treaty was a serious mistake; a treaty of violence, he said, did not reconcile the two nations; it served the purposes of Lenin. Marshal Foch, in his opinion, does not seem to have understood this historical lesson. The plan of Lenin was the coalition of the Russian and German proletariats against imperialism and capitalism of the Entente. France flattered herself, as the Germans had done, that she would escape the fire. The Germans had created a zone of neutral countries between themselves and Russia; France wished to create autonomous States on the border of Germany, but Herr Henrich remarked that neither autonomous States nor military forces circumscribed the Bolshevik danger, which must be throttled on the spot where it raged. If this danger were averted and the wages question settled, the manager was of opinion that German industry would recover. On the matter of wages, he rightly stated that this problem was arising, or would arise, in all the Allied countries. It was necessary for the German workmen and employers to come to an understanding as soon as possible; otherwise the depth of the abyss to which they were proceeding could not be measured. An effort in this direction had been already made by the formation of working communities, or joint committees of workmen and employers in equal numbers, to settle the wages question and the economic possibilities of industry. This was the first step towards an industrial Parliament which was desired, in which workmen and employers would be represented in equal numbers, and which would devote itself to social and economic questions in relation to industry. Apart from this, Herr Henrich mentioned that the workmen were preparing a European understanding; that there was needed a European understanding between employers, and that he hoped this would be established without delay.

The idea of an agreement between employers in Allied countries and those in Germany is positively astounding. It is a further confirmation of the mentality of the Germans, who still fail to understand that, except where absolutely necessary, Allied countries will neither trade with Germany nor enter into agreements for international action in regard to labour and social questions. Herr Henrich also entered upon dangerous ground when he expressed himself as an optimist in respect to any boycott of Germany. If the dangers of Bolshevism and wages questions were successfully overcome, and, "if we can find the raw materials, German industry will be able to recover in a few decades." The manager carefully overlooks, however, the intended rationing of raw materials by the Allies in so far as their resources are concerned, and unless the Germans and the Russians reach a mutual economic agreement for the utilisation of the great mineral and other resources in Russia, the optimism of Herr Henrich probably will soon change to pessimism. Concerning the loss of customers throughout the world, he stated that the Germans would recover them, because the products which the world had been unable to obtain from Germany during the war had not been bought elsewhere. In two or three respects this assertion is correct, but it is quite untrue in many lines of merchandise which have been purchased by neutral countries from Spain and the United States during the war, particularly by South American countries, before the United States became a belligerent. Herr Henrich repeats the ancient story about the perfection of German equipment and technical methods which are to enable the Germans to deliver good products at low prices, whilst the German tariff and the quality of the goods are to open the world's markets to them again.

If Herr Henrich had studied the iron and steel situation in Germany and the general course of labour movements there, it is probable that he would not have been so confident as to the future. The loss of Alsace-Lorraine and Luxemburg, and the preferential claim on a large quantity of the production of German coal which will be exercised by the Allies for quite a number of years hence, have reduced German industrially to a fourth-rate power. Iron and steel react on mechanical and electrical engineering, shipbuilding, and other industries, and not even Sweden and Spain, who themselves are determined to develop their industrial resources, could prevent Germany from a permanent loss of a very large percentage of manufacturing trade. It is only Russia which could save Germany from industrial disaster, and it should lie in the hands of the Allies to frustrate any attempt in the direction of the mutual amalgamation of these interests which, as some Germans hope, would lead to another war 30 years hence, with totally different results from those which are now on record.

RECONSTRUCTION: THE TIME FOR CLEAR THINKING AND STRAIGHT TALKING.

By FRANK J. MAURICE.

Some years ago the writer had the good fortune to be associated in some of his work with M. Flourence Guitton, the well-known French civil engineer, and learned from him of his successful introduction of the Taylor system into France, and of the excellent results obtained there in one works after another. From then to the present time the writer has accumulated information as to the extension of that system to the leading engineering and other works in the United States and in Germany, and has taken every opportunity of endeavouring to impart to others his conviction that "Scientific Management" is the keynote of the problem of industrial reconstruction in this country. This problem may be briefly stated as follows:—So to increase production and lower labour costs that labour may receive satisfying compensation—as higher wages, &c.—without prejudice to a fair interest on capital.

The formation of a society to investigate the subject was foreshadowed recently in these columns, and subsequently the Industrial Reconstruction Council took the matter up, and called a Conference on February 27th, when Major E. A. Pells, R.E. (Assistant Director, Efficiency and Costs Section, Ministry of Munitions), lectured on "Scientific Management," and in the brief time at his disposal outlined some of the principal features of the system—such as accurate time study, functional foremanship, planning room, &c. An interesting discussion followed, and the outcome of the conference was a proposition by the chairman that (1) a series of some half-a-dozen conferences on the subject should be arranged, or (2) that a separate society should be formed to deal with the matter, the first proposition being decided upon for the moment. It is very desirable that electrical manufacturers and works managers should obtain particulars of these conferences from the organising secretary (Lieut.-Col. E. Pottinger, D.S.O.) of the Industrial Reconstruction Council.

It has often been stated that the war was one of "workshops," but it is little realised that in the days when the Boche was able to throw dozens, or even hundreds, of shells into our lines to every one that we sent over, *it was the Taylor system in Germany which was giving him his output.* The Taylor system was extensively in use in Germany before the war, and in the early days of the war opportunity was still found further to extend the system for munitions production.

It is worthy of note that at the present time not a single works in this country employs this system, a few experiments in task work, with a bonus and other advanced-pay systems, being almost all there is to our credit in this connection, while the essentials of the system—accurate unit-time study, functional foremanship, standardisation of operations, planning-room, &c.—are, so far as the writer is aware, non-existent. There is still a considerable amount of prejudice, even in so-called well-managed works, against American methods, but when the statement is made, based on the evidence of those who have worked under and over the Taylor system, that production is increased thereby from 200 to 400 per cent., the claim made at the beginning of this article, that the system is the keynote of industrial reconstruction, will eventually have to be investigated by every progressive industrialist.

In the discussion following the Conference on Feb. 27th, there was exhibited a tendency to confuse the question of increasing production with the method of distributing the increasing profits accruing as between employer and employe. The two questions are entirely separate; and while there may be, and is, much difference of opinion as to how the profits should be distributed, there is no difference of opinion as to the necessity for increasing production—not merely that profits may be increased or maintained, but in order to assure to the nation a continuance of its industrial life at all.

To quote, in conclusion, from one of Dr. Taylor's books ("Shop Management," by Frederick Winslow Taylor, M.E., Sc.D.):—

"It is safe to say that no system or scheme of management should be considered which does not, in the long run, give satisfaction to both employer and employe, which does not make it apparent that their best interests are mutual, and which does not bring about such thorough and hearty co-operation that they can pull together instead of apart." And again: "What the workmen want from their employers beyond anything else is high wages, and what employers want from their workmen most of all is a low labour-cost of manufacture. These two conditions are not diametrically opposed to one another, as would appear at first glance. On the contrary, they can be made to go together in all classes of work, without exception, and, in the writer's judgment, the existence or absence of these two elements forms the best index of either good or bad management."

GREATER LONDON ELECTRICITY SUPPLY.

The agenda paper of the London County Council for March 4th contained an interesting report by the Special Committee on London Electricity Supply, setting out tables to enable comparison to be made of the present position of the electricity supply for Greater London with that obtaining before the war. Readers of the Electrical Review will recollect that the L.C.C. used to publish such statistics annually at a cost of about 1s., the last issue being for the completed returns of 1913-14, *i.e.*, in the case of the undertakings owned by companies the returns were made up to December 31st, 1913, and for the local authorities up to March 31st, 1914. The figures now published in less detail are made up for the companies to December 31st, 1917, and for the local authorities to March 31st, 1917. A few of the undertakings owned by companies outside the County of London have not provided returns, but whilst this is to be regretted, it is considered that such returns are not of sufficient importance to affect the figures as a whole, or the general conclusions to be drawn from them, whilst further delay would have been occasioned if it had been decided to hold up the available figures until every one of the undertakings had furnished the desired information. No figures are given to indicate the capital expenditure incurred to the date of the returns, and in many other respects the statistics will fail to afford the very full information which the well-known annual publication had previously provided. Whether this may eventually be issued is not indicated; the war has upset the regularity of many things, and useful as this regular issue has been, it may not be found possible immediately to resume its publication.

Statements are appended to the report showing separately for local authorities and companies a comparison between the years 1913 (or 1913-14) and 1917 (or 1916-17) under the following heads—maximum demand in kilowatts, number of units sold, generating costs per unit sold, and revenue per unit sold.

The following figures summarise the position in the two periods as regards the undertakings covered by the tables:—

—		Local authorities.		Companies.		Total.
		In London.	Outside London.	In London.	Outside London.	
Max. demand ..	1913	67,700 kw.	41,618 kw.	117,288 kw.	4,509 kw.	231,115 kw.
	1917	82,776 kw.	41,628 kw.	141,994 kw.	7,384 kw.	273,782 kw.
Increase per cent. ..		22·2	0	21·1	63·8	18·4
Units sold ..	1913	123,827,358	88,339,491	195,143,252	6,489,827	413,799,928
	1917	180,909,084	100,090,508	254,800,894	16,689,412	552,489,898
Increase per cent. ..		46·1	13·2	30·6	157·3	33·5
Load factor per cent. ..	1913	20·8	24·2	20	17·3	21
	1917	25	27·4	20·5	25·8	23·2
Increase per cent. ..		4·2	3·2	0·5	8·5	2·2
Generating costs	1913	£293,602	£231,130	£510,862	£31,579	£1,067,223
	1917	584,157	394,658	952,145	83,158	2,014.118
Per unit sold ..	1913	·57d.	·66d.	·63d.	1·17d.	·63d.
	1917	·77d.	1·01d.	·90d.	1·19d.	·89d.
Increase per cent. ..		35·1	63	42·8	1·7	41·2
Revenue	1913	£946,075	£579,961	£1,943,653	£124,169	£3,593,858
	1917	1,224,264	671,704	2,462,476	221,220	4 579.664
Per unit sold ..	1913	1·83d.	1·66d.	2·39d.	4·59d.	2·11d.
	1917	1·62d.	1·72d.	2·32d.	3·18d.	2·01d.
Increase per cent. ..		−11·5	3·6	−2·9	−21·7	−5

It will come as a surprise to our readers to see that the bottom right-hand figure actually proves a 5 per cent. reduction in the revenue per unit sold for 1917 as compared with 1913, although during the same period the generating costs had gone up 41.2 per cent.—the comparative figures when published for 1918 may not be so favourable to the consumers, but the result now shown is highly creditable to the engineering staffs of the London undertakings; the load having gone up by 33.5 per cent. is a significant factor; on the other hand, the load factor is seen to have grown only by 2.2 per cent.

The most noticeable reduction in price is on the totals of the companies outside the county boundaries, viz., 21.7 per cent., although the excellent figures for the local authorities in London cannot be too highly praised, starting, as they did, with a very much lower figure in 1913, and effecting the economy on a total revenue of greater magnitude than the companies outside London.

Turning to the details of the figures for the local authorities in London, the most conspicuous success has been achieved by Woolwich, whose maximum demand has increased by 207 per cent., and the units sold by 553 per cent., whilst generating costs and revenue per unit sold have been reduced by 22 per cent. and 44 per cent. respectively; to turn out over 26 million units with a load factor of nearly 45 per cent. in 1917, against 4 million units in 1913, is indicative of real hard work and a very strenuous activity. The output is only surpassed by one other borough, viz., Stepney, whose total is given as 27 million units. Woolwich alone has succeeded in reducing its generating costs, and Mr. Keats, the borough electrical engineer, and the members of his staff, are to be heartily congratulated. Battersea and Fulham have each increased the number of units sold by over 100 per cent. (as the two boroughs are linked up by trunk mains it is not clear whether some part of the energy may have been recorded twice, first being sold in bulk, and subsequently by the other authority to the consumers); in the column of generating costs Bermondsey shows an increase of 116.7 per cent., whilst under the heading of revenue per unit sold Woolwich has the only 1917 record under 1d., with a figure of 0.91d., Poplar and Stepney following with 1.06d. and 1.16d. respectively.

Dealing with the London companies on similar lines, the return shows that the South Metropolitan Co. has an increased maximum demand of 108.5 per cent., an increased sale of 186.6 per cent., an increased generating cost per unit sold of 38.8 per cent., and a diminished revenue per unit of 32.9 per cent.; the Metropolitan Electric Supply Co. has an increased output of 57 per cent.; the only company showing a lower generating cost is the Westminster, the 1913 figure being 1.3d., against 1.12d. for 1917, a decrease of 13.8 per cent.; this, however, is no doubt partly due to the purchase in bulk from the Central Co.

Amongst the returns from other areas, the largest by far is West Ham, but the units sold have increased in the three years under discussion by only 2.6 per cent. to a total of 35,298,301, whilst the maximum demand has actually diminished by 3.3 per cent., and generating costs have gone up by 78.6 per cent., although the actual figure of 0.75d. compares very favourably with the pick of the 1917 figures.

Comparing one set of figures with another in the summary given above, it will be seen that the London companies sell the greatest number of units, but that the best record for cost of generation is secured by the local authorities, the companies' costs being 10½ per cent. higher in 1913 and 16.9 per cent. higher in 1917 than the local authorities' costs; it is not easy to understand how or why this should be. It is easy to determine that one individual undertaking of either group may have especially favourable or unfavourable conditions which affect its record, but such conditions would naturally tend to average out, whilst that group having the greater output might be expected to have an advantage over the other group.

The report is signed by Mr. G. H. Hume as chairman of the Special Committee on London Electricity Supply; that committee was appointed, we believe, about 1912, and accumulated, with great care, a mass of evidence before producing its Bill of 1914, which it will be remembered failed to obtain the necessary majority of the whole Council when brought up for consideration under the Public Funds Act, and therefore the Bill never came into the Parliamentary arena, where its merits might have been thoroughly sifted. Mr. Hume has since sat on the Board of Trade Electric Supply Committee, and in view of the present Government activity in the matter it will not be surprising if the County Council Committee ceases to do more than hold a watching brief for the future; in this capacity it may still do most useful work in centralising, without controlling, the too numerous interests of Greater London's electricity supply.

Had the electricity supply of Greater London been taken over by a Government department during the war, would the average revenue per unit from the consumers have shown a 5 per cent. reduction? There is reason to doubt it; to quote a few of the well-known items monopolised by the Government: postal charges, telegrams, telephone service, railway rates—all have gone up, and no question of equity as between buyer and seller can be effectually raised. How soon it may be possible to restore the generating costs of 1913 we hesitate to guess, although we do not by any means hesitate to hope. Notwithstanding all the unrest in the labour world, so evident at the present time, science and skill, intelligence and industry will again be employed to the fullest advantage by the engineers in charge of the undertakings supplying Greater London with electricity for all purposes, whose 1917 records are both interesting and creditable.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

A Large Electrically-Welded Pipe.

In view of the interest that is being taken in electric welding at the present time, the illustration which we reproduce below (fig. 1) of a large electrically-welded pipe, forming part of the pipework contract carried out for the new Rotherham Corporation power station, will be of interest. The whole of the circulating-water system at the station referred to was manufactured, supplied, and erected by Messrs. Aiton & Co., Ltd., of Derby. The pumps deliver through branch pipes to a main bus pipe, 78-in. bore, tapering down to 39 in., each condenser being supplied through branch pipes, 25-in. bore, from this bus pipe. The bus and part of the delivery pipes are flanged, and constructed of mild steel plates 5/16 in. in thickness. The bus pipe is, the makers believe, the largest ever constructed in this country on this system, the flanges, branches, longitudinal, and circumferential seams all being electrically welded. The whole of the bus pipe is supported from the under side of the engine-room floor. The section shown in our illustration is one half of the whole bus pipe.

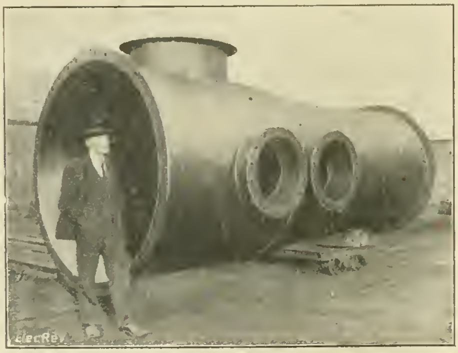

Fig. 1.—An Electrically-welded Bus Pipe.

Electrode Annealing.

Amorphous carbon electrodes have for a considerable time past been obtainable in Great Britain, though their manufacture has presented some few difficulties. Some little time ago the Davis Furnace Co., of Luton, was commissioned to design a gas-fired type of oven furnace which would overcome the trouble which had been experienced in satisfactorily annealing this material. The work calls for extremely uniform temperatures throughout the heating chamber, varying from 450 to 600 deg. C., which have to be maintained for long periods with great accuracy. The best results are obtainable if the electrodes are annealed in a vertical position, so it will be seen that a furnace capable of taking a charge of say 20-in. diameter carbons requires to be of very large dimensions. The particular furnace referred to is installed in a large steel works in the Midlands, whose output of electric steel exceeds 30,000 tons per annum. The heating chamber measures 9 ft. wide by 6 ft. back to front by 9 ft. high, and is designed to accommodate six electrodes at a time of sizes up to 22 in. diameter. The furnace is constructed of a special quality refractory material, with walls 9 in. thick. A supplementary access door, 2 ft. by 2 ft., is fitted at one end for the purpose of removing electrodes which may be accidentally broken during insertion, and it also provides a convenient means of effecting slight repairs. The top of the furnace, or cover-plate, is in two parts, of box section, and, in addition to providing for the insertion and support of the electrodes, it serves as a pre-heater for the air supply taken by the burners. The burners, of which there are six in all, three on each side, are of the makers' so-called "fan-air" type, for consuming gas at town pressure under a slight supplementary air pressure of about 6 in. water column. If necessary, this type of furnace can be arranged with the heating chamber divided by a central partition wall, which enables two kinds of electrodes requiring different annealing temperatures to be treated at the same time.

LEGAL.

Gilling v. Epsom Urban District Council.

This action came before Mr. Justice Bray in the King's Bench Division on February 25th, upon a special case referred to him upon points of law as to the liability of the Council to pay Mr. A. C. Gilling, its electrical engineer, salary during his absence in the Army, in accordance with a resolution passed at a meeting of the Council subsequent to his enlistment.

Mr. Kerr appeared for the plaintiff, and the defendant Council was represented by Mr. Courthope Monroe, K.C.

From the statement of plaintiff's counsel it appeared that he claimed (1) a declaration that he was entitled to recover from the defendants half salary as chief electrical engineer to the defendant Council as from February, 1916, (2) an account, (3) payment of the amount found to be due on taking the account, and (4) alternatively, damages for breach of contract. From the position of second assistant engineer plaintiff was in October, 1908, appointed chief assistant, and in July, 1909, he became chief engineer. His remuneration rose from £200 a year to £250 by annual increases of £10. He continued to perform his duties till September 3rd, 1914, when he joined His Majesty's Forces. On September 8th, 1914, the defendant Council passed the following resolution:

> In the case of men and officers in the ordinary and continued service of the Council on and since July 4th, 1914, the Council provide for payment to them or their representatives during their absence from duty of their full regular pay, less a deduction on account of their Army or Navy pay (exclusive of allowances), with a minimum in all cases of not less than half of such full regular civil pay, and that their situations be kept open.

From September 8th, 1914, to September 3rd, 1915, the Council paid the plaintiff his full salary of £250 per annum, less 1s. a day, the amount of his Army pay. On September 3rd, 1915, plaintiff accepted a commission, and from February, 1916, his Army pay exceeded his salary. On February 8th, 1916, the Council passed a resolution rescinding their former resolution relating to the war-pay of employés, and directing that with their Army pay and allowances their income should be made up to the amount of their employment pay. The payments to the plaintiff were allowed by the auditors of the Local Government Board, and the questions now submitted for the decision of the Court were (1) whether the resolution of September 8th, 1914, amounted to a contract with the plaintiff which was binding upon the defendant Council, (2) whether the resolution was binding upon the Council under the provisions of the Local Government Board (Emergency Powers) Act of 1916.

Counsel, continuing, said that before he joined the Forces plaintiff expressed his intention of volunteering to the Chairman of the Council, and he (the Chairman) replied: "All right, you go ahead," or something to that effect. His first point was that outside the Statute there was a contract which was binding upon the Council. The plaintiff volunteered, and the Council passed a resolution that it would pay the volunteers. Immediately after he had volunteered the resolution was passed, and he was treated as a person to whom the resolution applied. He got his half-pay for five months, and the auditor of the Local Government Board allowed it. Counsel contended that the resolution was binding upon the defendants, and could not be rescinded so far as plaintiff was concerned without his consent.

His Lordship: If he is released from his duties, where is the obligation upon the authority to pay?

Mr. Kerr said that plaintiff was released from business for a certain purpose, and his engagement as an engineer was not terminated. His place was kept open, and he was told that in the meantime he would receive certain payment. They said, "We don't regard you as having terminated your engagement, but as having leave of absence." Assuming that there was a consent that he should go, it was an agreement that he should go, and having agreed to pay half his wages, they could not now turn round and say "this is not binding upon us." If there was not a binding contract, the resolution was binding under the Statute.

His Lordship said he would like to help the plaintiff if he could, but he was afraid he could not.

Mr. Courthope Monroe, K.C., for the Urban District Council, said he did not want it to be supposed that the Council had acted harshly in this matter; but it wanted to have the point decided. When plaintiff went out to the war, the position of the local authorities was very doubtful, and they were not put in a legal position until the passing of the Act of 1916. Owing to the action taken by different local authorities it became necessary to put the matter on a legal footing. In the first place, they said they would only consider the pay and not the allowances in calculating the amount they would give, but they also had to take into account the allowances. The Act of 1916 said that so far as the money had already been paid it should be binding on the local authorities. That left the non-inclusion of the Army allowances in the air, and they would still be liable to be surcharged unless the Local Government Board sanctioned the payment. The payments went on until May 17th, and the whole benefits which the Corporation could confer had been received by the plaintiff. He never had any contract with the Council, because it could not contract until the Act was passed.

His Lordship said that when there was no consideration the contract would not be binding.

Mr. Kerr said that the mere fact the formal resolution of the Council was not passed until after the plaintiff had taken steps to join the Army should not bar him from the privilege. He contended that in joining the Forces plaintiff had the consent of the defendants, and that the promise defendants then made was binding.

His Lordship, in giving judgment, said that the resolution of the Council did not amount to a contract which was binding upon the defendants so far as the plaintiff was concerned. If the resolution had been passed before the plaintiff joined the Army it might be construed into an inducement to him to join, and that would amount to a contract, but the resolution was not passed until afterwards. The resolution clearly did not make a contract. It was said that he left with defendants' consent, but that did not bind the Council to go on paying his full wages. There would therefore be judgment for the defendants, with costs.

THE SALARIES OF ELECTRICAL STAFFS AT ELECTRICITY WORKS.

The application of the Electrical Power Engineers' Association for certain wages and salaries increases to members of the Association was submitted to an Arbitrator, Mr. W. H. Stoker, K.C., appointed by the Minister of Labour under the Conciliation Act, 1896, and on February 27th, 1919, an award was made covering the demands of the Association (see Elec. Rev., February 21st, 1919, p. 224).

The allowance of £90 per annum is to be resognised as a war advance, and all war advances, bonuses, or allowances previously granted are to merge therein, and also in the 20 per cent. increase.

In the case of any employé concerned having first entered the service of any of the undertakings concerned subsequently to July 31st, 1914, and prior to March 31st, 1918, the 20 per cent. is to be paid on the salary or wages paid to him on so entering, minus any proportion as may represent war wages, bonuses, or allowances, but plus any grade, merit, or scale incremental advances between the date of his so entering and March 31st, 1918. Any difficulty arising as to settling this proportion shall be determined by reference to such similar advances as may have been given to other similar employés of the same undertaking between July 31st, 1914, and the date of his so entering, or in default of such examples, by reference to other employés of the same undertaking enjoying wages or salaries comparable with those of the employé concerned. In the event of any difficulty in the settlement of the question on this basis, the matter is to be determined by consultation between the Association and the Federation or Associations to which the undertaking belongs, or if the undertaking does not belong to such Federation or Associations, with the undertaking itself. Failing settlement in this way, the matter is to be reported to the Minister of Labour. The case of employés serving more than one undertaking in the course of the period above mentioned to be dealt with on the same principle or basis as far as applicable.

In the case of grade, merit, or scale incremental advances granted or accruing subsequently to March 31st, 1918, and prior to February 27th, 1919, the 20 per cent. awarded is to apply to, and include also, such increases as from February 27th, 1919, as being part of the wages or salaries on which such 20 per cent. is given.

In the case of any employé concerned first entering the service of any of the undertakings concerned subsequently to March 31st, 1918, the 20 per cent. is to be given on the salary or wages paid him on entering, minus such proportion thereof as represents war wages, bonuses, or allowances, the amount of the same to be determined in the manner mentioned above, plus as from the date thereof any merit, grade, or scale incremental advances given subsequently to his so entering, and prior to February 27th, 1919.

Any employé who has left the employment of an undertaking before the date of the award, but during the period covered by it, is to be dealt with on the principle of his being entitled *pro tanto* to the advances given by the award for the period during which employé was employed.

In the case of composite advances given subsequently to July 31st, 1914, the proportion of such advance given on account of the increased cost of living and attributable solely thereto, shall be determined, as far as possible, in a manner similar to that set out above. Failing settlement the difficulty shall be reported to the Ministry of Labour.

The award shall not reduce the earnings of any of the employés concerned, nor prejudice their position in the case of any undertaking having agreed to pay the advances from an earlier date than March 31st, 1918.

Undertakings which previously to the award had agreed to the terms of the claim are included in the award by virtue of their agreement. In the case of any such undertaking as regards which the Association may have accepted or agreed on a different date for the commencement of the advances given, such acceptance or agreement is to apply, notwithstanding anything contained in this award

The award which is signed by Mr. W. H. Stoker, K.C., is dated February 27th, 1919.

BUSINESS NOTES.

Private Arrangements.—Dunn, Davies & Whitner, Ltd., Electrical Engineers, 92, Cannon Street, London, E.C., and Martell Road, Dulwich, S.E.—A meeting of the creditors of the above was held on February 24th, at Winchester House, E.C. Mr. E. H. Hawkins (of Messrs. Poppleton, Appleby & Hawkins) presided. The Liquidator (Mr. S. R. Worley) stated that he had also been appointed to act as Receiver for the debenture holders. The company was formed last August to take over an existing business as from June 1st, 1918. The business consisted of the manufacturing of zinc pots, and the company proceeded to manufacture batteries for electric torches. The company took over assets valued at £12,174, and undertook to discharge liabilities amounting to £954, or a surplus of assets over liabilities of £11,220. The assets taken over were as follows:—Stock £1,720, machinery £4,080, tools and implements £600, property £1,300 (subject to a mortgage), furniture £700, goodwill £3,504, book debts £225, and cash in hand £44. The vendors received fully paid-up shares for the assets they transferred to the company, while shares for £500 were subscribed for in cash. The company obtained a process for the manufacture of a particular battery, but trouble was experienced in manufacturing it. A contract was obtained for the delivery of 850,000 batteries, but the first lot tendered were rejected on account of a technical fault, and the second consignment shared a similar fate. The third consignment was accepted, but then the war came to an end, and all deliveries had to cease, and the company found itself landed with a quantity of stock. From the outset the company had been financed by the Bank, who, as security, took a debenture over the assets. Most of the money found by the bank had been lost, and it was estimated that there had been a loss on the trading of between £4,000 and £5,000. Possibly the loss exceeded £5,000, as it appeared that certain debts had been over-valued. Had the war gone on the company might have recovered itself. Originally a debenture was issued to the bank for £3,000, and any further advances which might have been made, but on January 19th a fresh debenture for £6,000 was issued to the bank. Mr. Worley added that so far as he was concerned as liquidator, there was very little to liquidate. The net assets were £4,627. It was difficult to say what the plant and machinery would realise. The amount due to the bank was £7,117, and the assets were not sufficient to meet the claims of the bank by £2,489. The claims of the unsecured creditors were £1,999, to which had to be added the unsecured portion of the bank's claim of £2,489, or a total of £4,488 unsecured, to meet which there were no assets available. In addition to the liabilities mentioned, Messrs. Dunn & Davies had advanced the company considerably over £5,000, on account of which no claim was being made. The directors of the concern never drew anything from the company.

The Chairman said the only possibility of the unsecured creditors receiving any return was if the debentures were invalid, or if the business could be sold as a going concern.

A creditor said that he had heard that two offers were being made for the business, and the liquidator said that so far no definite offer had been made to him. When he accepted the position of liquidator he was in hopes of being able to carry through a scheme of reconstruction.

The Chairman suggested that an informal committee of the principal creditors should be elected to assist the liquidator in the winding up of the company, and to consider any offers which might be made for the business. This course was unanimously approved of, and a committee of five of the principal creditors was elected. The voluntary liquidation of the company will therefore be continued. The principal creditors are:—

W. Canning & Co. ...	£580	J. Custin & Sons	£180
Keith & Blackman ...	334	South Suburban Gas Co.	140
Barnard & Sons	218	Vincent & Sons	98
F. Smith	92	Ilford Dry Battery Co.	88
Hill & Co.	61		

The Electrical Trade of Brazil.—This is the title of a pamphlet issued by the British Electrical and Allied Manufacturers' Association (Inc.), 36, Kingsway, W.C.2. It is a report by Mr. John M. Glen, branch manager in Rio de Janeiro of Messrs. Mather & Platt, Ltd., who have permitted its publication. The report was prepared more particularly for the information of electrical manufacturers who desire to extend their trade with Brazil, but, as is pointed out in the preface, some of the suggestions contained in it have a much wider application among firms having overseas connections with other countries. The general conditions of Brazil and its great hydro-electric, and therefore general electrical, possibilities are first described. Mr. Glen says that responsible directors of British firms should visit such countries and study the local conditions for themselves. They would then understand that electrical business abroad is a thing entirely different from that at home. This means that men must be trained and sent out who are willing to follow a newer policy. The author passes a criticism on the electrical trade of Great Britain for manufacturing articles and training men as if the home market were the only one. "To attempt to impose men, materials, rules, and regulations, based on home conditions on a country where the necessities and conven ences are entirely different, is, in the case of Brazil, but t court trade defeat." Mr. Glen says that his report is no intended to be read as an armchair pamphlet, as it is a attempt to quicken manufacturers into the realisation o what the conditions in Brazil actually are. It should lea them to see that they must establish themselves there wit their own engineers. In a section relating to electrical installations, type of current, voltage, frequency, and rule and regulations are reviewed; and other sections cove briefly such matters as water-power installations, railwa electrification, electric motors, switchgear, fuses, wires an cables, lamps, electric light fittings, &c. There is also advic concerning advertising, catalogues, and propaganda, als methods of importing and retailing. The report is undoubtedly a very valuable document prepared by a man who i well qualified to write on the subject.

A German Profit-Sharing Proposal.—Herr Fritz Dunker, a Berlin engineer, contributes to the *D.A.Z.* (January 27th) an article advocating a division of profits between employers and workers. The following example will give an idea of the gist of his proposals:—

If a business which pays Mk.200,000 annually in wages and salaries makes a net profit of Mk.100,000, after deducting 4 per cent. interest on capital—the average annual wage of an employé working eight hours a day being Mk.2,400—and then distributes 50 per cent. of this net profit among the wage and salary earners, their average annual income is increased by 25 per cent. *i.e.*, up to Mk.3,000. The remaining 50 per cent. of the profit is to be divided, one half to go to the employer and the other half, viz., Mk.25,000, to be applied in the amortisation of the business. In a business with a capital of Mk.500,000 in 20 years at latest it would be completely socialised, and the national wealth increased by Mk.500,000 on the valuo of the business.

The Situation of the A.E.G. and the Bergmann Co.—The following are copies of the replies forwarded by the A.E.G. and the Bergmann Electricity Works Co. to questions in relation to the present condition of these undertakings:—

The A.E.G. stated that as the company were not exclusively engaged on Army contracts during the war, but continued the output of peace manufactures as far as circumstances permitted, the transformation from war to peace work was proceeding without serious difficulties. The workmen who had returned from the Front had been reinstated, and as those men who were engaged during the war were being discharged only gradually, the wages bill had very considerably increased as compared with the conditions before the war, especially as the workmen had put forward immeasurable demands since the revolution took place. It was impossible for present conditions to be maintained permanently. The export business, which had been almost entirely destroyed in consequence of the blockade, could not be resumed during the armistice so long as the stoppage of shipping traffic occasioned by England also continued in the Baltic. War orders were cancelled on the conclusion of the armistice, although certain orders were being completed as emergency work at the cost of production. There was no possibility of competing with other countries working under normal conditions under the existing circumstances of wages and working.

The Bergmann Electricity Works Co. reported that the transition from Army to peace manufactures had been completed. In Berlin the extensions carried out for the execution of war orders were only of small extent; but the more considerable extensions at Rosenthal, especially the storage rooms, were partly utilisable for peace purposes. The production of shells and fuses had been discontinued. It was of advantage that the company had been able to continue a large part of peace products during the war, both in the machine and turbine works, and in installation materials. The cable factory was in normal operation, but instead of Army cables, lighting cables, which had to be neglected during hostilities, were being produced. The lamp and meter factories were in normal working, and the automobile factory, which had chiefly turned out heavy vehicles, still had work on hand for months in advance. The principal question was to replace the stocks which had been cleared, although great caution was necessary owing to the uncertainty respecting the future situation of prices. Concerning the supply of raw materials, the company stated that no great difficulties were expected in regard to metals, as the substitutes of which experience had now been gained were still being used, whilst the existing stocks of copper were being spread over a longer period, as a result of the working time of five hours per day and the reduced efficiency of the workmen. Orders for home and foreign account were on hand in sufficient numbers, but it was not possible to manufacture enough owing to the impossibility of utilising the plant during strikes, scarcity of coal and of electrical energy, and the disinclination of the men to work. The five-hours' day is merely due to the shortage of coal supplies.

New Industry in Spain.—Our Spanish correspondent says that the "Sociedad Anonima Petrol" is now installing in Fuentetoba (Soria) a factory for the distillation of petroleum, benzine, gasoline, and lubricants from bituminous slates. An excellent coke residue is obtained, suitable for the fabrication of arc-lamp carbons, carbon brushes, diaphragms for gramophones, &c.

Industrial Unrest and Greater Production.—Referring o the present industrial unrest, Mr. James F. Hope, M.P. Financial Secretary to the Ministry of Munitions), said that he miners' dispute was perhaps only a symptom of a good deal of general unrest that they knew existed about the country, and it was here, he believed, that the people would support the Government in a system of evolution, and not revolution. Whatever form a lasting settlement took it should be borne in mind that there must be as large a production as possible. They could not pay for the war out of banks, but they must be making more money all the time. They could not get all the cost of the war out of Germany. Therefore there must be production and proper reward for production. The greater the production and the greater the money that was made, the greater ought to be the reward, not only of the shareholders, but of the workers. If they could get employers to take the men more into their confidence, and the men to realise that it was to their interest to produce as much as possible and get their rewards for production at the same time, he thought they would get a lasting settlement.—*Sheffield Independent.*

Working Hours and Output.—Speaking at the annual meeting of Mather & Platt, Ltd., Mr. John Platt said that the unrest at present prevailing was much to be regretted, arising as it did from a legitimate desire for shorter working hours. This company had worked the eight-hour one-break day for over 25 years. Sir William Mather introduced the system in 1893, when it was given twelve months' trial. The result was acclaimed by the workers and the management as being so satisfactory that the new hours were definitely established, and had been worked ever since. "I venture to think that if other firms in engineering and other industries had realised the value of shorter hours earlier there would have been less trouble at the present time. The reduction of hours below 47 or 48 per week is also economically possible, provided the workers will welcome the introduction of more machinery and mechanical devices which will increase production, and at the same time do away with many monotonous processes now performed by hand. We must all realise that this country has to face keen outside competition, and unless production is not only maintained, but increased, we shall not be able to hold our own in the world's markets, upon which we, as an island kingdom, must necessarily depend. This year will be a difficult one, but with good feeling and common sense from all parties we should be on the threshold of greater prosperity and happier conditions for all concerned."

Catalogues and Lists.—Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham.—16-page booklet entitled "Electric Lighting and Heating for Ships," giving illustrations of various designs of indication signs, electric light fixtures, "Plexsim" hot bar fires for cabins, convector type heaters for saloons, electric toasters, Simplex punkahs, bulkhead, deck and other lighting fittings. Prices are quoted. Firms in the trade can have copies of the list on application.

The Key Engineering Co., Ltd., of 4, Queen Victoria Street, E.C. 4, have prepared their usual vest pocket celluloid calendar for 1919.

Export Restrictions Removed.—The *London Gazette* for February 28th, contains a further list of export restrictions which have been removed.

Siemens & Halske During the War.—A festival to welcome home the officials and workmen who had returned from the front, was organised by the Siemens & Halske Co. in Siemenstadt, Berlin, on February 13th. After mentioning that 2,600 had fallen out of the total of 46,000 workmen who had been called up for active service, Herr von Siemens referred to the activity of the Siemens undertakings during hostilities. There were, he stated, only 20 wireless stations available on the outbreak of the war, whereas several thousand installations of all sizes existed on the conclusion of the armistice. The Siemens high-speed telegraph connected together all the battle zones, and the equipment provided by the firm was also used in the naval battle in the Skager Rack. The largest aeroplanes were made by the firm. The sum of 34,000,000 marks had been paid on behalf of the workmen at the front, and a total of 70,000,000 marks had been voluntarily paid by the firm during the war. The speaker concluded by remarking that the firm regarded the future with confidence, based upon their cautious financial policy.

Liquidations and Dissolutions.—Standard Cable Manufacturing Co., Ltd., London.—Last day for proofs for dividend, March 18th. Mr. H. de V. Brougham, liquidator, 33, Carey Street, W.C.

Balcke & Co., Ltd., London.—Last day for receipt of proofs for dividend, March 18th. Mr. H. de V. Brougham liquidator, 33, Carey Street. W.C.

British Engineering Standards, Ltd.—A meeting of members will be held at 28, Victoria Street, Westminster, S.W., on March 31st, to hear an account of the winding up from the liquidator, Mr. C. Dresser.

Norman Dickson, Pringle & Co., commercial engineers, 25, Victoria Street, London, S.W.—Messrs. N. Dickson, W. G. Pringle and A. Pringle have dissolved partnership.

Small Tools Order Suspended.—The Ministry of Munitions has suspended the operations of the Small Tools Order, 1918, as from February 28th.

Machine Tool Association.—The report of the Machine Tool and Engineering Association, Ltd., for 1918, states that there are now 189 members. The assets amount to £2,780. The expenditure for the year was £1,135. The question of reorganising the Association has been seriously considered, and the proposals of the Board were to come before the annual meeting on Wednesday.

Steel Prices.—The Minister of Munitions gives notice of the following increases in the maximum prices of steel for home sales, as from March 1st, 1919. The prices are in each case net f.o.t. makers' works :—

Mild steel billets, blooms, slabs,
Sheet and tinplate bars, ordinary quality, £12 5s. per ton.

Small angles, tees and flats,
Extra List E (re-rollers only), £17 5s. per ton.

Small rounds, squares and hexagons,
Extra List G (re-rollers only), £17 5s. per ton.

The steel makers' price for small angles, rounds, &c., remains unchanged at £16 10s. per ton.

Auction Sale.—Messrs. Percy Huddleston & Co. will sell by auction, on March 13th, at Hammersmith, a large quantity of electrical apparatus consisting of motors, fans, cable, telephones, bells, &c. For full particulars see advertisement pages to-day.

Philips Glow Lamp Works.—The financial statement of Philips Glow Lamp Co. shows net profits of 3,020,000 florins for 1918, as compared with 2,680,000 florins in the previous year. It is proposed to pay 15 per cent. on the preference shares; and 51 per cent. on the ordinary shares, as compared with 41 per cent. The directors have purchased four steamers for the transport of the company's manufactures, and a large portion of this expenditure is said to have been already written off the books.

Book Notices.—We have received a copy of No. 2 of *Unity*, the new monthly organ issued by the National Alliance of Employers and Employed. The issue before us (March) contains many short articles on industrial and social subjects by Mr. Whitley, M.P., Mr. Adamson, M.P., Mr. Brace, M.P., Lord Leverhulme, Mr. Dudley Docker, Dr. Saleeby, and others.

Lektrik Lighting Connections. Sixth Edition. London: Messrs. A. P. Lundberg & Sons and S. Rentell & Co., Ltd. Price 9d. net.—No fewer than 55,000 copies of this useful little book have been issued; the present edition is enlarged and improved, and now contains over 240 illustrations. A chapter on improved tumbler-switch controls and modern systems of wiring has been added. A list of 177 holders of advanced and 307 of intermediate certificates is given, but the names of holders of preliminary-grade certificates, numbering 827, are too numerous for inclusion. Messrs. Lundberg pay a feeling tribute of appreciation to the memory of the late Mr. W. Perren Maycock, who collaborated with them most efficiently for seven years as examiner. Arrangements will be made to carry on the examinations.

Trade Announcements.—Mr. C. D. Flint, who was for many years advertising manager for the Ediswan Electric Co., Ltd., has started business as C. D. Flint, Ltd., advertising and printing contractors, at 190, Fleet Street, E.C. 4. Mr. Flint and his brother, Mr. R. K. Flint, are directors. The firm have printing works at Wimbledon, and will use the directors' experience of engineering advertising with the object of brightening and improving such advertising. They will make a speciality also of both the compilation and the production of trade catalogues.

Messrs. Film Booking Offices, Ltd., 22, Soho Square, W. 1, have now opened a wholesale "machinery department" for the supply of cinematograph, electrical, mechanical, and engineering apparatus and accessories. Catalogues are invited.

Messrs. S. Evans & Sons, electrical engineers, of The White House, 1 St. Mark's Road, Maidenhead, announce that Messrs. S. H. and F. W. Evans having been released from the Forces, the business will be carried on as formerly.

Mr. J. R. Collen, late foreman to W. R. Reynolds, has been demobilised from H.M.S. *Tiger*, and has started business as the Maryland Point Electrical Works, at 2a, Water Lane, E. 15.

Mr. F. J. Lock, electrical engineer, of Station Road, Taunton, has resumed business on his release after nearly four years' service in the Army.

The Bradford Armature Winding Co. have commenced business at 479, Manchester Road, Bradford.

The *Financial Times* states that the three following engineering works, engaged in the manufacture of labour-saving material, have amalgamated :—Wellman, Seaver & Head, Ltd., the James Smith Hoisting Machinery Co., Ltd., and the engineering department of Rosebery Owen & Co., Ltd.

The Gattie System.—In a leaflet recently issued, Mr. Gattie's claims on behalf of his system of sorting goods are set forth in the form of "fourteen points," in the course of which it is pointed out that the transport charges in this country are the highest in the world, and impose a heavy handicap on our industries, the loss on the railways at present being estimated at 80 millions sterling per annum. Demonstrations of the system are given every Wednesday morning at the works of the New Transport Co., Ltd., in Battersea.

The Coal Exports Committee.—Arrangements having now been completed for the merging of the duties of the Coal Exports Committee with those of the Coal Controller, that Committee will on March 8th be dissolved.

Fire.—Damage to the extent, it is stated, of from £3,000 to £5,000, was caused by a fire at the works of the St. Helens Rubber and Cable Co., Ltd., Warrington. The damage by fire was confined to the testing department.

Bankruptcy Proceedings. M. M. Soesan, electrical case fitter, 17, Museum Chambers, Bury Street, London, E.—Receiving order made, March 1st, on debtor's own petition. First meeting March 12th: public examination, April 8th: both at Carey Street, W.C.

A. Matson, electrical engineer, Stockton-on-Tees.—Supplemental dividend of 1s. 9½d. in the £, payable March 7th, at the Official Receiver's Office, Middlesbrough.

Lyons Fair.—Bastian Quartzalite fires and heating apparatus are being shown at the Lyons Fair by l'Appareilage Electrique Grivolas, the French agents of the Bastian Electric Co., Ltd., of London.

Converter Plant Control Order, 1918.—The Ministry of Munitions has suspended the operation of the above Order as from March 4th.

Reduction of Capital.—Sanders Rehders & Co., Ltd.—A petition for reducing the capital from £75,000 to £42,300 is to be heard on March 25th.

LIGHTING AND POWER NOTES.

Accrington.—Proposed Extensions.—The Electricity Committee has decided to engage Mr. Robert Blackmore, M.I.E.E., to report upon the proposed extensions at the electricity works.

Barmborough.—Mains Extensions.—Plans have been submitted to the Doncaster R.D.C. for the laying of a H.T. cable from the Mauvers Main Colliery to Barmborough; the matter will be reported upon at the next meeting.

Bexley.—Proposed New Station.—The electrical engineer suggests the establishment of a central generating station for Bexley Heath, Dartford and Erith, or, alternatively, the acceptance of a part supply in bulk from the adjoining authority, which will enable the Council to carry on until it is known what is actually to be done under the B. of T. scheme.

Birmingham.—New Power Station Site.—Further particulars are now available of the site for the future power station, referred to last week. In its report the Electric Supply Committee states that about 12 months ago the Director of Electric Power Supply of the Ministry of Munitions requested the Committee to consider the electric power requirements of Birmingham and the surrounding industrial districts, and the possibilities of supply therein. The investigations made it clear that whilst Birmingham was well situated for an ample coal supply, it was restricted as regarded water for condensing purposes. Prof. Boulton, of the University, indicated that the two possible sources of water for supplying cooling towers were the Staffordshire mines drainage water and the sewage effluent running to waste at Minworth. The amount there running to waste was ample for dealing with a station of 900,000-kw. capacity. The Hams Hall Estate is said to be ample to accommodate a station of 900.000-kw. capacity; it provides sufficient coal storage space, whilst the low-lying land could be used as an ash dump.

On the E.S. Committee's report, the chairman moved that the offer of Lord Norton to sell the estate be accepted, and that the Finance Committee be instructed to apply to the L.G.B. for sanction to borrow £38,000 to cover the purchase money. The new station, he said, was not required immediately, but the Committee was looking forward ten or more years. The justification for the proposal was to be found in the continuous growth of the electricity supply department. This year the gross revenue would closely approach a million sterling. Since the outbreak of war the revenue and output (160 million units per annum) had more than doubled. They could only judge of their future requirements by past experience. At the same rate of expansion, which might, however, be accelerated, the Nechells station would meet the city's requirements for 15 years. With regard to coal and water, last year they burned 314,000 tons of coal at a cost of £298,000. At Summer Lane there was in daily circulation nearly 30 million gallons of water, while at the new permanent station at Nechells, when developed to its full capacity, it was estimated there would be 84 million gallons in daily circulation. The presence of the sewage effluent was the determining factor in the selection of the Hams Hall Estate, the price of which was fair and reasonable. The report was approved without discussion.

Bolton.—Proposed Extensions.—The T.C. has been recommended by the Electricity Committee to apply for a loan of £150,000, for extensions at Back-o'-th'-Bank generating station.

Linking-up Scheme. The L.G.B. has given sanction to the T.C. to borrow £7,500, for the purpose of linking-up the municipal electricity undertaking with that of the Lancashire E.P. Co.

Bradford.—Electric Cooking.—On February 21st and 22nd, the Lord Mayor entertained 1,400 repatriated prisoners of war to dinner. 700 dinners were served each night, and the whole of the food was cooked electrically.

Proposed Extensions.—The electricity department has signified its willingness to supply electricity in the Idle and Thackley districts as soon as there are sufficient prospective consumers.

Bray.—Proposed Extensions.—The U.D.C. has decided to apply for L.G.B. sanction to a loan of £5,000 for extensions of plant at the electricity works.

Burnley.—Hours of Labour.—In accordance with an agreement entered into between the Lancashire and Cheshire electricity undertakings and the Trade Unions, the T.C. has decided that the 47-hour week for employés of the electricity undertaking shall come into operation immediately.

Canada.—Electricity Statistics.—The Dominion Water Power Branch of the Department of the Interior, in conjunction with the Bureau of Statistics, has prepared a report on the present position of electricity supply in the Dominion, and the following is abstracted from a synopsis published in the *Electrical News*:—The total number of central stations on January 1st, 1918, was 666, of which 323 were company owned and 343 municipal. A large proportion of these took a supply in bulk from the Ontario Hydro-Electric system, and the number of actual generating stations was 470, of which 296 were company owned and 174 municipal. The plant installed was rated at a total of 1,844,571 h.p., of which 78·3 per cent. was company operated and 21·7 per cent. municipal; 1,652,661 h.p. was derived from water power, 180,200 from steam plant, and 11,710 from gas and oil plant. The average horse-power per thousand of population was 221 for the whole of the Dominion, Yukon having the highest of any Province, with 1,206 h.p. per thousand. Of the total electrical energy generated in Canada, 89·6 per cent. was derived from water power. The total number of employés engaged in central stations was 8,847, with salaries and wages aggregating $7,777,715 per annum. The capital invested in the electricity supply industry was $356,004,168, and the revenue from the sale of electricity in 1917 was $44,536,848. The average cost per horse-power installed, including capital charges, &c., was $193. The cost of construction of hydro-electric stations per installed horse-power, omitting distribution systems and similar charges, was $69·11.

Chelmsford.—Price Increase.—The B. of T. has informed the T.C. that the Order authorising the E.L. Co. to increase the price of electricity does not empower the company to make a minimum quarterly charge.

Chester.—Hydro-Electric Installation.—The borough electrical engineer, Mr. S. E. Britton, has issued a report on the working of the Corporation electricity department for the five years ended October 20th last, which contains the following comparison between the hydro-electric and steam installations:—

	Hydro-Elec.	Steam.	Total.
Units generated	8,622,015	9,625,819	18,247,834
,, used on works	354,986	1,763,804	2,118,290
,, used in distribution	967,600	939,200	1,906,800
,, sold	7,299,429	6,923,315	14,222,744
Generating costs	£5,370	£25,957	£31,327
Capital expenditure	£18,473	£55,992	£74,465
,, charges	£5,240	£16,215	£21,455
Income from sale of energy	£59,612	£56,510	£116,152

The great difference in the generating costs is largely accounted for by the cost of coal, of which 18,895 tons were used, at a cost of £16,217; it is estimated that the hydro-electric plant is saving between three and four thousand tons of coal per annum. The average price received for energy from the combined systems was 1·96d. per unit. The existing water power installation is capable of developing 600 h.p., and at times the maximum flow of water at the weir amounts to 2,800 h.p. Although the whole of this could not be economically developed, the engineer recommends that further steps be taken to utilise water power.

Continental.—Spain.—Our special correspondent in Spain writes:—Don José A. Gayoso has been authorised to use 2,000 litres of water per second from the River Neira. He proposes to construct a canal 1,309 metres long, and will thus obtain a fall capable of developing 200 h.p. during the dry season. Two turbo-generators will be installed, and the energy generated will be used to augment the existing supply in the town and district of Sárria. Energy will be transmitted from the new power house at 10,000 volts pressure.

The use of 20,000 litres per sec. from the River Aragon at a head of 18·1 metres, has been granted to Messrs. Mugica, Arellano y Cia at Gallipienzo (Navarra) for industrial purposes.

The proprietors of the Central Eléctrica, of Quiros, solicit the use of 1,000 litres per sec. from the River Ricabo. The water would be conducted by a canal 1,362 metres long to the existing power house.

Don Juan Uria has asked for the concession of 4,000 litres per sec. from the River Quiros, for the production of motive power for industrial uses. It will be necessary to build a dam across the river, and a canal 3,304 metres long. On account of the rough nature of the country, nine tunnels must be cut for the passage of the canal.

A concession has been granted for the utilising of the water power of the River Araguil, near Asiain (Zaragoza), for the generation of electricity.

Germany.—A large State-controlled scheme for the generation and supply of electrical energy in Germany is said to be in course of preparation by the German Ministry of Finance. The aim is to bring about the most economical and most rational exploitation of Germany's sources of generation of electricity. There are in Germany over 4,000 electricity works, and according to the *Engineer*, the less profitable concerns are to be abandoned, and those more favourably placed are to be helped and extended. The country is to be divided into a number of supply districts, within which the different works will be made to co-operate so as to avoid undesirable competition. The scheme comprises the exploitation both of the coal deposits in Northern Germany and the water power in the more southerly districts.

Strike.—The Independent Socialist Party declared a general strike in Berlin on Monday. The electricity supply was cut off in several districts, and the tramway system ceased working.

Coventry.—Extensions.—The Electricity Committee recommends that a cable be laid, at an estimated cost of £15,260, to the new works of the Peel-Conner Telephone Co., which is to undertake to take a supply for at least three years, and that at least £8,000 be paid per annum for the supply.

Dundee.—Proposed Extensions.—The Electricity Committee has obtained 190 poles of land, in the neighbourhood of the Carolina Port generating station, for extensions.

Edinburgh.—Consulting Engineer's Fees.—At a meeting of the T.C., the chairman of the Electricity Committee, in reply to a question, said that the remuneration of the consulting engineer in connection with the new Portobello power station would receive consideration. The Lord Provost remarked that 4 per cent. on a capital expenditure of £1,000,000 amounted to a large sum, and the point was worth looking into.

Faversham.—Extensions.—The R.D.C. has consented to the T.C. supplying electricity to the shipyard of J. Pollock, Sons and Co., The Brents, and to premises at Ospringe, which is outside the borough.

Grimsby.—Proposed Extensions.—In view of the fact that the Corporation and the Great Central Railway Co. require additional plant for their generating stations, the Corporation has decided to ask the Railway Co. if it will take a bulk supply from the Corporation's station.

Halifax.—Salaries.—The Electricity Sub-Committee has recommended that the application of the E.P.E.A. for increased salaries for the technical staff be granted, and that payment be made from March 31st last.

Mains Extensions.—The Tramways and Electricity Committee has been authorised to lay about 1,000 yards of E.H.T. mains to Hebble Mills, and to install the necessary switchgear and transformer, at an estimated cost of £905.

Haslingden.—Proposed Extensions.—The Tramways and Lighting Committee has decided to apply to the L.G.B. for sanction to a loan of £2,000 for services.

Herne Bay.—Mains Extensions.—The U.D.C. has consented to the laying of underground mains for the supply of electricity for lighting and power by Messrs. Hunt & Sons.

Heywood.—Price Increase.—The T.C. has decided to increase the charges for electricity from April 1st by 10 per cent. for lighting and by 5 per cent. for power.

Hull.—New Plant.—The Electricity Committee has authorised the acting electrical engineer to purchase a motor and switchgear, at a cost of £5,805.

Garden City Lighting.—The Committee has decided to canvass the residents of the Garden City with reference to installing electric lighting, and to consider the question in connection with new housing schemes.

Ilford.—Street Lighting.—The borough electrical engineer has reported that a large number of public lamps and fittings require renewal, and recommends that the new lamps be fixed on brackets, instead of on the poles at present in use. He also recommends that the public lamps, which are at present controlled by 30 switch pillars, be connected to the works and controlled from there.

Ireland.—Lighting Restrictions.—Owing to the increased supplies of coal, the Lighting Restrictions Order has been considerably relaxed.

Leicester.—Proposed New Plant.—The Corporation electrical engineer (Mr. T. R. Smith) has reported that the demand for electricity continues to increase, and that the generating plant is already fully loaded. As the proposed new station cannot be in operation for at least three years, he suggests the installation of a 5,000-KW. turbo-alternator, with accessories, and the replacement of the six old boilers by two large modern water-tube boilers, with economisers, &c., at the Aylestone station, to cope with the load during the next two or three years. The whole of this plant could be moved to the new station when available. One firm has offered to deliver the turbo-alternator, &c., within four months; the total cost is estimated at £100,000. The maximum capacity of the existing plant is 8,750 KW., and it is often called upon to supply 10,000 KW., while applications have been received for a further 3,500 H.P., which cannot be supplied. The Corporation applied for sanction to build a new power station in 1917, but owing to war conditions this was refused by the B. of T. The total cost of the new station is put at £140,000, and the Electricity Committee has recommended the Corporation to appply for L.G.B. sanction to borrow this sum, and to promote a Parliamentary Bill for the acquisition of Freeman's Meadow as a site for the power station.

London.—Battersea.—Proposed Loan.—The Finance Committee has recommended the L.C.C. to sanction the borrowing of £15,730 by the B.C., for the installation of a new boiler at the electricity works.

Islington.—Proposed Loan.—The L.C.C. has been recommended by the Finance Committee to sanction a loan of £72,000, for electricity purposes, by the B.C. The loan is in respect of the increased cost of plant, which was estimated to cost £53,000 in August, 1917. The original scheme has not been varied, the excess being caused by the extra cost of labour and materials.

Manchester.—Proposed Price Increase.—The Finance Committee has approved a recommendation of the Electricity Committee that the charges for electricity be increased. The proposed advances are from 40 to 60 per cent. for lighting and domestic purposes; from 50 to 85 per cent. for power; and from 20 to 30 per cent. for large power consumers. The charges for the hire of motors and for the delivery and fixing of new motors are to be increased by 25 per cent.

Morecambe.—New Plant.—The Electricity Committee has decided to spend £4,000 on new plant.

Peterborough.—Proposed Extensions.—The T.C. has circularised the manufacturing firms within its area, in order to ascertain the probable demand for electricity, and whether it will be justified in carrying out the proposed extensions.

Street Lighting.—The acting electrical engineer has been instructed to attend to the irregular working of the automatic public lighting controls.

Pontefract.—Price Increase.—The Yorkshire Electric Tramway Co. has informed the B. of G. that as from January 1st the price of electricity will be advanced by 20 per cent., with a sliding scale based on the cost of labour and coal.

Salford.—Extensions.—The Electricity Committee has decided to supply electricity to the Malleable Steel Castings Co., Pendleton, at a minimum of £2 per KW. and an annual payment of not less than £800.

South Africa.—Water-Power Rights.—The Rand Mines Power Supply Co. has intimated its intention of applying for Parliamentary authority to use the water to be impounded in the Vaal River by the Rand Water Board. Negotiations with this end in view have been proceeding for the past four years, but no satisfactory agreement could be arrived at between the company and the Board, and the Board has decided to opppose the company's Bill on the ground that it is a direct challenge to its powers in respect of the Vaal River scheme.—*South African Mining Journal and Engineering Record.*

Cape Town.—The city electrical engineer has reported that the condition of the plant causes the supply of electricity to be "critical in the extreme." About 15 months ago the blades of one of the turbo-generators were found to be defective, and an order was placed with the makers for a new set, which was to be received at Cape Town before the end of February. This turbo-generator recently broke down completely, and a new 3,000-KW. set, which was delivered about 15 months ago, was also put out of action owing to the rotor burning out. The supply then depended upon one turbo-generator and two very old Ferranti sets.

Stalybridge.—Proposed Loan.—The Stalybridge, Hyde, Mossley and Dukinfield Electricity Board has decided to apply for L.G.B. sanction to a loan of £92,000 for electricity purposes.

Waterford.—Proposed E.L.—The Corporation has appointed a Committee to consider the acquisition of the local National Shell Factory, with a view to converting it into an electricity generating station.

Watford.—Proposed Loan.—The U.D.C. has applied for a loan of £6,100, for extensions to the electricity distribution system.

Wigan.—Price Increase.—The Corporation has increased the electricity charges, from April 1st, by a further 15 per cent., making a total of 40 per cent. over scale prices.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—Whitley Committee.—The Tramways Committee has approved a scheme for a Works Committee on the Whitley model, for semi-skilled employés.

Colne.—Fare Revision.—The Corporation has adopted a new scale of fares, which includes 1d. for ½-mile stages and 1½d. for 1-mile stages.

Halifax.—Tramcar Alterations.—The Corporation tramcars are to be fitted with covered-glass fronts, for the protection of the drivers.

Huddersfield.—Sunday Service.—The resumption of the Sunday tramway service is still held in abeyance by the action of the men in refusing to work unless they are paid double time for Sunday labour. The T.C. has offered time-and-a-half rates, but this has been refused.

London.—Accident.—A tramway-car and a motor lorry collided in Cambridge Road, E., on Thursday, last week. Four persons were injured and removed to hospital.

L.C.C. Extensions Opposition.—It is said that the City Corporation may oppose the proposed L.C.C. Bill for extending the tramways to link-up North and South London. One objection made is that congestion is likely at a place like Ludgate Circus.

The L.C.C. Highways Committee reports that over 600 tramcars, out of a total of 1,662, are being repaired. During the past few weeks. 288 axles have broken, compared with 127 during the whole of 1914, when more cars were in service. The cause is attributed to the overloading of the cars, the recent frosty weather, and the general depreciation of the cars, due to abnormal war-time conditions. The restricted service due to broken axles will be relieved by the middle of this month, but any further increase depends upon the rate at which spare parts and materials for repairs can be obtained.

Much inconvenience was caused by the failure of the electric power on the L.C.C. tramway system between Camberwell Green and the Elephant and Castle, on Friday morning last.

Manchester.—New Cars, &c.—At a meeting of the Tramway Committee, it was stated that about 50 new tramcars were being built, and tenders for the supply of motors, trucks, bodies, and rails, to the value of £150,000, had been accepted. About 700 employés had been demobilised.

Northampton.—Sunday Service.—After a suspension of about six months, the Sunday service on the Corporation tramway system was resumed last week.

Tramway Men's Wages.—A conference between the Municipal Tramways Association, the Tramways and Light Railways Association, and the National Transport Workers' Federation was held at Birmingham last Friday, on the hours of labour and conditions of employment of tramway men. A discussion took place in private, but it was stated that no real progress had been made A Sub-Committee was appointed to make further inquiries, and to report at another conference to be held at Manchester to-day.

Portsmouth.—Women Employes.—To avoid swelling the ranks of the unemployed, the Corporation is not discharging women tramway workers.

United States.—Strike.—An Exchange message states that the workers on the New York tube railways struck work on Tuesday morning in sympathy with the marine workers, and the tubes under the Hudson River were stopped.

TELEGRAPH AND TELEPHONE NOTES.

Cable Censorship.—Mr. Churchill, replying to a question in the House, said that the Government was very desirous of abolishing the censorship as soon as it was possible to do so, but it was essential that it should be maintained at present. Cable delays did not arise mainly from censorship, but from congestion due to cable interruptions and other causes.—*The Times.*

Cable Delays.—According to the daily Press, City firms report cable delays far worse than during hostilities; the complaint is general. Cables from Singapore and Shanghai are now taking five or six days, and in some cases ten days; from Sydney, nine days; from Melbourne, eight days; and from Pretoria, six days. It is stated that Government departments are mainly to blame for the delays by sending excessively long messages which have priority over private messages.

A cable, last week, took five days to reach London from Amsterdam, whilst a message takes six days to reach Athens and five days more to reach Colombo than before the war. Business people find it quicker and much cheaper to do business by mail rather than by cable. The inland telegraph system is no better; a wire handed in at London took nearly three hours to reach Glasgow, and a Press dispatch took nearly six-and-a-half hours to arrive.

The *Daily Mail* explains that the eastern cable traffic has increased two-and-a-half times on pre-war figures; two of the six cables are interrupted, and the breakdown of the cable between America and the Far East, a few days ago, happened at an unfortunate time. There were interruptions on eight of the twelve cables to Holland. On Saturday news was received that one cable had been repaired in mid-Atlantic.

The Indian Section of the Manchester Chamber of Commerce, at a meeting last week, decided to make urgent representations to the President of the B. of T. and Postmaster-General that cable delays have increased during the last fortnight, and that trade with the Far East is being interfered with.—*The Times.*

France.—The powerful wireless station now in course of construction near Bordeaux by the American Army has been sold by the United States to the French Government.

Germany.—According to a Government announcement, the Imperial Wireless Committee, which was entrusted with the unification of the German wireless system, has created an Imperial Wireless Telegraph Administration, divided into seven departments. The Imperial Postal Administration has appointed Herr Bredow to be director of a special department for wireless telegraphy, which was formerly a section of the telegraph and telephone system. He is to amalgamate the entire wireless telegraph system, including the naval and military stations, so far as they are not imperatively necessary for the purely military service.

In the naval terms of the next and final Armistice, which, according to the *Times*, have been agreed between the Allies, it is provided that the German cable system, comprising 14 cables—European, trans-Atlantic, and Asiatic—will now be returned to its previous owners. The wireless stations of Nauen, Hanover, and Berlin are not to be used for any but commercial purposes. Permission to use these stations for military and political purposes will only be given when the military conditions of the Peace Treaty have been carried out. Meanwhile, the Allies will determine the wave length to be used by German stations, and will supervise the German use of the stations. The same conditions will be applied to the Austrian wireless stations at Vienna, Budapest, and Pola.

Holland.—Owing to the interruption of several of the cables between this country and Holland, an auxiliary wireless service has been provided by the British and Dutch Post Offices, pending the completion of the cable repairs which are now in hand. Telegrams should be marked "*via* wireless." The charge will be the same as for the service by cable namely, 2d. a word.

Wireless in the Air Service.—It is understood that the Government is taking steps to compel commercial airships and aeroplanes to carry wireless telephone or telegraph installations. The larger machines of both types may have to carry both wireless telegraph and telephone installations, the former for accurately fixing their position at night or in fog by communicating with long-distance "compass" stations which give the pilot his angular direction, and the telephones for speaking to passing aircraft and making arrangements with aerodromes for landing.

The Telegraph Service.—In the House of Commons, on Monday, the Postmaster-General stated that the estimated loss on the telegraph service for 1917-18 was about £556,000, but the conditions were abnormal, and the estimate was not an adequate criterion of the normal financial result. A full statement on the subject was to be published soon. Before the war the loss on Press telegrams was estimated at over £200,000, but although there had been a considerable reduction in the volume of Press work, the saving had probably been off-set by the increased cost of materials and wages.

Wireless Telephony.—Mr. Godfrey Isaacs, managing director of the Marconi Wireless Telegraph Co., has informed a Press representative that the company expects early next year to have in operation a commercial service of wireless telephones between London and New York. At first it may be necessary to make the calls from central offices, but the company is hopeful of being able to introduce methods for relaying the messages over private wires. This, it is claimed, will mean that British and American subscribers will be able to carry on a desk-to-desk conversation by merely lifting the receiver off the hook and asking the exchange for the desired oversea number.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Aberdare.—March 3rd. Electricity & Tramways Department. Three double-deck tramcars. (See this issue.)

Australia.—Sydney.—April 28th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. (January 31st.)

Melbourne.—Commonwealth. March 11th. P.M.G.'s Department. Covered and braided wire, schedule 1,510; telephones and diaphragms, schedule 1,505. (February 28th.)

March 18th. Bronze and copper wire, schedule 1,509. (February 28th.)

Queensland.—March 26th. P.M.G.'s Department. Telegraph and telephone material, schedules 447/451 and 453. (February 21st.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

Aylesbury.—Corporation Electricity Department. One 1,000-KW. generating set complete; two 500-KW. rotary converters. (February 14th.)

March 10th. Laying cable and wiring infirmary for the B. of G. Workhouse Master.

Belfast.—March 12th. Electricity Department. Six or 12 months' supply of stores, including electrical items. (February 28th.)

Dublin.—March 19th. B. of G. Supply of electrical fittings for three or six months. Specification from the office of Master of the Workhouse.

Liverpool.—March 17th. B. of G. Electrical supplies for three months for Guardians of Toxteth Park. Clerk to Guardians, 15, High Park Street, Liverpool.

London.—HAMMERSMITH.—March 12th. B.C. Stores for the electricity department for 3, 6 or 12 months. (February 28th.)

'ISLINGTON.—March 19th. Corporation of London. Electrical work at the Metropolitan Cattle Market. (February 28th.)

Manchester.—March 11th. Tramways Committee. Supply, &c., of (*a*) permanent-way special track work; (*b*) permanent way points, tongues, and hardened steel centres. Mr. J. M. McElroy, general manager.

March 11th. Tramways Committee. Stores, including several electrical items. (February 21st.)

Macclesfield.—March 17th. Six months' or one year's supplies of electrical goods for Cheshire County Asylum, Parkside. Mr. G. F. Tingay, Clerk of Asylum.

Mansfield.—Corporation Electricity Committee. 1,250-1,500-KW. turbo-alternator, condensing plant, 500-KW. rotary converter, transformer, and switchgear. (February 14th.)

Rochdale.—March 13th. Tramways Committee. Stores for one year. Particulars from Mr. G. Webster, General Manager, Tramway Offices, Mellor Street.

Stockton-on-Tees.—March 12th. District Fund, Gas and Electricity Committees. Articles and stores for six months. (February 28th.)

Taunton.—Electricity Department. One 500-KW. steam turbine generator, travelling crane, cables and meters. (Feb. 14th.)

Warrington.—March 19th. B. of G. Electrical goods for three months. Mr. A. Bottomley, Clerk, Bewsey Chambers.

CLOSED.

Canada.—The contracts for building the first two new units for the hydraulic development of Niagara River for the Hydro-Electric Power Commission of Ontario have been placed with the American House of Wellman, Seaver & Head. Ltd.. of London. These units are to develop 52,500 H.P. each, and will be the largest which have yet been installed.—*Birmingham Post.*

Leicester.—T.C. Accepted:—

One 5,000-KW. turbo-alternator, switchgear, two 1,000-KW. rotary converters, condensers, superheaters, economisers, stokers, steel chimneys and pumps, &c., £80,000.—Messrs. Dick, Kerr & Co.

Manchester.—The Tramways Committee has accepted tenders to the amount of £150,000, for tramcar motors, trucks, bodies and rails. 50 new cars have already been laid down, out of the first instalment of 100.

Salford.—Tramways Committee. Recommended:—

12 M.I. gear cases, £98; 12 do. do. £107.—British Westinghouse Co.
72 life-guard cradles, without laths, £144.—Joseph Bowring.
Electrically welding and retreading 400 track joints, £1,000 (approx.).—Rail Welding Co.

Electricity Committee. Accepted:—

700 yd. ·1 sq. in. cable, at £497.—W. T. Glover & Co.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, March 7th. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Warming Buildings by Hot Water," by Mr. M. H. Jones.

Manchester Association of Engineers.—Saturday, March 8th. At the Grand Hotel. At 6.30 p.m. Paper on "Automatic Machines," by Mr. H. E. Thomas.

Birmingham and District Electric Club.—Saturday, March 8th. At the Grand Hotel. At 7 p.m. Paper on "Electric Welding as a Commercial Proposition," by Mr. H. W. Wolton.

National Foremen's Association of Engineering and Allied Trades (West London Branch).—Saturday, March 8th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

Royal Institution of Great Britain. Saturday, March 8th. At Albemarle Street, W. At 3 p.m. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Prof. Sir J. J. Thomson.

Chief Technical Assistants' Association.—Saturday, March 8th. At 3 p.m. At Anderton's Hotel, Fleet Street, E.C. Annual general meeting. Adjourned discussion on "Problems in Connection with Linking-up."

Royal Society of Arts.—Monday, March 10th. At 4.30 p.m. At John Street Adelphi, W.C. Cantor lecture "Fuel Economy," by Prof. W. A. Bone, F.R.S. (Lecture 1.)

Wednesday, March 12th. At John Street, Adelphi, W.C. At 4.30 p.m, Paper on "Electric Welding and its Applications," by Mr. W. L. Lorkin.

Thursday, March 13th. At John Street, Adelphi, W.C. At 4.30 p.m. Paper on "The Report of the Indian Industrial Commission," by Mr. D. T. Chadwick, Indian Trade Commissioner.

Society of Engineers (Inc.).—Monday, March 10th. At 5.30 p.m. At the Geological Society, Burlington House, Piccadilly, W. Paper on "Experiments with Clay in its relation to Piles," by Mr. A. S. E. Ackermann, B.Sc.

Industrial Reconstruction Council.—Tuesday, March 11th. At the Institute of Journalists, Tudor Street, E.C. At 6 p.m. Conference on "Labour Conditions in Relation to Future Industrial Prosperity," to be opened by Capt. J. O. Grady, M.P.

Institution of Civil Engineers.—Tuesday, March 11th. At 5.30 p.m. At Gt. George Street, S.W. Discussion on the following papers: "Electric Welding Developments in Gt. Britain and the U.S.A.," by Major J. Caldwell and Mr. H. B. Sayers: on "Experiments on the Application of Electric Welding to Large Structures," by Mr. W. S. Abell; and on "The Application of Electric Welding to Ship Construction and Repairs," by Mr. J. R. Smith.

Association of Engineers-in-Charge.—Wednesday, March 12th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "Recent Developments in Engine Steels," by Capt. L. Aitchison.

Institution of Electrical Engineers.—Thursday, March 13th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Lecture on "Dielectrics in Electric Fields," by Mr. G. L. Addenbrooke.

(North-Eastern Centre).—Monday, March 10th. At the Mining Institute, Newcastle-upon-Tyne. At 6 45 p.m. Discussion on "The President's Address to the Territorial Centres."

(North Midland Centre).—Tuesday, March 11th. At the Metropole, King Street, Leeds. At 7 p.m. Paper on "The Effect of Air and Water on Material used in Engineering Works," by Mr. H. E. Yerbury.

(North-Western Centre.)—Tuesday, March 11th. At 7 p.m. At the Engineers' Club, Manchester. Paper on "Large Power Transformers," by Mr. A. G. Ellis and Mr. J. L. Thompson.

(Scottish Centre).—Tuesday, March 11th. At Princes' Street Station Hotel, Edinburgh. At 7 p.m. Paper on "The Functions of the Engineer: his Education and Training," by Lieut. Bt.-Col. W. A. J. O'Meara, C.M.G.

NOTES.

British Scientific Products Exhibition, 1919.—The King has consented to act as Patron of the British Scientific Products Exhibition, 1919, which will be held at the Central Hall, Westminster, during the month of July. The president of the Exhibition is the Marquess of Crewe. K.G., and Prof. R. A. Gregory is chairman of the Organising Committee.

The British Science Guild has been encouraged to organise this Exhibition by the success which attended that held at King's College last summer, and the more recent Exhibition at Manchester. Now that many inventions can be shown which could not be put before the public during the war, there is every prospect that this year's Exhibition will be even more successful than its predecessors. The objects of the Exhibition will be to illustrate recent progress in British science and invention, and to help the establishment and development of new British industries. Firms desirous of exhibiting are invited to communicate with the Organising Secretary, Mr. F. S. Spiers, 82, Victoria Street, London, S.W. 1.

National Electricity Supply.—The scope of the Ministry of Ways and Communications which it is proposed to set up, was explained to the House of Commons on Wednesday last in a 10 minutes' speech, by the Home Secretary. The new Ministry is, it is proposed, to take control of the electricity supply, tramways, railways, light railways, canals, waterways and inland navigation, roads, bridges, ferries. vehicles, and traffic regulations. In addition the Bill also gives the new Ministry control of public services, taxicabs, harbours and docks, piers, and possible acquisition of all or any. Mr. Shortt explained that the new Ministry could not nationalise the railways on its own initiative; any such proposal would have to go first before the House. Regarding the proposal to control electricity supply, he admitted that at first sight that might excite differences of opinion, but he pointed out that "transport was probably the biggest and most permanent customer for electricity," and that the success of transport undertakings depended on the development of the industry of the country. The more industry, through the provision of cheap power, was enabled to increase its output, the more the transport services would prosper, and therefore there was every inducement for the railways to see that every manufacturer who could improve his business by the use of cheap power should be enabled to get that power. The Bill will apply to the whole of the United Kingdom.

In the House of Commons on Wednesday, in reply to Mr. George Terrell, Mr. Bridgeman (Secretary, Board of Trade), said that the President of the Board hoped that it would be possible to introduce a Bill dealing with the supply of electricity in the course of a few days.

Coal Control.—The President of the Board of Trade has appointed Sir Evan Jones, Bart., M.P., Controller of Coal Mines, in succession to the late Sir Guy Calthrop. Mr. W. A. Lee will continue to act as Secretary of the Department, and will be responsible for dealing with export and prices questions.

U.S. Scientific Attaché in London.—According to the American journal *Science*. Major C. E. Mendenhall has been appointed Scientific Attaché to the United States Embassy in London, and will come to England almost immediately. Major Mendenhall is Professor of Physics in the University of Wisconsin. and has been given leave of absence for the purpose. It is expected that he will be able to supply his Government with valuable information as to the progress of scientific research in this country, especially in its industrial applications.—*The Times*

Miners' Electric Safety Lamps.—At a meeting of the North of England Branch of the National Association of Colliery Managers, at Newcastle-on-Tyne, in November last, the Branch President's "Notes on the Ceag Miner's Electric Safety Lamp" were submitted for discussion. Replying to criticisms advanced at previous meetings, the author said that he thought lightning arresters ought to be installed in all collieries where charging stands were used. Referring to cell explosions due to the leakage of acid through a punctured cell, he described the following experiments that he had made. A cell was filled with acid of a specific gravity of 1.250, which was allowed to escape through the cell being punctured at its base. In ten seconds after the cell was empty brilliant arcing was noticed about the cross, and smoke was given off; this continued for 50 seconds. During the next six minutes only a small quantity of smoke was given off; then arcing was again noticed, and a large increase of smoke, which continued for one minute, till a hole 2 in. by ½ in. was burnt through the side of the cell, when it ceased. For the next fifteen minutes a small quantity of smoke was given off, and then increased strongly for six minutes. By this time the bottom half of the case had smouldered away. The cell then collapsed, causing the plates to fall together; simultaneously there was a flash at the contacts at the top of the cell, which caused the already heated cell to catch fire. The duration of the experiment was thirty-five minutes. Another experiment was carried out under exactly similar conditions, and after ten minutes it was found that the cross in the cell was burnt in two places to the extent of ⅜ in. by ⅛ in. In a third experiment the cell was covered as far as possible with sheet mica, the separation cross being dispensed with and mica substituted. With these exceptions the experiment was conducted as before. There was no visible arcing, but a vapour was given off, which ceased after five minutes, and current still continued to pass through the plates. After 30 minutes the current was cut off, and when examined the cell was found to be undamaged, but the mica separator was charred, which probably accounted for the current being able to make a circuit of the plates. During the first experiment recorded above, the sliding rod or variable resistance, which was held in position by a solenoid coil, dropped as soon as the first flash appeared in the cell, and to allow the experiment to succeed the sliding arm had to be held in position. Therefore, it seemed to be highly improbable that a fire would take place through a leaking or dirty cell on the battery, if the sliding arm of the resistance was in good working order. He suggested that with attendance any tendency to fire ought to be detected before any material damage was done. The cross was the danger zone, and in all cases of acid cells he would substitute a mica cross, and also line the cell with sheet mica. By introducing "jellac" instead of the acid this danger was very nearly overcome, because in his opinion, if the acid and "jellac" were mixed in the right proportions, there was practically no leakage or spill, thereby obviating the occurrence of an arc with a fire to follow.

Mr. S. Hare thought that every charging cabin should be divided up into compartments, which should be made fireproof, so that in the event of a cell taking fire in any one compartment it could be dealt with before it extended to other divisions of the charging house.

Mr. G. Raw said that until the celluloid case could be superseded by a non-inflammable one, the danger of fire during charging would remain. The only safe course was to keep the charging cells under proper supervision, and, if possible, in separate partitions. With regard to the "jellac," he regarded its alleged satisfactory results with a certain amount of scepticism, because there was unavoidably a certain amount of wasting of the plates, and unless the resulting sediment could fall to the bottom of the cell clear of the plates, as in the dilute electrolyte, he foresaw trouble with the plates in time.

The Branch President said he had had a cell punctured for six months; very little "jellac" had leaked out of it yet, and no fire had occurred. When a fire took place in the Ceag lamp it occurred at the cross-pieces. If these were kept clean there was no chance of a cell taking fire.

The Metric System in the United States.—At the second annual meeting of the American Metric Association, held in Baltimore on December 27th, and in Washington on December 28th, Mr. David A. Molitor, consulting engineer, outlined his work for the C. E. Schmidt Co., of Detroit, tanners. He found that about 500 different commodities were being purchased for the use of this company, and that they were received in many different units of weight and measure. It became clear that economy would be effected by entering the weight or measure of all material received in metric units. This step was taken with great success. The metric weights and measures were then used exclusively throughout the factory. The output of the factory was increased approximately 50 per cent. with the same working staff. The weighing in one department had previously been done by an expert in the old weights and measures. After the change to the metric system, this work was done by a labourer, with fewer mistakes than formerly. He estimated that a saving of approximately 20 per cent. could be effected in the bookkeeping and calculations of factories which introduced the metric weights and measures throughout.

Dr. C. O. Mailloux, consulting engineer, chairman of the United States Committee of the International Electrotechnical Commission, told of his practical experiences in the use of the metric system in the United States and foreign countries, and described his last interview with Sir John Wolfe Barry. He expressed to Dr. Mailloux his firm conviction of the desirability and necessity for adopting the metric weights and measures in England, and discussed the practical steps contemplated for their general use. Dr. Mailloux pointed out the fact that the electrical units throughout the world were based on metric weights and measures, and that this in itself was indicative of their ultimate adoption for all purposes in America and England.

Mr. Jesse M. Smith, past-president of the American Society of Mechanical Engineers, stated that he had been in close touch with the metric movement for fifty years. He had studied in Berlin during the winter following the Franco-Prussian war; the metric system was then used in the text books, and also for practical work throughout Germany. He had frequently used the metric system in America and other countries since then, and believed it to be only a question of time when the metric system would be adopted in all parts of the world.

United States Senator John F. Shafroth read a Bill which he had introduced in Congress, and asked for a discussion on the subject. This Bill was a step toward the general use of metric weights and measures, making exceptions where such seemed to be advisable for special work. The Bill was endorsed by the American Metric Association.

Secretary of Commerce Hon. William C. Radfield was the principal speaker at the "Metric Dinner," held on the evening of the 27th. After outlining his practical experience as a manufacturer for thirty years, and his travels in other countries in the interests of his export trade, he voiced the conviction that the metric weights and measures should and would be adopted for general use in the United States.

Resolutions were passed expressing the desire of the American Metric Association to co-operate more fully with American industries and trades using and contemplating the use of metric weights and measures, and inviting the co-operation of the universities, colleges, and other educational institutions in bringing in the general use of metres, litres, and grams for the welfare of America.

Colliery Cable Unprotected.—Following a fatal mishap in a mine, when a workman received an electric shock through coming in contact with a pull, or signal wire, William Cary, manager of the Kingston Colliery, Hyde, and William M. Reynolds, managing director of the company, were fined £1 and £5 respectively, at Hyde, for allowing a cable in the mine to be unprotected, and Cary was fined £5, and witnesses' fees, for not adequately preventing the signal wire from touching the cable.—*Manchester Daily Dispatch.*

Radiotelegraphy in the U.S. Navy.—In the annual report of the U.S. Navy, a good deal of the engineer-in-chief's section is devoted to the activities of the Radio Division of the Bureau of Steam Engineering. There are 4,000 installations on naval ships and other craft built and being built, while on shore the Bureau maintains about 210 stations. "The Bureau," says Rear-Admiral R. S. Griffin, "has developed, or assisted in the development of, the use of radio for fire control, the radio-compass, underground radio reception, the distant control of radios-tations, the radio-telephone transmitter, and radio equipment for aircraft. A large number of the units of the fleet have been equipped with radio-compasses and radio-telephone transmitting and receiving sets, both apparatus of the greatest practical value. There are 25 radio-compass stations ashore for locating enemy vessels and unauthorised radio-stations, and for assisting vessels to determine their positions."

The development of radio-telegraphic communication from aircraft in flight to stations on land has been so advanced that it is now possible at a distance of 200 miles, or from land to flying aircraft up to 50 miles, and communication from aircraft resting on the water to points on shore can be effected at a maximum distance of 40 miles. The development of a radio-telephone for use on aircraft has progressed to such an extent that it is now possible to communicate from aircraft in flight to land stations at a maximum distance of 60 miles, and from land stations to flying aircraft up to 15 miles.

Electricians and Engineers in Newspaper Offices.—We have received from Mr. W. J. Webb, London district secretary of the Electrical Trades Union, a copy of a new working agreement for electricians and engineers employed in the newspaper offices in the London district. The agreement states that the hours for men on day work are to be 47 per week, and on night work 42; day work is comprised between 8 a.m. and 6 p.m., and night work between 6 p.m. and 6 a.m. Overtime is to be paid for at the rate of time and a half for the first four hours, and double time afterwards. The minimum wages are:—

	Day.	Night.
Electricians (mechanics) and engineers ...	£4 10 0	£6 0 0
Electricians' assistants	£3 15 0	£4 5 0

Other provisions relate to working days, rotating shifts, Sunday papers, &c. The agreement is terminable by three months' notice, and came into operation at the beginning of February. Disputes are to be referred to a joint committee of the Newspaper Proprietors' Association, the Electrical Trades Union, and the Amalgamated Society of Engineers.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following arrangements have been made for the first four informal meetings which, by kind permission, will be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., at 7.30 p.m. :—

March 17th.—Discussion on the Future of Trade Unions as Affecting the Engineering Industry. (Introduced by Mr. F. Pooley.)

April 14th.—Discussion on Electrical Instruments. (Introduced by Dr. R. D. Gifford.)

May 12th.—Discussion on the Regulations Issued by Electricity Supply Undertakings. (Introduced by Mr. W. E. Bradshaw.)

June 2nd.—Discussion on Increased Output, &c. (Introduced by Major Kenelm Edgcumbe.)

Arrangements are being made for visits to works on the afternoons of the above meeting-days (except the first). Particulars will be announced at the first meeting.

At the Irish Centre, on Thursday last week, Mr. G. Marshall Harriss, general manager of the Dublin United Tramways Co., read a paper on the subject of "Irish Rivers as Aids to the Distribution of Cheap Power." Mr. Harriss pointed out the necessity of increasing the output of agriculture—the most important industry in Ireland—in order to compensate for the higher wages and shorter hours demanded by the workers, and stated that for this purpose cheap power was essential. Owing to the cost of imported coal they must utilise water power as fully as possible, and he gave particulars of a proposal which was being considered by the Board of the Dublin and Lucan Electric Railway, to utilise the water-power of the Salmon Leap, Leixlip, to operate the railway. Mr. Harriss said that by this means a gross annual output of 8,385,000 units could be generated, equivalent to a consumption of 10,700 tons of coal. While water power was variable in amount, this drawback could be overcome where a public supply of electricity was available, by drawing from the latter when the water was deficient, and paying back electrical energy when it was abundant. On this basis the extension of transmission lines throughout the country for agricultural purposes would be justified. State aid would be necessary, but private enterprise should also be encouraged and protected.

Institute of Metals.—Mr. C. M. Walter, M.Sc. (chemist and engineer in charge of the Industrial Research Laboratories, Birmingham Gas Department), lectured last week at a meeting of the Birmingham Section of the Institute. After speaking of the electric muffle and oven furnaces of the "wire-wound" and "resister" types, he remarked that in the case of a special design of tubular furnace, the application of electrical heating had been found to give excellent results for certain classes of work, and already a number of such designs had been placed on the market by a Birmingham firm (Messrs. Kynoch) which had taken up the manufacture of electrically-heated furnaces of this particular type.

Electrical Power Engineers' Association (Glasgow Section).—The members of the Section are holding a dinner at the Trades' House Restaurant, Glasgow, on Saturday, March 22nd.

Stoke-on-Trent Engineers' and Engineering Students' Association.—On February 22nd the first annual festival of this Association was held; founded in 1914, it has now 500 members. The Mayor (Alderman W. E. Robinson) presided, and among those present were Mr. R. Smith (president), Mr. W. M. Selvey, Mr. C. H. Yeaman (past president), and Mr. E. Jolley (secretary). In the course of the evening it was urged by Mr. Yeaman that the Association should be represented on the Board of Governors of the Technical School, and Dr. Freeman advocated the foundation of a University College.

A lecture on "The Evolution of a Modern Tramway System" was delivered on February 24th by Mr. F. Bland, of Messrs. Edgar Allen, Ltd., to the members of the Society of Engineers and Metallurgists, at the Applied Science Department of Sheffield University.

The Electrification of Seeds.—In the House of Commons, recently, in reply to a question, the Secretary to the Board of Agriculture, Sir Arthur Boscawen, said the Board had arranged for experiments to test the claims put forward by those interested in commercial processes for the electrification of seeds. The experiments were being conducted at several centres, but, as they had not yet been completed, it was not possible to state what results would be obtained.—*Mark Lane Express.*

The I.E.E. Electrical Appointments Board.—Naturally, in view of the rapidity with which demobilisation is taking place, candidates for employment in civil occupations are coming forward in greater numbers than inquiries from employers, and the register of the Appointments Board shows a considerable want of balance. The claims of the engineers who have been fighting our battles to prior consideration need no emphasis but we may suggest as an additional reason for employers to lodge inquiries the fact that those who come first will have the best opportunities of securing the pick of the list, and even if they are not quite ready to proceed with their after-war programmes at the moment, it will be to their advantage to get into touch with the most suitable men without delay. Communications should be addressed to the Secretary, Electrical Appointments Board, 1, Albemarle Street, W. 1.

Parliamentary.—Bedwellty U.D.C. is making application to Parliament for powers to purchase the Rhymney Valley and General Electric Supply Co.'s undertaking, and to carry on the business of the company.

An Electrical Problem.—In a letter to the *Electrical World*, Prof. V. Karapetoff points out that for an aviator to determine away up in the clouds his speed with respect to terra firma, he must have something there that is invariable with respect to the ground, and about the only thing of this kind seems to be the earth's magnetic field. Imagine a long horizontal wire stretched across the aeroplane: an electromotive force will be induced in this wire by the vertical component of the earth's magnetic field, directly proportional to the velocity of the aeroplane. But in spite of the apparent simplicity of such an arrangement, it seems to be impossible to measure this E.M.F. by any known means. The two leads from the ends of the wire to the galvanometer will be cut by the same magnetic field in the opposite direction, and the total voltage registered by the instrument will be zero. Placing these leads in an iron pipe so as to shield them from the magnetic field would not remedy the matter in the least.

"Here is then an interesting practical problem and also an extremely important theoretical proposition about measuring the induced E.M.F. in a moving conductor when the measuring device itself is moving with the conductor."

We may remark that the device would be useless unless the aeroplane were moving steadily either horizontally or at some known angle with the horizontal plane; this could not be determined in a cloud, and therefore the "practical" aspect of the matter is of little moment. But the electrical problem is exceedingly interesting. It is somewhat analogous to the problem of measuring the mass of a body when the experimenter and his apparatus are falling freely under the action of gravitation: this can be done.

Fatality.—At Accrington, on Monday, Charles Knighton (64), a labourer at Messrs. Howard & Bullough's works, died whilst attending to the electric motors. He informed another employé that the switch of one of the motors would not act, at the same time pressing the handle out of gear. He then pushed the handle in the opposite direction, and at once fell to the ground, dead.

The International Electrotechnical Commission.—The Central Office of the I.E.C. has been maintained during the war through the generous assistance of the National Committees, with which it has been in direct communication, and is now considering the question of reorganisation of the whole Commission. In order to carry this into effect it will be necessary to have a plenary meeting of the Commission, when various important matters will be considered—such as the question of the enemy countries, which before the war took part in the work of the Commission, and that of filling the gaps which time and other circumstances have unfortunately made in the membership of the various Committees. In the question of nomenclature, for instance, it will be difficult to replace such a delegate as the late Dr. S. P. Thompson. With regard to the rating of electrical machinery, during the war Europe has not been able to devote much attention to research work, and consequently has not made so much progress in the study of insulating materials as the United States. Moreover, certain misunderstandings have arisen owing to the fact that the American and British Committees have, with the very best intentions, in certain cases slightly exceeded the limiting temperatures adopted by the I.E.C. This has given rise to misapprehension on the part of the French Committee, and it has been thought wise to arrange for a meeting of the Special Committee on Rating in Paris just after Easter, rather than wait for a full meeting of the Commission. In this way it is hoped that the difficulties will be surmounted and the foundations laid for a plenary meeting of the Commission. The Central Office is at present engaged in arranging the meeting of the Special Committee, which consists of representatives of Belgium, France, Great Britain, Italy, Sweden, Switzerland, and the United States of America.

The question of graphical symbols in electrotechnics has been under discussion in America, Great Britain, and Italy, and a large amount of preparatory work will be at the disposal of the Special Committee on Symbols.

It is probable that an international standard for the resistance of aluminium will be adopted, in the same way as has been done for copper. The French Committee is also suggesting that the I.E.C. should take up the question of screw lamp sockets and holders. It is becoming more and more important in all international work that a clear-cut distinction be made between standards and detailed specifications.

Manchester Strikes.—Apparently the strike of electricians in the Manchester district was partly based upon a misunderstanding, the employers not having been aware that the apprenticeship demand had been dropped by the Electrical Trades Union, leaving only the minimum wages question for settlement. The members of the Union are balloting on the question of a general strike in the district in support of the men who are out.

The strike at Messrs. Crossley Motors, Ltd., Gorton, ended last Sunday, when the men decided to resume work on Monday. The strike did not receive official Trade Union recognition. About 3,500 men were concerned in it, and of these 2,000 had returned to work last week.

Copper Prices.—Messrs. James & Shakespeare report March 5th:—Copper bars (best selected), sheets and rods, £118.

Messrs. F. Smith & Co. report March 5th:—Electrolytic bars, £81; electrolytic sheets, no change; electrolytic wire rods, £91; ditto H.C. wire, 11¼d.; silicium bronze wire, 1s. 3½d.

French Company.—La Société des Accumulateurs Fixes et de Traction is the name of a new company which has lately been formed at Romainville, with a capital of £40,000.

Scientific Management.—The demand of Labour for shorter hours and higher wages can be complied with if the workers will abandon restrictions on output; to secure the necessary increased rate of production, however, this alone will not suffice—we must have in all industries greater efficiency, based not so much on individual effort as on scientific management. America has led the way in this respect, and the astonishing results obtained by English firms who have adopted these methods should be more widely known. The Industrial Reconstruction Council has taken up the matter, and at a public meeting held at the Institute of Journalists on Thursday last week, it elected a sub-Committee to arrange a series of fortnightly conferences, which would deal with this subject in all its bearings. Further particulars may be obtained from the Organising Secretary, I.R.C., 2 and 4, Tudor Street, E.C. 4.

Strike Prosecutions.—Referring to the paragraph under this heading in our last issue, Mr. W. T. Weeks writes stating that he and other members of the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers were not on strike, neither had they any intention of supporting the strike; it was owing to their continuing at work that the trouble arose. Mr. Godfrey, he says, walked into their station and called them blacklegs. We regret that an injustice has inadvertently been done to Mr. Weeks and his fellow-Unionists.

The Wage Problem in Industry.—On Wednesday, last week, Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd., delivered a very timely paper before the Royal Society of Arts, in London. There was a sparse attendance—too sparse altogether for the consideration of a paper on such a subject from a man of great industrial reputation, whose sympathies have long been favourable to better conditions of living for the industrial classes. There should have been a far larger audience and a more worthy discussion. Sir G. R. Askwith, K.C., presided, and, referring to the movement among the workers of the country, said the demand was that the results of production should be distributed more equitably. Mr. E. W. Mundy (secretary of the Labour Co-partnership Association), and Mr. Neville Priestley, spoke in defence or support of the co-partnership principle, but the author did not see that co-partnership went to the root of the matter. He agreed with the chairman that the distribution of wealth was the main problem with which the country had to deal, but how was improved distribution to be brought about? Was it to be brought about by a free fight between one section of the community and another, or by some reasoned method? The Government would eventually have to face the responsibility for determining the relative distribution of wealth as between one section of the community and another. The questions now confronting us should not be determined by brute force, but by some kind of impartially-constituted tribunal, and unless public opinion could be educated up to that point the country would remain in the quagmire in which it found itself to-day.

Appointments Vacant.—Two electricians for the Sheffield Corporation Waterworks; overhead wireman for the Ramsbottom U.D.C. Traction Department; meter tester for the Greenock Corporation Electricity Department. The Municipal Tramways Association is inviting applications until March 24th for the appointment of general secretary at not less than £750 per annum. See our advertisement pages to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Highways Committee of the L.C.C. recommends that Mr. J. TERRY, district traffic superintendent (southern section) in the Council's tramways department, be appointed to act temporarily as traffic operation superintendent, with an acting allowance of £100 a year, in addition to his salary of £350, and that Mr. S. R. GEARY, an assistant in the tramways department, be promoted to be a divisional superintendent in the traffic branch at £300 a year, rising to £400.

The staff and workmen at the Swansea Corporation electricity station have presented a silver cigarette case, suitably inscribed, to Mr. F. J. BURGESS, the chief engineer, and a pair of silver vases and fruit-stand to Mrs. Burgess. Mr. Burgess is leaving Swansea, after four years' service, to take an active interest in the firm of Messrs. Burgess and Sons, of Exeter. The borough electrical engineer (Mr. J. W. Burr) presided.

The Hull Corporation Tramways Committee has increased the salary of the tramways manager from £600 to £800 per annum.

Dover T.C. has decided on the following additions to salaries:—Mr. R. C. Harper, borough electrical engineer, to be given a war bonus of £130 from January 1st; Mr. E. W. Smith, works superintendent, a war bonus of £65; Mr. H. E. Osborne, mains engineer, war bonus of £52; Mr. E. H. Bond, tramways general manager, war bonus of £25.

Mr. W. CLOUGH, who recently retired from the management of the Bury tramways department, was last week presented by the chief officials with a silver tea service as a mark of appreciation of his services with the Corporation for 26 years.

Southport Tramways Committee has appointed Mr. E. SIDGWICK, of Rochdale, depôt superintendent at £250 a year.

Mr. C. WATMOUGH, late A.I.D., has been appointed engineer and secretary to the Ingleton Electric Lighting and Power Co., Ltd.

On Saturday, at the electric light works, East Street, Grantham, the staff and workpeople gave a "send off" to the manager, Mr. J. E. EDMUNDSON, and presented him with a silver fountain-pen and wallet. Mr. J Jenkinson made the presentation. Mr. Edmundson, in responding, remarked that health reasons had led him to decide to leave. In a brief allusion to the labour unrest, he said if Capital and Labour worked together that would help to solve many of the problems now engaging the industrial community. If the men had a grievance at any time, he advised them not to harbour it, but to get it off their chests. Mr. Edmundson left Grantham on Monday, and Mr. F. H. Brandreth, of Stamford, takes up his duties as manager this week.

General.—Sir OLIVER LODGE has announced his intention to retire from the Principalship of the Birmingham University at the end of July, in order to make room for a younger man to enter upon his duties with the period of reconstruction. Sir Oliver proposes to devote the remainder of his life to the problem of the Ether of Space.

Mr. PERCY B. SMITH has been demobilised from the R.A.F. after more than three years' service, and has resumed his position as representative of Messrs. Home & Rowland, electrical engineers, of Charlton, London, S.E. 7.

The *Industrial Australian and Mining Standard* states that Messrs. B. WOODFULL, S. G. HALL, and A. H. STONE, engineer assistants in the electric supply department of the Melbourne City Council, who are at present on active service, have been appointed to take advantage of the travelling scholarships established by the Council in 1916. They will spend a year with some leading manufacturer in England. The Council will grant them £50—to cover their return fare, and £1 per week to supplement their earnings while abroad. Those enjoying the privileges of the scholarships undertake to return to the employ of the Council at the end of the term.

The daily Press states that Sir MAURICE FITZMAURICE has retired from the post of Chairman of the Canal Control Committee, and the President of the Board of Trade has appointed Mr. Sydney Preston to succeed him.

Mr. JOHN LEE, postmaster of Belfast, has been appointed Controller of the Central Telegraph Office, London.

Mr. H. M. PEASE, who has for a number of years carried out the duties of assistant manager and sales manager of the Western Electric Co., Ltd., of North Woolwich, has now been appointed managing director.

Mr. C. J. FOX, who has been connected with the British Westinghouse Co., Ltd., for 15 years (nine years as selling engineer in Nottingham and district, and latterly in the Lancashire area), has resigned to take up the position of managing director of Messrs. W. J. Furse & Co. (Manchester), Ltd., electrical and mechanical engineers, 18, Corporation Street, Manchester.

Roll of Honour.—Sergeant D. H. CREEARS, who has died of pneumonia at Charleroi, was employed at the Accrington Corporation electricity works.

Obituary.—MR. A. C. REYROLLE.—The death occurred in Newcastle-on-Tyne, on February 27th, of Mr. A. C. Reyrolle, the managing director of Messrs. A. Reyrolle & Co., Hebburn-on-Tyne. Mr. Reyrolle was a native of Corrèze, France, and was born in 1864. He came to London in his 19th year, and went as an "improver" to Messrs. Lége & Co., scientific instrument makers. In 1886 he opened a workshop in Charlotte Street, where electrical work was carried on, and in 1897 he opened a factory in Pancras Street, Tottenham Court Road. In 1901 he commenced the Hebburn business, and afterwards closed the London works in order to give full attention to the Tyneside business. The manufacture of switchgear is a speciality with the firm, and in this direction, and others, the business has steadily grown until the firm now employs 700 hands, and stands in the foremost rank of switchgear manufacturers. Mr. Reyrolle always took a great interest in his employés, and he recently organised a practical school for the apprentices. He was a member of the Hotspur Lodge of Freemasons. Mr. Reyrolle leaves a widow and a son to mourn his death. The funeral took place on Monday at Elswick Cemetery, in the presence of hundreds of friends and employés.

MR. H. T. BYFORD.—The *Times* "Deaths" Column records the death at Liverpool of Mr. Henry Talbot Byford, A.M.I.E.E.

ALD. J. HEALD.—We regret to state that Ald. James Heald, chairman of the Lancaster Electricity Committee, died on February 27th from septic pneumonia, at the age of 68 years. Mr. Heald served his apprenticeship at Preston as a plumber, and afterwards started business at Lancaster, ultimately adding electrical engineering to it. He had been a member of the Corporation since 1894.

MR. B. DAVISSON.—Messrs. C. A. Vandervell & Co., Ltd., received news of the death of Mr. Bertram Davisson, who was manager of their Manchester depôt before the war. Mr. Davisson joined the Army in 1914 in the Legion of Frontiersmen, and was attached to the Belgian Army. When the

Legion was disbanded he went into the R.G.A., and was out in France till the Armistice was signed. He was practically demobilised, and was about to resume his duties with the firm, when he was seized with influenza, and, pneumonia supervening, he passed away on Saturday last. His age was 31.

Lieut. E. Atherton, M.C.—Lieut. E. Atherton, M.C., who has died in hospital of pneumonia, was on the staff of the British Engine, Boiler & Electrical Insurance Co., Ltd., Manchester.

Mr. H. Bibby.—The death has occurred suddenly, on February 25th, of Mr. Harry Bibby, electrical engineer, of Bold Street, Warrington, aged 34 years.

REVIEWS.

Elementary Mathematics and their Application to Wireless Telegraphy. By S. J. Willis. London: The Wireless Press, Ltd. Pp. 182; 120 figs. Price 3s. 6d. net.

This book of 182 pages, with 120 illustrations, is mainly aimed to meet the needs of that numerous class of capable wireless students of average or fair education who are not conversant with more advanced mathematics. The contents relate mainly to logarithms, geometry, algebra, trigonometry, and vector methods, together with a chapter on the various uses of squared paper for plotting curves. The subjects are not, of course, treated in any approach to a comprehensive manner, but are practically a digest of the portions more especially useful in the solution of wireless formulæ and calculations. Examples of the application of the methods are given in each chapter, but rather few of these treat specifically electrical matters. The value of the book might, it is considered, be enhanced by a greater proportion of the examples being selected from actual wireless problems. The book should prove a useful incentive to wireless students of good mathematical ability and will also, no doubt, be popular among practical men, who, though having an acquaintance with more advanced mathematics, do not keep sufficiently in touch to make full use of its advantages. To the former it should prove a useful "stepping stone" to the closer study of higher mathematics, while to the latter it will serve as a memory jogger and time saver.

The Manufacture of Aluminium. By J. T. Pattison, F.C.S. 1918. Pp. viii + 104; 18 figs. London: E. & F. N. Spon, Ltd. Price 7s. 6d. net.

The manufacture of aluminium in the very nature of things is bound to be more or less of a monopoly in every country fortunate enough to have water-power that can be used for this purpose. Monopoly of effort usually implies monopoly of knowledge, and the electrolytic production of aluminium is no exception to this sad rule. Hence Mr. Pattison is unable to give us here anything more than an "Historical Survey of Processes" in the key chapter of his book, the nature of which is more accurately described by the sub-title—*With Full Notes on Aluminium Alloys, the Analysis and Examination of Aluminium Works Materials, and the Manufacture of Carbon Electrodes.*

From Chapter III onwards, in which the author presents his account of these subsidiary matters, beginning with the last, there is a great deal of extremely useful and interesting information not readily, if at all, available elsewhere, and we are glad Mr. Pattison has thought fit to collect and publish it. These remarks apply more particularly to Chapter VIII, on "The Analysis and Examination of Aluminium Works Materials," which include the greater part of the little book, and which will be found undoubtedly useful to the works chemist. Since the publication of the book a somewhat revolutionary method of aluminium analysis has been described before the Faraday Society by Mr. John Rhodin. It was subject at the time to some severe criticism at the hands of the "orthodox" aluminium chemists, but by the pragmatic test it would appear to have justified itself.

The Applications of Electrolysis in Chemical Industry. By Arthur J. Hall, B.Sc., F.I.C. 1918. Pp. ix + 146; 58 figs. London: Longmans, Green & Co. Price 7s. 6d. net.

This is one of the series of monographs on industrial chemistry, which is being issued under the general editorship of Sir Edward Thorpe. While it was no doubt wise to include a volume on industrial electrochemistry for the sake of completeness, it cannot be said that this book gives us anything that has not already been published in book form. Moreover, the descriptions of processes seem to us to be too slight in most cases to be of practical use, while in many branches of the subject, for example, the electrolytic production of hydrogen and oxygen, where there has been notable advance during the past few years, the author has contented himself with presenting hardly more than an historical survey. We have never understood why it is considered necessary to begin books on electrochemistry with a chapter on "Methods of generating the current." In this instance it seems to be the editor and not the author who is responsible for the idea. To the designer of the generators used in electrolytic processes the information given is obviously useless, while the general student will surely have acquired in other ways the elementary principles of the dynamo. It would have been more useful to occupy the space so utilised with a much fuller discussion of the question of power centres and power costs than the author has allowed himself.

In the chapter on "Electrolytic Refining of Metals," ground is covered that is mostly familiar. Much recent work that has been done in iron refining is not referred to at all. On the other hand, many processes are given, *e.g.*, the Hoepfner process for copper extraction (described in the next chapter, on "The Electrolytic Winning of Metals") which are no longer in use. This fact should be stated. The best chapters in the book are those on "Electrolysis of Alkali Chlorides" and "Hypochlorites, Chlorates, Perchlorates," but these too, suffer from the faults already indicated, and they are undeniably "thin." Two short chapters on the "Production of Inorganic and Organic Compounds" bring the book to a close. In the case of the latter substances the author excuses his brief treatment by reference to Dr. Löb's well-known treatise. But why, then, have written the book at all? A bibliography would have served the purpose!

NEW COMPANIES REGISTERED.

Trolleybus, Ltd. (153,352).—Private company. Registered February 24th. Capital, £100 in £1 shares. As title. The subscribers (each with one share) are:—G. Reader, 35, Coleman Street, E.C., solicitor; W. A. Chadwick, 35, Coleman Street, E.C., solicitor. Table "A" mainly applies. Solicitors: G. Reader & Co., 35, Coleman Street, E.C.

E. Pearson & Sons, Ltd. (153,407).—Private company. Registered February 27th. Capital, £4,000 in £1 shares. Electric and sanitary engineers, &c. The subscribers (each with one share) are:—G. E. Pearson, Nethercape House, Farsley, electrical engineer; F. Laycock, 82, Beech Grove, Lidget Green, Bradford, solicitor's managing clerk. Subscribers appoint the directors. Registered office: Nethercape, Farsley, Yorks.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rangoon Electric Tramway Supply Co., Ltd.—Satisfaction to the extent of £7,507 on February 20th, 1918, and to the extent of £7,655 on February 19th, 1919, of debenture stock dated 1906-13, securing £250,000.

Electrical Distribution of Yorkshire, Ltd.—Mortgage on the undertakings of the company authorised by various provisional orders, and its general assets, present and future, dated February 11th, 1919, to secure all moneys due or to become due from company to Barclay's Bank.

CITY NOTES.

Liverpool Overhead Railway Co. Mr. H. C. Woodward, presiding at the annual meeting on February 25th, referred to industrial unrest, and said that constant disputes and unreasonable demands could only lead to unemployment on a vast scale by preventing enterprise in the shape of new undertakings, and by driving capital out of the country. The traffic of the railway in 1918, after a slight decline in the number of passengers carried in 1917, had again soared upwards. The increase in first and third-class traffic was equivalent to 58 per cent. and 30 per cent. respectively, and the workmen's traffic had increased 19 per cent. The marked increase of traffic had been swallowed up by much heavier expenses, both in labour and materials, and by payments to the Government under the original agreement. The consequence was that they could only repeat the dividends of the previous three years. The year's total expenditure on the railway and tramway was £108,834, an increase of £23,428, due to higher cost of coal, &c. For the increase in workmen's traffic they had added two third-class coaches, but as that traffic was continually growing, the congestion was not diminished to any great extent. The limited length of platforms and small shed accommodation would, they feared, prevent further improvements in that direction. The greatly enlarged traffic and its safe conduct had been a source of anxiety. Their traffic still went on increasing.

Telegraph Construction and Maintenance Co., Ltd. The annual meeting was held on February 27th, at 38, Old Broad Street, E.C. The Earl of Selborne, K.G., who presided, said that their work had continued of the same character as in the previous year—work which might accurately be called national work at high pressure. He congratulated the shareholders on another year's successful working. Their contracts for munitions of war, of course, stopped last November. The last part of the year had been a broken period in which they had been endeavouring to get back to their old work again. During the war they had manufactured 20,000 miles of trench telephone cable, mostly with several conductors; they had also made 19,000 miles of submarine cable, and their ships had been actively employed, generally on most dangerous work, laying, repairing, and diverting cables. The *Telconia* had made 75 repairs to cables, and laid 24 new ones around the English and Irish coasts; both that vessel and the *Colonia* had several times been in close proximity to German submarines, but, thanks to the efficient protection given by the Admiralty, both ships had come through without loss. In addition to that, they had done a good deal of their ordinary work for the maintenance of the cables of the English and other submarine telegraph companies. Their engineering shops had also been fully employed in making munitions of war. All that work had involved running their factories at high pressure and working long hours throughout the war, and their turnover had been larger than it had been for some years. They had only had to pay excess profits tax in one year, and then but a small amount, and last year, owing to the break in their contracts, their profits were slightly reduced, and therefore there would be some return on that account, which would probably leave them all square over the whole period. That was very satisfactory to them, as it had been their policy all through the war to execute all their contracts upon as small a margin of profit as possible, and although they had carried out an enormous amount of work of vital importance they had only made sufficient profit to enable them to maintain their usual dividend. The accounts showed much the same results as they had done for some years. The £140,000 4 per cent. debentures were paid off on January 1st last. The directors decided upon that course, as it would not have been possible to renew the debentures in the present state of the money market without considerably increasing the rate of interest, and the liquid resources of the company permitted of the redemption. The board had had under consideration the question of issuing fully-paid shares in respect of reserves created in the past which were not now needed, and the time seemed opportune once the debentures had been paid off. They therefore decided to ask the shareholders to authorise certain alterations in the Articles of Association which were necessary for that purpose. It must be obvious to them that the present nominal capital of the company was small for the magnitude of the work carried on, and that although they had been paying 20 per cent. for some years upon that nominal capital, the rate of profit which they made upon the actual capital employed was much less. It was, therefore, proposed to double the share capital, and to issue to the shareholders one new fully-paid-up ordinary share for each share held. If that was carried out, the shareholders would have two shares for every one they now held, but as that would not bring any new money into the business, but only capitalise funds already being used, they must not expect to receive any larger cash dividend upon their total holding. Although they had ceased to make munitions of war they were still a controlled company, and had to act entirely on Government instructions in all matters concerning the wages paid to their employés and the hours of work. Their relations with their workpeople had been generally satisfactory throughout the period of the war, and continued to be so. They had plenty of work in hand, and would be glad if they could get on with it quicker, but the difficulties of obtaining material were still considerable. Referring to the labour unrest, his lordship said there were Bolshevists in this country, but there were very few of them, and, in his view, no greater injustice could be done than to confuse for one moment the industrial movement which was causing them so much anxiety with the Bolshevism that prevailed on the Continent. The movement which was now going on here was really mainly one for the improvement of status, and they must always carefully bear in mind that the vast majority of the men who were making these demands were men who had stood absolutely by their side either in the trenches, the coal pits, on the railways, or in the shops, during the whole of the war. Even when the situation seemed most difficult, that, he was sure, was the moment when they should weigh everything the men put forward with the utmost calmness and freedom from passion, and throughout try to bring to bear upon the whole consideration of those vast problems that kindliness which St. Paul told them was the foundation of righteousness.

The report was adopted. Subsequently a special resolution was passed altering certain of the Articles of Association in order to enable the directors to increase the share capital as outlined by the chairman.

Indo-European Telegraph Co., Ltd.

It has now been possible to issue the accounts for 1917. The report says that the interruption of the company's through communications continues, and telegraphic receipts have been limited to traffic over the eastern sections of the company's system. Various parts of the company's line in Russia were isolated or damaged, but they have for the most part been restored. Definite proposals for the re-establishment of the company's route are now before the authorities. The total distribution in dividends for 1917 was brought up to the same level as in previous years by drawing upon the equalisation of dividends fund. Revenue was £123,892, as against £162,274 for 1916 (decrease £38,382). The expenses were £80,778, against £75,329 for 1916 (increase £5,449). The balance, including £10,323 brought forward, is £32,859, and after deducting the interim dividend, it is £22,234, to which is added £25,000 transferred from equalisation of dividends fund. After deducting the final dividend 22s. 6d. per share, making with the interim dividend 7 per cent. for the year, and distributing 30s. per share from the equalisation fund, making a total of £3 5s. per share, free of tax, £3,109 is carried forward to 1918.

Electrical Distribution of Yorkshire, Ltd.

Mr. R. W. Wickham, presiding at the annual meeting in Leeds, said that the prospects for 1919 were brighter than those for 1918. The cessation of hostilities, by permitting labour and material to be released, enabled the board to make extensions of the company's mains which had long been desirable, but had of necessity been deferred. Many demands for supply were now being made, and the revenue from these new consumers and from an unrestricted use of electricity by old consumers, combined with the increased charges, would, it was hoped, help to the resumption of that steady expansion of business which had been a feature of the company's trading in past years. The extensions of mains would require additional capital, and an opportunity would be afforded to the shareholders to take up a balance of 4,366 ordinary shares, and so bring up the total number of shares issued to 50,000. In eight of the districts covered by orders held by the company they were unable to proceed with the construction of works until a date to be fixed by the Board of Trade after peace had been declared, but in the remaining districts they proposed to make extensions as early as labour and materials made it possible. This work would require a considerable amount of capital, and a further issue would be made as the restrictions of the Government were relaxed.

St. James' and Pall Mall Electric Light Co., Ltd.

Mr. W. Leaf, presiding at the annual meeting at Carnaby Street, on February 25th, said that they had had to face drastic restrictions which had materially reduced their output, and had had to meet increased labour and other expenses. The advance of 10 per cent. in charges for current had not met the loss due to increased costs. The output had been reduced from 15,643,000 units to 13,942,000, and the total revenue from sale of current produced only £152,136, against £153,648 for 1917. In spite of the reduction in the net profits they had not hesitated to recommend an increased dividend (10 per cent., against 9 per cent.). Last year the outlook in February was in many ways most disquieting, alike for the electrical industry and for the nation at large, and they felt it their duty to advise a most conservative treatment of the profits. To-day circumstances were very different. They had heavy enough problems before them, but they were meeting in the hour of victory. They were girding themselves for the new tasks in a spirit of hopefulness and courage, and thought it right that some small reward for the self-denial of last year might fairly be claimed. They had restored their contingency fund to the highest point it had ever reached, and they did not think there was any need at the moment to make it higher. Their depreciation fund was based on most prudent calculations. Ten per cent. was no more than a fair return on the capital invested, under strict limitations as to term and uncertain conditions of repayment 12 years hence. It was clear that in the reconstruction period there would be an immense increase in the demand for electrical energy. They had made their plans to meet this demand by an increase of £53,886 in the capital expenditure of the Central Co. It had been spent mainly in the purchase of further land for the extension of Grove Road station and in the paying for the new 6,000-kw. turbo generator which was completed last August. This set, coupled with the new boilers put in in 1917, had resulted in a very marked reduction in coal consumption at a time when prices were steadily increasing. The speaker continued: "Despite the serious fall in our output, due to the restrictions to which I have already referred, the relative quantity of coal burnt at the Grove Road works has been reduced by no less than 6 per cent., or about 2,500 tons, and our running costs for coal now rank with those of the most economical stations in the country, bearing in mind the distance of London from the coalfields. This economy in generation has led to a continuous growth in the proportion of our output which is supplied to us by the Central Co. In 1916 the Central Station generated about 20 times as much current as our own stations. In 1917 this proportion had grown to 30 times, and last year it had further developed to about 40 times. In other words, the Central Station is now responsible for over 97 per cent. of our total output. We are thus making every use of the advantage of production on the large scale." They were already setting to work on the erection of new buildings at Grove Road power station. It was their intention to keep that station up to date in every respect, so that whatever happened, when the day of purchase came, they might have a valid claim for a full price for a plant of the first rank. Referring to the new Government Bill relating to electric supply, concerning the draft of which they were in complete ignorance, the speaker said: "If Parliament decides upon a general consolidation our policy will be to assist, taking at the same time a very determined attitude in defence of the right to full compensation to which you are entitled as proprietors of this undertaking. The London companies are in constant conference over the very difficult task of determining exactly what are the terms which we shall be prepared to require if it is decided that we are to be expropriated; and we are further considering whether it will be possible to put forward some joint scheme under which we may be permitted to co-operate in the future supply of London. More than that it is impossible for me to say till we know something of the Government proposal." After referring to the excellent relations that existed between the company and its employés, the chairman paid a tribute to the services rendered by the managing director, Mr. Walker, who, during the past few weeks, acting in conjunction with Mr. C. P. Sparks and Mr. Frank Bailey, had represented the London electrical undertakings in all negotiations with the Government, and had saved the situation.

Westminster Electric Supply Corpn., Ltd. Lord Downham of Fulham, presiding at the annual meeting, on February 26th, referred to the effect that rationing of electricity had upon their operations. Just as they had succeeded in inducing a large number of their consumers to adopt electric heating, the apparatus hired out to them were returned owing to what practically amounted to a prohibition of their use. Connections to the premises of new private consumers also ceased entirely, although that setback was, fortunately, somewhat mitigated by their being called upon to supply many temporary buildings erected in their area of supply for war purposes. To meet the increased cost of production, due to coal prices and higher salaries and wages, they had raised their prices but had not thrown the additions entirely on to consumers. During 1918 they had expended on war bonuses and advances £18,000, or equal to a 3 per cent. dividend. Preparations had to be made for a considerable increase in output. To provide for this, for repayment of debentures, and for general purposes, they had invited shareholders to take up 50,000 additional ordinary shares. The result was entirely satisfactory. There were some shares left over, and out of these they would reserve to the staff a certain number on exceptionally favourable terms as to deferred payment of instalments. After referring briefly to the Government electricity scheme and to the recent industrial troubles, the chairman, in conclusion, said that they who owned, either individually or collectively, or controlled and directed the industrial and commercial undertakings of the nation should be at least as careful of the interests and welfare of those who made the profits as of those who shared them. In these disturbed and restless days it behoved everyone to put his house in order.

Notting Hill Electric Lighting Co., Ltd. Capital expended during 1918, £941. The lamps connected (30-watt) increased from 252,307 to 259,074. The profit for 1918 was £20,016, against £24,270 for 1917. The consumers, 4,637, are all, excepting 18, supplied at 200 volts. There is put to depreciation, renewal and reserve £3,000; debenture interest absorbs £1,856; Kensington and Notting Hill joint debenture stock charges require £3,962; income-tax £5,617. Both classes of 6 per cent. preference shares have received their full dividend, and £1,340 remains to be carried forward. The reduction in the balance available for dividend from £11,279 to £7,496 will not permit any dividend being paid on the ordinary shares. [It may be added that there are 27,050 ordinary shares of 1s. each.—EDITORS.] The report adds:—

> The unsatisfactory result of the year's working is due mainly to the increase in the working charges, especially in the cost of labour. The war bonus ordered by the Government now amounts to 28s. 6d. per man, plus 12½ per cent. on all earnings. This was to some extent compensated for by the increase in the charge for current up to the maximum of 8d. per unit, but the Fuel and Lighting Order which came into force in October caused a drop in consumption of about 30 per cent. during the last quarter of the year.

Units generated or purchased, 3,224,629; units sold, 2,303,797. Used on works, 12,200; expended in distribution, &c., 908,632. Annual meeting: March 11th.

Tyneside Tramways & Tramroads Co.—Presiding at the half-yearly meeting, Dr. J. T. Merz said there was a gross increase in the receipts of £9,500, but as against this there was an increase of £8,500 in the costs, owing to the higher prices of materials, wages, and current. They had placed certain sums to special reserve, and an outstanding feature was that they had increased the investments to £38,600, which was £9,500 more than in the year before. They aimed at increasing their reserve, because all the money they had would be wanted presently for relaying some parts of the line, and repairs to rolling stock, although the latter had been kept up in as good a condition as possible during the war period. They expected to get a full report of what was required upon the lines and rolling stock from their engineer, Col. McClellan, who had been with the Army for nearly five years.

Charing Cross, West End & City Electricity Co., Ltd.—Dividend of 4 per cent. for the year 1918 on the ordinary share capital of the West-End undertakings of the company.

Tyneside Electrical Development Co., Ltd.—Dividends at the rate of 6 per cent. on the preferred ordinary and 10 per cent. on the deferred ordinary shares, putting £1,000 to reserve, and carrying £815 forward.

Metropolitan Electric Supply Co., Ltd.—The report shows that the capital expenditure increased by £25,267 during 1918. Gross revenue for the year £348,726 (increase £30,280). Working expenses £208,112 (increase £23,569). Balance at credit of revenue before providing for depreciation £140,614. Added to depreciation and reserve £50,000, making it £477,359. To credit of net revenue £90,614, plus balance brought forward, and interest on investments, making £109,130. Interest on debenture stocks, &c., and preference dividend having been paid, the total distribution on the ordinary shares is 5 per cent. for the year, and £4,836 remains to carry forward. New connections 1,611 KW., making the total 42,559 KW.

South Metropolitan Electric Light & Power Co., Ltd.—Mr. H. St. John Winkworth presided, on February 26th, at the annual meeting. He said that there was little doubt that the Government restrictions on new business would in the near future be withdrawn, and the development of the company's business be allowed to proceed unhampered. They had increased the amount put to depreciation and the carry forward. It was advisable to strengthen their position in view of the uncertainty of the times. The prospects for the current year were very uncertain. An improvement was being shown each week in the new orders received, but they must expect a falling off in revenue from war factories. After the change over to peace work had been effected, they would experience steady and continuous improvement.

Tramways, Light & Power Co., Ltd.—Viscount Chilston, at the annual meeting, said that the year had been one of greatest anxiety to all connected with the company's affairs. Notwithstanding all their difficulties, the accounts were satisfactory. The income received from their various undertakings was £45,509, as against £42,215 in the previous year. They proposed to make a further substantial addition to reserve out of the year's profits. If labour demands recurred, as there was every possibility that they would, some legislation must be enacted by which tramway companies were permitted to charge increased tolls. They were watching the matter very carefully, and would give cordial support to any action taken in that direction.

Newcastle & District Electric Lighting Co., Ltd.—The net profit for 1918, after charging debenture and loan interest and allowing for depreciation, is £8,321, plus £13,257 brought forward. Dividend 4 per cent., less tax, for the year, carrying forward £13,099. A further £3,400 of the 6 per cent. second mortgage debentures has been redeemed. The amount at the credit of reserve for depreciation and renewals £50,000, and in addition £16,000 allowed for the year, have been written off plant and machinery, &c. Mr. W. D. Hunter has resigned the position of managing director and engineer, but remains as a director. Mr. N. S. Tennant has been appointed general manager and engineer.

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—Owing to mail delays from Australia the meeting cannot be held before June, but in a circular letter just issued the company states that the disorganisation caused by the war has continued, and costs all round have again been higher. Expenses were further added to by a breakdown of a portion of the plant during August, the repairs to which have been costly, and have only recently been completed. Due to various causes, including a decreased demand for current, the profit made during the year, after making the necessary provision for debenture interest and redemption, will not permit of the payment of a dividend to the holders of the preference shares in April next. The usual full statement of the position will be published later.

Kensington & Knightsbridge Electric Lighting Co., Ltd.—During 1918 the number of houses and shops connected increased by 63 to 5,173, and the devices of 30-watts consumption by 14,991 to 572,615 (17,178 KW.). Units sold: 4,580,854. Net profit £11,763, plus £580 brought forward. After paying the first and second preference dividends, and a total of 6 per cent. for the year on the ordinary shares, £543 is to be carried forward. Sir H. W. Bliss has retired from the board. Mr. F. J. Walker, "who has been associated with the electricity supply industry from its earliest years," has been elected in his place. Annual meeting: March 20th.

Electro-Bleach & By-Products, Ltd.—Excess profits duty for 1918 not having been ascertained, the accounts for that year cannot yet be submitted. Satisfactory progress has been made, but it is not likely that the directors will recommend further dividends for 1918 beyond those now announced, namely: further interim dividends of 3½ per cent., less tax, on the preference shares, making 7 per cent., and of 12½ per cent., less tax, on the ordinary.

Clarke, Chapman & Co., Ltd.—Net profit after providing for debenture interest, repairs, &c., £170,801. An interim dividend of 2s. per share has already been paid on the ordinary shares, and a final dividend of 3s. per share, less tax, is now announced. £89,623 is carried forward, subject to excess profits duty for 1918.

Northallerton Electric Light & Power Co., Ltd.—Net profit of £342, as compared with £249 for 1917.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—A general meeting is to be held on March 10th to consider a resolution converting the 150,000 unissued ordinary shares into preference shares, entitled to a cumulative dividend of 6 per cent., payable on March 31st and September 30th, and to priority for capital over the ordinary shares without further participation.—*Financier.*

Barcelona Traction, Light & Power Co.—The "Financier" states that an issue of 30,000 6 per cent. debentures of 500 pesetas (£20) each has been made by the above company, and has been taken firm by a syndicate of Spanish bankers at the price of 95 per cent.

Jarrow & District Electric Traction Co., Ltd.—Total revenue for 1918 £15,597, an increase of £4,814. After paying expenses, debenture interest, providing for renewals, putting £900 to reserve, and paying a dividend at 6 per cent. on the ordinary shares, £2,832 is to be carried forward.

County of London Electric Supply Co., Ltd.—Final dividend on ordinary shares at the rate of 9 per cent. per annum, less tax, making 7 per cent. for the year. £50,000 has been placed to reserve for depreciation, and £15,000 to special reserve for deferred maintenance. £15,500 carried forward.

Canadian General Electric Co., Ltd.—Quarterly dividend 2 per cent. on the common stock, and a half-yearly dividend of 3½ per cent. for six months on the 7 per cent. preference stock.

City of Oxford Electric Tramways, Ltd.—For 1918 the profit amounted to £10,454. Dividend 4 per cent.

STOCKS AND SHARES.

Tuesday Evening.

Rubber shares have resumed a prominent place in Stock Exchange activity—not from any new conditions making for the industry's prosperity, but from the fact that the speculative investor throughout the country demands another outlet for the money now that the oil excitement has subsided. Apart from the rubber animation there is not a great deal doing in stock markets. The mystery of the national outgoings being so comparatively little less in armistice than in war days has a depressing effect upon gilt-edged securities, the holders of which are talking of a bad Budget—bad from the taxpayer's viewpoint. Reconstruction work of all kinds at home is hampered, mainly by the labour uncertainties, and partly by the vagaries of the New Issues Committee.

Home Rails have slipped further down what seems to be their permanent way of gentle melancholy. Steam stocks are depressed. Dulness is apparent in Metropolitans and Districts. Underground Electric income bonds at 93 xd. have gained ½ on balance. Taking the dividend at 6 per cent., the yield at this price would be 1s. short of 6½ per cent. on the money. Several of the prior-charge stocks are a little lower, which is not a tranquilising fact to those who looked for these issues to improve the nearer nationalisation came.

The burst of buoyancy that carried up prices of Mexican stocks has soon subsided, although the reaction did not rob the markets of all the strength they drew from the appointment of influential committees for protection of outside capital invested in the country. Another report published during the past few days has underlined the arguments advanced here as to the vital necessity of more money being raised for the purposes of reorganisation. The first step in rehabilitating Mexico will be the provision of an American loan to the Government of the country. There is plenty of money, we make bold to say, ready to leave Great Britain for Mexican undertakings were it permitted to go, and were satisfactory evidence offered as to internal peace having been restored in Mexico. It will certainly be some time before permission is given for British capital to emigrate, and other financiers will have matters much their own way unless the various protection committees take vigorous steps to justify their existence.

The Metropolitan Electric Supply Co. has done well, and raises its dividend from 4 per cent. to 5 per cent. The net revenue shows an increase of over £6,000, and the carry-forward of £4,800 is a trifle under the amount similarly dealt with last year. The shares have risen 5s. to 3⅜. The County of London Electric Co. declares a dividend at the rate of 5 per cent., making 7 per cent. for the year, the same as that for 1917. Prices in this section are well maintained. Westminsters at 6¾ have recovered the dividend of 4s. a share deducted last week. St. James's at 7⅛ xd. are nominally 5s. lower, but the dividend was 6s. 6d. per share. The Notting Hill Co. is paying nothing on its ordinary shares, which last year received 3s. per share. The price is about 32s. 6d.

In the telegraph market the feature continues to be the demand for those stocks and shares upon which dividends are paid free of tax. Eastern Ordinary has improved to 160½. Cuba Submarines are 5s. better at 11. Globe Ordinary at 14½ are also ½ up. A small recovery occurred in West India and Panama shares. The Indo-European Telegraph Co. maintains its dividend of 13 per cent., but the report just out shows that the dividend equalisation fund has been drawn upon for £24,500, the net profit having fallen from £59,000 to £22,500. This report is for 1917, and doubtless the directors see a more cheerful prospect for 1918, otherwise they might have reduced the distribution.

British Aluminium Ordinary have given way a little to 1⅞, and British Westinghouse Preference are 1/16 easier. Edison "A" shares show a slight recovery. Sales on behalf of a deceased account led to falls in Callender's Ordinary and Preference, but Henleys at 4 have recovered the dividend just deducted. Labour conditions continue to cramp enterprise in this section, and the same handicap applies also to shares in the armament and the iron, coal, and steel companies.

Telegraph Constructions have been an interesting market, the price mounting to 56½ before a few shares came in to check the substantial rise. The scheme for doubling the capital by the distribution of a bonus share for every share at present held has put up the price nearly £10 since the details appeared. What the dividend is likely to be on the doubled capital, is now the question. The present 20 per cent. would automatically become 10 per cent., but as the company is a very rich one, and the business seems likely to expand rather than to remain stationary or to contract, some there are who look for the dividend on the new capital to be 15 per cent.—equal to 30 per cent. on the present basis. Time will show, obviously, but there is high confidence felt in the likelihood of the price improving even further, and, after removal of Treasury control on new issues, a splitting of the £12 shares into others of more popular proportions would enhance their value.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1916.	Dividend 1917.	Price March 4, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	9	10	7⅜	—	£6 15 7
Charing Cross Ordinary	5	4	3⅝	—	5 10 4
do. do. do. 4½ Pref...	4½	4½	8⅜	—	6 13 4
Chelsea	8	5	3¾	—	4 1 1
City of London	8	8	12¾	—	6 5 6
do. do. 6 per cen Pref. ..	6	6	10⅛	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	6	7	6	—	5 16 8
London Electric	Nil	Nil	1⅝	—	Nil
do. do. 6 per cent. Pref...	4	5	4	—	6 5 0
Metropolitan	8	4	3⅜	+ ¼	7 8 0
do. 4½ per cent. Pref. ..	4½	4½	3¼	—	6 18 6
St. James' and Pall Mall	8	9	7⅛xd	—	7 0 4
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	20/6xd	—	6 16 7
Westminster Ordinary	7	9	6¾xd	+ 3/16	6 13 4

Telegraphs and Telephones.

	Dividend 1916.	Dividend 1917.	Price March 4, 1919.	Rise or fall.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	98½	—	6 1 10
do. Def.	1½	1½	21⅞	—	7 13 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	11	+ ¼	*6 7 4
Eastern Extension	8	8	15¾	—	*5 1 7
Eastern Tel. Ord.	8	8	160½	+1	*4 19 6
Globe Tel. and T. Ord.	7	7	14½	+ ½	*4 16 7
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	58	—	5 12 0
Marconi	15	20	4⅛	—	4 9 0
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7¾	—	*5 1 7
West India and Panama	6d.	1/3	1¾	+ 1/16	*3 11 5
Western Telegraph	8	8	16⅝	—	*4 16 3

Home Rails.

	Dividend 1916.	Dividend 1917.	Price March 4, 1919.	Rise or fall.	Yield p.c.
Central London Ord, Assented ..	4	4	63¾xd	—	6 6 0
Metropolitan		1	28⅛xd	—	4 7 9
do. District	Nil	Nil	25½	— ½	Nil
Underground Electric Ordinary..	Nil	Nil	3½	—	Nil
do. do. "A" ..	Nil	Nil	10/-	—	Nil
do. do. Income ..	6	4	93xd	+ ½	*5 7 6

Foreign Trams, &c.

	Dividend 1916.	Dividend 1917.	Price March 4, 1919.	Rise or fall.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅜xd	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	5½	3 11/16	—	—
do. do. 2nd Pref. ..	5½	—	3¼	—	—
do. do. 5 Deb... ..	5	5	70½	—1	6 19 10
Brazil Tractions	—	—	58	—1	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	63½	—2	7 17 8
do. do. Preferred	Nil	Nil	44	—2	Nil
do. do. Deferred	Nil	Nil	42	—	Nil
do. do. Deb. ..	4¼	4¼	62	—	6 17 8
Mexico Trams 5 per cent. Bonds..	Nil	Nil	64	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	53	—	Nil
Mexican Light Common	Nil	Nil	39	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	69	—	—

Manufacturing Companies.

	Dividend 1916.	Dividend 1917.	Price March 4, 1919.	Rise or fall.	Yield p.c.
Babcock & Wilcox	15	15	3⅞	—	3 17 5
British Aluminium Ord.	10	10	1⅞	—9d.	5 6 8
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref. ..	7½	7½	2 1/16	— 1/16	6 3 0
Callenders	20	25	10⅛	— ½	5 19 1
do. 6½ Pref.	5	5	5¼	— ¼	6 8 10
Castner-Kellner	22	20	8 5/16	—	6 1 3
Edison-Swan, "A"	—	—	19/-	—3d.	—
do. do. 5 per cent. Deb. ..	4	4	74½	—	6 14 3
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10¼	—	6 6 10
do. Ord.	10	10	17½	—	*5 14 3
Henley	25	25	2 5/16	—	5 8 2
do. 4½ Pref..	4½	4½	4xd	+1/6	5 12 6
India-Rubber..	10	10	17	—	*5 17 8
Siemens Ord...	10	—	6 3/16	—	*7 18 6
Telegraph Con.	20	20	56½	+2	*4 5 6

* Dividends paid free of Income Tax.

THE DETERMINATION OF THE EFFICIENCY OF THE TURBO-ALTERNATOR.

By S. F. BARCLAY, Ph.D., A.M.I.E.E., and S. F. SMITH, D.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

With the methods ordinarily employed of establishing the efficiency of the turbo-alternator, the stray loss that is present on load is either deduced by a substantially conventional method, or is ignored altogether. As alternators for larger outputs are constructed, the stray loss becomes of greater importance. It is becoming impracticable to apply the existing methods to the very large alternators now being constructed; it becomes increasingly important, therefore, to introduce a method of establishing the alternator efficiency, which is based on the measurement of the actual losses on load.

The object of this paper is to show that the actual losses on load can be deduced conveniently and accurately from measurements of the cooling air flowing through the alternator: but that misleading results may be obtained unless certain precautions are taken in applying them.

The accurate determination of the alternator efficiency is the only means of ascertaining the magnitude of the actual stray loss; for if the total loss on load can be found, the stray loss can be deduced when the other losses have been measured separately. With turbo-alternators of even moderate size the stray loss may be as high as five or six times the ohmic loss in the stator copper. If the efficiency on load can be determined accurately, it will be one of the most important of the designer's informative tests.

The common practice in this country is to base the guarantees of the alternator efficiency on the summation of the various losses that can be measured separately, and either to ignore the stray loss altogether, or to employ a substantially conventional method of determining it. In the conventional method adopted by the American Institute of Electrical Engineers, and used by some manufacturers in this country, the whole of the stray loss present on short-circuit is included when computing the conventional efficiency of polyphase machines. That the nature and distribution of the loss under the two conditions may be quite different, however, is shown by studying the heating in the two cases. For instance, in the case of a 5,000-KW. alternator at 3,000 R.P.M., embedded thermo-couples showed a temperature rise of 250° F. at the ends of the stator core after running for an hour on short-circuit, although on full load the temperature rise of the same parts was only 60° F. When there is agreement between the values of the stray loss on load and on short-circuit it is partly accidental, and is not to be expected in all cases.

For some time past the authors have been investigating the subject in conjunction with turbo-alternators made at the Sheffield works of Messrs. Vickers Ltd., and their investigations show that, provided certain precautions are taken, the alternator efficiency can be conveniently and accurately determined under actual load conditions from measurements of the cooling air. From such measurements the separate losses can also be deduced—a matter of considerable importance when a driving motor is not available.

Modern turbo-alternators invariably have forced ventilation, and with the exception of the relatively small amount of heat dissipated from the external surface of the stator, all the losses, except the bearing losses, are carried off by the cooling air. Consequently, the most obvious method of finding the losses on load is to ascertain, with regard to time, the heat energy that is being carried away by the ventilating air; for if the volume of air flowing through the machine in unit time, and the average increase of temperature that the air undergoes in absorbing the losses in the machine, are known, then the total losses on load can be calculated without difficulty. This method will hereinafter be referred to as the "air-heating" method. The principle involved in this method formed the subject of a paper on "The Testing of Electric Generators by Air Calorimetry," read before the Institution[*] in 1903 by Prof. R. Threlfall, the machines in this case being totally enclosed in a specially constructed housing.

An alternative method that does not involve measuring the air volume is to ascertain the increase in temperature of the cooling air caused by a loss of known magnitude in the alternator, and from the observed temperature rise of the air on load to deduce the total losses. This method will hereinafter be referred to as the "calibrated air-temperature" method.

The bearing losses may be determined fairly accurately by measuring the volume and temperature rise of the lubricating oil, and by making a suitable allowance for the heat dissipated in other ways.

Air velocity can be measured by the Pitot tube, the Venturi tube, electrical methods, and the anemometer.

The Pitot tube consists essentially of a dynamic tube placed in the line of air flow and a static tube with the plane of its orifice set at right angles to the line of air flow. The shape and size of the orifice of the dynamic tube have been found by careful experiment to be unimportant, but the size and position of the orifice of the static tube are most important. Tubes conveying the two pressures—*i.e.*, the dynamic and static heads—are connected to a differential fluid gauge. The difference of pressure that the gauge shows has been found to be proportional to the square of the air velocity over a very wide range. For the present purpose the average gauge readings are of the order of one-fifth of an inch of water, and for accurate work with such low pressures it is necessary to employ a special form of manometer with the tube inclined at a large angle to the vertical. The micro-manometer designed by Mr. B. J. B. Roberts is very exact, and has been employed by the authors in their investigations with excellent results.

The principal objection to the Pitot tube for this work is that when making absolute measurements it is dependent for its accuracy on the air flow being in line with the dynamic tube and at right angles to the static tube—conditions that cannot exist when the air flow is variable in direction.

The Venturi tube is a very exact instrument, but for its accuracy it is even more dependent than the Pitot tube on the flow of air being constant in direction, and it is, therefore, unsuitable for the present purpose.

The electrical measurement of air velocity has been successfully carried out. A wire of high electrical resistance-temperature coefficient, such as platinum, is employed, and either a constant voltage is maintained across it and the variation in resistance read, or the resistance is maintained at a constant value and the necessary variations of current are read. The air velocity is deduced from the readings on the basis of the law that with unvarying wind velocity the linear forced convection of a thin wire increases as the square root of the air velocity. A hot-wire velocity indicator operating on this principle has recently been devised by Prof. J. T. MacGregor-Morris. Four exactly similar wires of material having a high electrical resistance-temperature coefficient are arranged as a Wheatstone bridge. One pair of opposite arms of the bridge is exposed directly to the air current; the other pair is also in the air current, but is protected by being enclosed in thin-walled tubes of high thermal conductivity. This small bridge is attached to the end of a tube of convenient length, and the leads are carried inside the tube to a portable battery and to a milliammeter or millivoltmeter. The difference between the cooling of the arms of the bridge that are exposed to the air current and the arms that are shielded from it is indicated on the ammeter or voltmeter, which can be calibrated to read the air velocity directly. The indicator attains a steady reading in a few seconds, and in the form described it is suitable for measuring velocities up to about 2,000 ft. per minute. Such an instrument should be satisfactory for measuring the air discharge from a turbo-alternator, particularly since the accuracy would be little affected by the air having a non-stream-line flow, as must be the case to some extent. The anemometer is usually considered to be somewhat inaccurate, but for the purpose in view the authors have found that a well-made instrument, when properly handled, gives sufficiently accurate results. Further, on account of the air flow being variable in direction, the anemometer is probably better adapted to read the absolute value of the average velocity at a given point than are more exact instruments. The velocity of the air discharge from a turbo-alternator is of the order of 2,000 ft. per minute, and, with an instrument of the kind used by the authors, measuring about 2·6 in. over the tips of the vanes, the frictional effect is not more than 3 per cent. of the vane-wheel speed, so that even an appreciable error in the correction for friction has only a negligible effect on the result. The other inherent defect of the anemometer—the effect of inertia—is only of appreciable importance when the air flow is variable. The authors have checked the accuracy and consistency of the anemometer in various ways.

The first difficulty that the authors encountered in the measurement of the volume and temperature of the air was a consequence of the great variation in the velocity of the air at the discharge opening of the alternator, due to the essentially peculiar shape and disposition of the openings in the stator core and frame, and also to the rotation of the rotor tending to cause the air to discharge obliquely instead of vertically.

With the object of equalising the air flow a temporary discharge trunk of the kind shown in fig. 1 was fitted, and close-mesh expanded-metal baffle plates were fitted in the trunk, as shown in fig. 1. Although there was still some variation, yet if the anemometer readings were taken at fairly frequent intervals the average velocity could be found with a sufficient degree of accuracy. The resistance of the expanded-metal baffles to the flow of air was found to have no appreciable effect on the temperature of the alternator.

For the accurate measurement of the air volume it is desirable that the discharge opening should be divided into squares, not much larger than the overall diameter of the anemometer, by stretching thin cords across the trunk, as shown in fig. 1, and an anemometer reading should be taken over each square.

Starting and stopping errors can be diminished by moving the instrument rapidly from square to square without stopping it, and the average value of the air velocity is found by dividing the total reading by the number of squares. It is desirable to run the anemometer for an appreciable period over each square—15 seconds being the minimum desirable time.

The average temperature of the air can be found with sufficient accuracy by using one thermometer for each square and taking the average of the readings. The thermometers can conveniently be attached to the cords in a horizontal position. The determination of the average temperature of the inlet air presents no difficulty, but it should be verified that there is no external source of heat—such as a steam pipe—near the thermometers. When an air filter is used in conjunction with the alternator, the inlet temperature has to be read between the filter and the alternator, and it is particularly necessary to do so when the filter is of the wet type.

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[*] Electrical Review, December 11th, 1903.

The average temperature of the air at the inlets and outlets can also be determined very accurately by measuring the change in resistance of a coil of wire, of which the electrical resistance-temperature coefficient is known, mounted in the air flow. The precautions to be taken in the measurement of the air volume and temperature are simple, but without such precautions the authors have found that quite misleading results may be obtained.

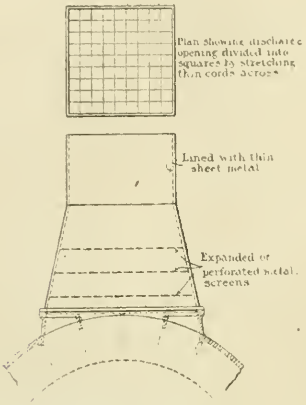

Plan showing discharge opening divided into squares by stretching thin cords across
Lined with thin sheet metal
Expanded or perforated metal screens

Fig. 1.—Temporary Discharge Trunk to Facilitate the Accurate Measurement of the Air Volume and Temperature.

The Determination of The Losses on Load by the "Air-Heating" Method.

The method of calculating the losses from the volume and temperature rise of the air will now be described. The value of 0·0711 lb. is taken for the weight of a cb. ft. and 0·242 for the specific heat of dry air at the assumed temperature of 100° F. and at an atmospheric pressure equal to 29·92 in. of mercury. The mechanical equivalent of heat is taken to be 778 ft.-lb. per therm.

Let V = volume of air leaving the alternator discharge in cb. ft. per minute,
T_i = average temperature of the air at the inlets,
T_o = average temperature of the air at the alternator discharge.

The heat energy being carried away by the air is then—

$$P = V \times 0{\cdot}0711 \times 0{\cdot}242 \times (T_o - T_i) \times 778 \text{ ft. lb. per minute,}$$
$$= V\,(T_o - T_i)/3{,}305 \text{ kilowatts} \quad \ldots \quad \ldots \quad (1)$$

where T_i and T_o are in degrees Fahrenheit.

The various corrections that may have to be made to the above formula are dealt with in an appendix. For commercial testing, corrections need be made only in the event of the air temperature or barometric pressure differing appreciably from the conditions assumed, and in respect of the heat energy that is dissipated from the stator frame (about 1·5 per cent.). Formula (1) may be amended to include the corrections as follows :—

$$P = V\,H\,(T_o - T_i)/174\,(460 + T_o) \text{ kilowatts} \quad \ldots \quad (2)$$

where H is the atmospheric pressure in inches of mercury.

The Determination of the Losses on Load by the "Calibrated Air-Temperature" Method.

When the alternator coupled to a driving motor is being run at the works, the stator-core loss with various values of the exciting current can be measured—a test that it is always desirable for the maker to carry out for his own information. When the machine is being tested on site, the temperature rise of the cooling air is measured (1) on open circuit with the rotor unexcited, (2) on open circuit with the rotor excited to a known value, (3) with the alternator on load.

Let t_e denote the temperature rise of the cooling air in test (2) with the rotor excited, P_c the rotor copper loss, and P_i the stator core loss corresponding to this excitation (the value of P_i is given by the core-loss curve taken at the works). Then, if t_u denotes the temperature rise of the cooling air in test (1) with the rotor unexcited, it follows that the difference $t_e - t_u$ in the rise in temperature of the cooling air is caused by the known loss $P_i + P_r$ kilowatts. The loss in the alternator necessary to cause the temperature of the ventilating air to increase one degree is then—

$$\triangle P = (P_i + P_r)/(t_e - t_u) \text{ kilowatts.}$$

The quantity $\triangle P$ thus represents the calibration of the temperature rise of the cooling air of the machine in question.

If now t_l denotes the temperature rise of the cooling air in test (3) when the alternator is on load, it follows that the load loss will be—

$$P = \triangle P \times t_l \text{ kilowatts.} \quad \ldots \quad \ldots \quad (3)$$

The accuracy of the method depends mainly upon the weight of air flowing through the machine remaining constant whilst the heating tests are being made. The effect of losses in the alternator is, of course, to heat the air and cause it to expand, and so increase the volume for a given weight. The opposition to the flow of an increased volume of air will depend on the position of the parts where there is the greatest restriction to the air flow with respect to the position of the parts where the heating occurs. The load losses given by this method are somewhat too large, but the authors have estimated that even in radially-ventilated machines the losses are only 2 to 3 per cent. too high. This estimate is confirmed by tests. A general correction cannot be made in respect of this error, since it will be influenced by the system of ventilation. In the absence of accurate information it can be assumed that the losses obtained by the "calibrated air-temperature" method are 2½ per cent. too high.

TABLE I.—Comparison of Results Obtained by Four Different Methods.

Machine No.	Methods based on cooling air.		Methods based on "summation of losses."	
	"Air-heating" method.	"Calibrated air-temperaure" method.	A.I.E.E. method.	Stray loss ignored.
5,862	352	362	336	211
7,001	327	338	315	255
7,541	46	47	52·5	42·8

Typical results obtained by the "air-heating" and "calibrated air-temperature" methods are given in Table I, compared with the "summation-of-losses" method as adopted by the American Institute of Electrical Engineers, and with this method when an allowance for stray loss is excluded.

General Conclusions.

These investigations have led the authors to the opinion that the "air-heating" method may quite well be adopted for the determination of the turbo-alternator efficiency for commercial purposes, with advantage to the purchaser and the manufacturer. By taking the prescribed precautions when measuring the air volume and temperature, the losses on load can be determined quite as accurately as is required, and probably more accurately than in any other way. From the manufacturer's point of view, a great advantage of the method is that a driving motor is not required—an item of importance when dealing with alternators of large output. Also, when on account of transportation difficulties the stator has to be built on site, in addition to measuring the total losses on load, the method could be employed to measure the separate losses with ease and accuracy.

The method is independent of tests made at the works, and in the event of dispute a check test could be made at any time.

The "calibrated air-temperature" method has the one advantage compared with the "air-heating" method that the air volume has not to be measured, but on the other hand, it has certain disadvantages. The efficiency cannot be determined solely by tests on site, and once the alternator has been dispatched from the works, a check test in the case of dispute cannot be made.

The "summation-of-losses" methods in present use which ignore the stray loss have little value.

The authors express their obligation to Messrs. Vickers, Ltd., for permission to carry out the experimental investigations, and to Mr. H. P. Hayhurst and his testing staff for the care that they have taken in carrying out the tests.

Discussion in London.

Prof. G. W. O. Howe, in opening the discussion, said he was glad to find a representative of the manufacturer and of a technical college collaborating as the authors of the paper they had just listened to had done; it was a good omen for the future. The problem of stray losses was a most serious and at the same time puzzling one. With the large size of machines now being built, these losses would demand very careful consideration, and he thought that when any tests were to be made it would first be necessary to run the machine for some time in order to allow the temperature to settle down before any readings were taken. He pointed out that on page 3 of the paper the law upon which was based the electrical measurement of air velocity was not given. Referring to the author's air discharge trunk, the speaker thought that, by electrical methods, an average measurement could be taken over the whole area at once, instead of having to take a number of measurements over the cross section by the author's method. He was not enthusiastic over the anemometer as a measuring instrument; in his opinion frictional difficulties would be encountered. With regard to the curves plotted from Pitot-ture readings taken at the opening of the discharge trunk, he did not see why the conditions should not be further improved so that one average reading could be taken for the whole surface. The authors employed a number of thermometers, but it was not stated whether the temperature varied very much. Here again he thought that an electrical method of measurement could be devised with advantage.

Mr. A. H. Law expressed pleasure that this method of testing had been brought before the Institution. He had advocated it for nine years, but everybody always maintained that accurate results could not be arrived at by such methods. He pointed out that an anemometer was usually calibrated at normal air temperature, and stated that an error was introduced when the air temperature was raised, due, he thought, to the lubricant becoming more fluid. With the large size of machines that were now being built it would become necessary to carry out all tests *in situ*, and the difficulty of driving such large machines under these conditions at once became apparent. He showed a number of interesting slides illustrating the method adopted by his firm by which the generator was run up to speed by the turbine, after which the former was allowed to run as a motor. They coupled the two machines by means of copper plates fixed to the coupling flanges and driving against rectangular surfaces. These copper plates were tapered in such a way that when the required speed was reached the coupling parted, and the copper, being a soft metal, was worn away, thus disconnecting the two machines. Another side showed that, by suitably arranging conditions, a test of a large generator could be commenced at 9 o'clock in the morning and completed by 5 o'clock in the evening of the same day.

Prof. J. T. MACGREGOR-MORRIS explained the principle of a hot-wire, air-velocity indicator recently devised by himself, and which was referred to in the paper; he showed slides illustrating experiments he had carried out with the instrument on the East Coast, which should that it was portable and not easily damaged, the whole apparatus having been carried several miles on a bicycle. Referring to the "air-heating" method of determining the losses, he explained that the pressure was not great over the whole, and he thought a measurement of the average temperature over the whole area could be taken quite easily. The formula given on page 7 of the paper for this method could in reality be reduced to 2 measurements—temperature and volume. He did not think it would be a difficult matter to devise two instruments to take these two measurements, and the problem would then be quite simple.

Prof. E. W. MARCHANT thought that the most important point brought out by the authors was that the stray losses could be so great. In the past they had devised means of measuring various losses very carefully, but these stray losses could be so great that he thought they would have to start all over again and attack the problem afresh. He described air-blast cooling tests that had been carried out by Mr. Teago at Liverpool University. A fluid gauge that was used consisted of a U-type, the open ends of which were formed into cups. One arm of the tube contained water coloured with methyl orange, and the other a mixture of chloroform and toluol. The density of the latter mixture being the same as that of water an indicator was thus provided which could be read, the variations of the readings on the arm of the U-tube being magnified something like 100 times those in the cup. This gauge had been used with success in connection with tests on transformers. He had no faith at all in the anemometer, and thought some other instrument could have been chosen in its place.

Major A. M. TAYLOR pointed out that the error incurred in measuring the total loss was the error incurred in measuring the stray loss, provided the "known" losses were really accurately known (since the stray losses were obtained by a process of subtraction), and provided that the stray losses were quite a large proportion of the total losses. Taking the authors' figures for the various errors investigated, it would seem as though the aggregate error in the measurement of the total losses would not be likely to exceed 8 to 10 per cent. It was well to bear in mind that the loss being investigated was about 1 to 1½ per cent. of the output of the alternator. Compared with the less-known losses occurring on the steam side, it might seem to steam engineers rather like splitting hairs to be analysing such losses as these, and the question arose whether the talents of the authors would not be better directed to analysing the steam losses, which aggregated from 15 to 20 per cent., and did not seem to readily lend themselves either to exact measurement or calculation. As regarded the employment of the perforated metal screens shown in fig. 1, he would suggest that if a series of guiding blades—like the blades of a turbine—were designed to transfer the right-to-left components of the velocity of the air, without shock or undue friction, into vertical components, the same results might be attained without the throttling effect which was to be expected with these screens. With reference, again, to the losses occurring on the steam side, he asked whether it would not be possible to measure some of these losses by electrical methods.

Mr. C. C. PATERSON pointed out that a considerable amount of heat might be lead away into the ground through the bed plate and foundations of the generator; this would naturally affect any tests that were made, and he inquired whether the authors had taken it into account or whether they considered the amount of heat so dissipated as negligible.

Dr. F. T. CHAPMAN made similar inquiries as to the heat which might be transferred to the generator from the steam turbine by means of the bed plate, &c.

Mr. LL. B. ATKINSON said it would be a waste of time to take numerous readings by means of an anemometer all over the cross section of the air discharge trunk as advocated in the paper. In his opinion a deflection instrument should not be difficult to devise by which an average reading for the whole area could be measured. This deflection instrument could be calibrated with an anemometer, after which the latter could be dispensed with.

Other speakers drew attention to the fact that when such low pressures were to be measured it was difficult to attain any degree of accuracy. Pitot tubes were considered to be unsatisfactory, and experiments with the inclined-tube method showed that it was difficult to obtain consistent results. Prof. Threlfall's instrument was preferred; this was a most difficult instrument to use properly, but when so used gave good results.

Dr. S. P. SMITH, replying to the discussion, said that a standard method of determining losses was very desirable. It was a matter of surprise, considering the amount of work that had been done on the subject as revealed by the discussions, that the present paper had not been written a good deal earlier than it had been. Referring to the curves plotted from Pitot-tube readings taken at the air-discharge trunk, he said that the problem was entirely different to that which air-channel experts had to deal with. They quite realised the defects of the anemometer, and they had expected to have to face much criticism, but in spite of its shortcomings, was there a more suitable instrument available? A number of valuable suggestions had been made in the discussions, and they would be made use of. Stray losses could be very large, and it was of the utmost importance that they should be reduced to the minimum. Of course, a steady temperature was necessary before any readings could be taken, but Mr. Law had shown that a good deal could be done to shorten the time taken to carry out tests. Suggestions that an average in place of individual readings could be taken over the area of the air-discharge trunk would simplify tests, and the problem was being considered, but there was considerable variation of the air temperature over the area of the trunk depending on the method of ventilation adopted. He was glad to have Mr. Law's experience and his explanation of his method of running a rotor up to speed. It was true that stray losses could be found by eliminating other known losses.

THE FARADAY SOCIETY.

THE PRESENT POSITION OF THE THEORY OF IONISATION.

AT its January meeting the Faraday Society held a general discussion on the present position of the theory of electrolytic dissociation. The chair was first taken by the PRESIDENT (Sir Robert Hadfield, Bart., F.R.S.), and subsequently by Prof. ALFRED W. PORTER, F.R.S. (one of the vice-presidents), who also contributed one of the papers. The opening address —broadly surveying the subject—was given by Prof. G. SENTER, and an important communication, summarising the evidence now available in support of the theory, was sent from Stockholm by Prof. SVANTE ARRHENIUS, the founder of the theory, who, under normal circumstances, would have been present in person.

The theory of ionisation was originally postulated to explain the anomalous behaviour—as regards vapour pressure, osmotic pressure, freezing points, and conductivities, for example—of electrolytes in solution, and it supposes that in the act of solution these are split up or dissociated into ions, the percentage amount of dissociation depending on the dilution of the solution. If this be the case, however, where dissociation is incomplete, there should be a certain relation between the quantities of dissociated and undissociated solute present, determined by the well-known law of mass action. In the case of strong electrolytes this relationship has been found not to hold good, and much of the discussion centred round this phase of the dissociation problem. Prof. ARRHENIUS took the view that more experimental work remains to be done before we know what precisely are the deviations that call for explanation. Prof. S. F. ACREE, of Syracuse University, U.S.A., in a paper which will be referred to again, incidentally emphasised the importance of the highest technique in experimental methods of determining concentrations of ions and molecules, otherwise any laws deduced are open to doubt; and Dr. E. NEWBERY even went so far as to throw doubts on the whole experimental basis of results based on conductivity measurements of solutions, which frequently eliminate "transfer resistance," namely, that part of the irreversible resistance of an electrolytic cell which is concerned with the transfer of the current from electrode to electrolyte. It happens that the latest experiments on strong electrolytes in which "ultra-pure" water was employed and every possible precaution taken, show these to obey the mass low in very dilute solutions, in accordance with the prediction of Arrhenius. Various suggestions have been put forward to explain the deviation in the case of concentrated solutions, but none of them is conclusive, and the problem must be considered to be *sub judice* The theory that the solvent itself may be ionised was disposed of by Capt. J. W. MCBAIN, while a recent view that salts are completely ionised even in strong solutions, and that the apparent increase of ionisation in dilute solutions is due to the operation of electrical forces, was acutely criticised by Capt. J. R. PARTINGTON, who concluded that it is not yet established whether deviations at high concentrations are due to the ions or to undissociated salt, or to both.

The problems of strong electrolytes ultimately hangs on conceptions of the mechanism of electrolytic ionisation, and this brings us to the important question of the hydration of the ions, which was dealt with by many contributors to the discussion. When the last debate on this subject, some few years ago, was held by the Society, the view was generally adopted that not only were the ions hydrated, that is, associated with some molecules of the solvent, but that this association was the very cause of ionisation. Experimental evidence since accumulated does not, however, support that view. Mr. W. R. Bousfield has spent much ingenuity in calculating the amount of hydration of ions by applying to them Stokes's famous law relating to the movement of small spherical particles through a viscous liquid, but Dr. Henry Sand disputed the validity of this assumption, and Dr. F. H. Lindemann showed that even if Stokes's law were applied, it would have to be with a different constant, and if so, no evidence of hydration had been forthcoming. On the other hand, Prof. J. C. Philip, from a consideration of Kohlrausch's study of variations in ionic conductivities, reached the conclusion that ions must be hydrated.

This phase of the subject is assuredly still *sub judice*, and we look forward to a third Faraday symposium to relieve our perplexities.

Another aspect of ionisation referred to by many speakers, following Prof. Arrhenius, was the catalytic action of electrolytes in accelerating velocities of reaction. It used to be held that the ions only are the active chemical factors in solutions, but Dr. Senter and Prof. Acree have shown that undissociated molecules are also chemically active, and this would go far to explain why neutral salts accelerate the catalytic activity of strong acids. Another view, favoured by Arrhenius, is that the presence of the undissociated salt increases the osmotic pressure and thus the chemical activity of the reacting ions.

The interesting question of the nature of the interionic electrical forces in electrolytes was dealt with in several contributions, notably by Dr. S. R. Milner, who considered that the electrical theory was capable of accounting in a general way for the characteristic features of the ionisation of strong electrolytes. Dr. Lindemann showed that the energy necessary for dissociation depended on the dielectric constant of the medium—which was of the same order as its dielectric constant in bulk—while Dr. H. M. Dawson, going a step further, ascribed the anomalies of strong electrolytes to the disturbing effect on the ionising power of the solvent medium induced by these highly polar compounds of great dielectric capacity. We could have wished that more attention had been paid to this fascinating side of the ionisation problem.

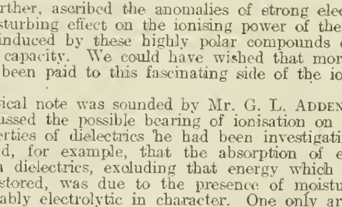
A practical note was sounded by Mr. G. L. Addenbrooke, who discussed the possible bearing of ionisation on some of the properties of dielectrics he had been investigating. He had found, for example, that the absorption of electrical energy in dielectrics, excluding that energy which was reversibly stored, was due to the presence of moisture, and was probably electrolytic in character. One only arrived at the true dielectric constant after eliminating the effects due to moisture. On plotting the dielectric constants of a large number of elements and compounds against other physical properties a definite grouping became manifest. A tentative explanation was indicated of these and the absorption phenomena in terms of the modern theory of the electronic and ionic constitution of matter.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Three-phase Problem.

Recently I had occasion to find a solution to the following little problem :—



The diagram represents an ordinary star-connected three-phase system.

A and B are wires connected to two of the phases.

N is a wire connected to the neutral or star point, acting as common middle wire to the two phases.

The question was to find a formula for the current passing in the middle wire N.

Dealing with the problem by the usual trigonometrical methods, I made out the working as follows :—

If C_1 = current in phase 1 and C_2 = current in phase 2, the current in N $= C_1 \cos 30^\circ + C_2 \cos 30^\circ$.

When the load is balanced and $C_1 = C_2$, this reduces to :—

Current in neutral $= 2\,C_1 \cos 30^\circ = \sqrt{3}\,C_1 = 1{\cdot}7\,C_1$.

Giving as the general formula for any case, whether the load is balanced or not :—

Current in neutral = ·866 (current in phase 1 + current in phase 2).

I am told that my calculation is wrong. Will some three-phase expert either confirm my working, or kindly correct it where necessary? I am, of course, aware that the connections shown are unusual.

February 24th, 1919. **W.**

[If the currents C_1 and C_2 are equal, the resultant current in the common return

$$= C_1 \cos 60^\circ + C_2 \cos 60^\circ = \tfrac{1}{2} C_1 + \tfrac{1}{2} C_2 = C_1 \text{ or } C_2.$$

If C_1 and C_2 are not equal, the resultant current can be found as a diagonal of a parallelogram of which C_1 and C_2 are adjacent sides at an angle of 120°; or from the general formula

$C = \sqrt{C_1^2 + C_2^2 - C_1 C_2}$.—Eds. Elec. Rev.]

The Re-settlement of Officers.

With reference to the letter from "Warrant Officer R.E." in your issue of recent date, may I say a few words with regard to the efficiency of the Royal Engineers? Your correspondent seems to have lost sight of the fact that the "Sappers" also played some part in our electrical operations during the war.

Personally, I think that any lack of technical ability was due to the fact that the positions of authority were in many cases given to officers and N.C.O.'s who were totally unsuitable for the work. As an instance, I was one of a party of 75 men which included 10 B.Sc. (Eng.) and many other technical men, who were commanded by an officer who, in civil life, was a comedian of some repute.

I hope this glaring instance may serve to explain to some extent why our technical corps did not achieve greater wonders.

Ex-Sapper.

Telephone Calls at the Patent Office Library.

I should like to suggest, through the medium of your journal, that it would be a very great convenience to regular users of the Patent Office Library if arrangements could be made whereby such users could be called by telephone from their offices.

To this end, I would recommend the placing of the public telephone in or near the booth of the attendant immediately outside the library, and that he should be provided with a book of tickets after the style of cloakroom tickets. One of these tickets could be purchased, say, for a penny, by a person entering the library; the counterfoil, with his name thereon, being kept by the attendant.

By this means a business man, having to go to the library —and many have to spend hours there—could be communicated with from his office by telephone, the procedure being as follows :—

On the attendant receiving an inquiry for Mr. Blank, he would look among his counterfoils for that name and, finding it, would communicate to the attendant within the library by 'phone or otherwise, the number on Mr. Blank's counterfoil. This number would be called out, giving Mr. Blank to understand that he was required on the telephone. Persons making use of the service would be required to surrender their tickets on leaving the library.

The fee could be adjusted so as to make the service self-supporting were it so desired; but, having regard to the profits made by the Patent Office, this would not seem to be important.

A. H. Moore.

London, E.C., *February 28th*, 1919

Early Wireless Telegraphy.

My object in writing to you on this subject on Januar 25th was to defend the late Sir William Preece against wha seemed to me the very unfair suggestion that had been mad in your columns that Mr. Marconi, when he first arrived i this country, failed to meet with sympathy in official circle and I am glad to see that Mr. Marconi entirely agrees wit my correction in this respect.

I notice, however, that Mr. Marconi goes on to find fau with my statement that the assistance which he receive from the Post Office "included the use of a considerable su of public money."

With regard to this, of course, I have never suggested any time that actual payments were made by the Post Offic to Mr. Marconi, but in order to remove entirely this ide which, though never put forward by me, appears to hav existed, I may state that I have a recent letter from S John Gavey in which he writes :—"To my knowledge, monetary transactions of any kind took place, nor were an payments made by the Post Office to Mr. Marconi duri the period that we were working in association."

This, however, does not in any wise affect what I did sta in my letter to you, which was that the Post Office gave Mr. Marconi "much technical assistance, including the u of a considerable sum of public money which was expende in developing wireless telegraphy by numerous experimen carried out with the help of Post Office officials, includi Mr. (now Sir) John Gavey." Of course, opinions may diff as to what sum of money may be described as considerabl but that substantial sums of public money were expende and considerable technical assistance given by the Post Office to Mr. Marconi in the manner I have stated is borne out by a printed official report by Sir John Gavey written in 1903, which I have before me, in which an account is given of the experiments "instituted by the British Post Office" for the purpose of investigating Mr. Marconi's method, beginning in May, 1897, and in which it is specifically stated that "the apparatus used at this time was partly Marconi's own gear and partly modified and re-designed appliances made in the Post Office workshops or purchased by the Department." The report proceeds to give detail of "the masts of rather over 100 ft. total height," and of induction coils and other apparatus and materials which the Post Office provided, and in some cases specially purchased for the purpose. Further, Sir John Gavey in his recent letter to me, writing of "such Post Office funds as were expended on Mr. Marconi's wireless experiments," states that these were utilised "to meet the cost of materials, labour, and travelling expenses of Post Office engineers in carrying out distant experiments, notably those across the Bristol Channel, where three temporary wireless stations were erected, manned, and subsequently removed, by the Post Office staff."

A. A. Campbell Swinton.

London, S.W., *March 3rd*, 1919.

A Protective Association for Non-Technical Staffs.

I fully endorse "Accountant's" letter in your last issue suggesting affiliating of smaller Associations to the E.P.E.A., but suggest that the E.P.E.A. cater for all non-technical staffs in electrical and tramway undertakings. There are many members of these staffs for which no association caters, and I am confident that if such were included they would be a source of strength to the E.P.E.A. Personally, I am on the eve of joining the Tramwaymen's Union, the only Union at present that is of any use to non-technical staffs. If the E.P.E.A. would take the initiative and form an association to embrace these outside elements I have no doubt of its success.

Three Spires.

March 1st, 1919.

I have followed with interest the correspondence which has appeared in the Electrical Review. Small sectional organisations are out of date, and cannot be expected to protect the interest of their members. The National Union of Clerks is over 40,000 strong, and is developing the guild method of organisation. This method gives each section of clerks the advantage of a sectional organisation without the disadvantages. The electrical clerks' section or guild of our organisation could come to an arrangement with the E.P.E.A. in the same way as the Iron and Steel Clerks' Section, or Guild, has come to one with the Iron and Steel Confederation. We are in a better position to come to arrangements with other organisations than a small sectional organisation.

"Another Supporter" does not realise that the National Union of Clerks has come to the same arrangement with the Railwaymen's Union as the Railway Clerks' Association. In fact, the Railway Clerks' Association is affiliated to the National Union of Clerks in the same way.

At the present time we need more organisation and fewer organisations, and I appeal to the power clerks to assist us to build up a powerful organisation representing all clerks, which will, at the same time, ensure full protection to the various sections by federating them to their industrial unions. This is a scientific method of organisation, and it only requires the necessary membership to secure complete success.

Ben Griffiths,
Welsh Organiser,
National Union of Clerks.

Cardiff, *February 24th*, 1919.

An Association for Technical Staffs.

Would you or any of your readers be good enough to inform us if there is any association incorporating the technical staffs of electrical manufacturing companies, such as estimating, designing, and testing staff. There is, of course, the Association of Engineering and Shipbuilding Draughtsmen, but unfortunately most of those mentioned are not eligible for this. It is admitted on all sides that the staff men have had the least consideration of any branch, and to receive attention to just demands it seems imperative to make combined efforts.

We are pleased to notice in your columns that the E.P.E.A. is obtaining substantial recognition, but presume that this Association confines itself to officials at generating stations.

Five of Them.

February 27th, 1919.

[It is an open secret that a very big movement is on foot to form an association of the type referred to by our correspondent, and we understand that it will shortly make its début.—Eds. Elec. Rev.]

Electrical Engineering in the Army.

I have read with interest your leading article on "Electrical Engineering in the Army," also the correspondence arising thereon. I think the following brief outline of the system employed at one of our Bases for supplying electric light and power to hospitals, camps and workshops may prove of interest to your readers. The area is divided up into two districts, North and South, and each district into six divisions. At the central distributing point of each division, a static transformer is installed, the transformers ranging from 25 k.v.a. to 250 k.v.a. The current is received from the French supply company at 5,500 volts, and transmitted to the various sub-stations by means of a three-core cable laid underground, and passing in and out of each sub-station. There are two separate cables, one going north and the other south, the approximate length of cable laid being 10 miles. The l.t. supply of 210/125 volts, 3-phase, 4-wire, is transmitted from each sub-station to supply the division, four circuits being employed, North, South, East, and West. The outgoing mains are controlled by four tripolar switches and 12 s.f. fuses, a copper link being used for the neutral, which is earthed at the transformer. The lighting load is balanced between the three phases and neutral, and a three-phase, 210-volt, 50-cycle supply used for power. Periodical readings are taken at each sub-station, and the out-of-balance current is kept within 1 per cent. at the average maximum load. In the hospitals, each marquee ward is provided with electric light, whilst the hutted wards have, in addition, special connections for the use of radiant heat and light baths. For the operating theatres, special fittings are made for the operating tables, eye and throat work, and the X-ray departments are provided with an up-to-date installation for taking instantaneous photographs. In the camps, huts and messes are electrically lighted, whilst in the workshops extensive use is made of the supply for power.

M. M. E.

France, *February 12th*, 1919.

Engineer Surveyors' Salaries.

Mr. Forsyth's letter concerning insurance surveyors' salaries is not quite correct, namely, £360. Presuming this to include the war bonus, which he does not mention, it is still in excess of the actual remuneration of at least one of the old surveyors of over 10 years' service. Perhaps he will kindly correct the above figures, or, better still, practise what he preaches.

Ultra.

March 2nd, 1919.

How NOT to Obtain a Situation.

At this time, when so much is being said and so many articles written on the subject of employment, not only as regards men about to be demobilised but also civilians, I think it would be very advisable if prospective applicants gave more attention to the method of applying for a position than is generally the case at present. It has been my lot for some time to examine applications and fill vacancies on behalf of certain electrical undertakings, and the more I have to deal with this work the more I am led to believe either that the engineering profession contains a large number of fools or that carelessness and indifference are the most striking points in the character of a number of its members. While it must be admitted that many men send in applications that are excellently drafted, at the same time it is appalling to see the style in which a large number are composed. Some applicants give no details whatever of past experience, but write in a general rambling way; others give so little information of any sort that, after reading the application, all one is really aware of is the applicant's name and address. It has been my custom when inserting adverts in any paper to state as clearly as possible the nature of the training and experience required for the particular job, and to ask applicants to state age, full details of experience, &c.; but, on going through the replies received, I invariably find that a large percentage contain no information which would be really useful to a prospective employer in deciding as to a suitable applicant. I could give many instances, did space permit, but two which occurred recently will show what I am sorry to say is becoming a type instead of an exception: In one case the vacancy was for a shift engineer, and amongst the replies was one from a man who started by giving his age and then, after mentioning where he was employed at the time, stated, "I have been here ten years, so that ought to be good enough recommendation for anyone." I think it must be obvious that although the applicant may have been a good man, at the same time a man might be ten years in a certain job simply because his qualifications did not entitle him to a better position. The other instance was an application which consisted solely of a copy of the advert. and the following words: "I beg to apply, and hope my application will be considered." If this evil was only met with amongst the younger members of the profession, one might say that it was due to mere impulsiveness or lack of thought, but unfortunately amongst older applicants it is also common. I saw an application some time ago for a resident engineer's position from a man who held a university degree, in which, after a few vague statements, these words occurred: "I feel confident that I am the very man for the post, and could run the works as no one else could." I apologise for trespassing so far on your space, but I feel that some attention should be called to this question, and I am sure there are many engineers who could state similar facts.

Static.

February 28th, 1919.

Electrified Seed.

I quoted Dr. Mercier's own words, "Mountains of sugar and rivers of rum"; and now he says, "but I never used the phrase he attributes to me"! May I again ask for a reference to the author of the phrase?

We shall get at some of the facts if we make the best of what can be drawn out of the learned doctor, who tells us that "in each acre some 130,000 plants were subjects of experiment." This works out at about 27 plants per square yard; and it would be interesting to learn how many untreated *seeds* were sown to the square yard—also how many *plants* grew from what the birds left? Did Dr. Mercier know that birds prefer *un*treated seeds?

I am more anxious to get at the truth than "to catch Mr. Fry tripping," for he is quite able to take care of himself; and perhaps Dr. Mercier will kindly inform us *how many* treated and untreated seeds go to the bushel.

March 1st, 1919. **Wide Awake.**

The Future of the E.T.U.

As a member of the Newcastle Central Branch of the E.T.U., I feel it is necessary from the point of view of truth and honesty to enter an emphatic protest against your leading article in your issue of February 21st. You ask: "What is the matter with the E.T.U . . . The facts are notorious." "During the war the E.T.U. admitted to membership every Dick, Tom, and Harry that it could induce to enter, no matter how nebulous or remote his claims to electrical qualifications might be," &c. Now, I wish to bring to your notice the fact that the E.T.U. extends far beyond the environs of Ludgate Hill; consequently as a member of this northern branch and district, I unhesitatingly condemn your assertion as a lie. I challenge anyone to prove this to have happened in this branch and district. Your reference to the union "advertising itself as an efficient umbrella for those wishing to evade military service, &c.," may very well be passed over with contempt. Our head office do not possess an imposing roll of honour, but had they one, I am confident it could be well filled with the names of our members. Also many of those "highly skilled men who uphold the dignity of their calling" might, incidentally, have been "war-shy," and glad of the anti-military umbrella. It would be interesting to know how this portion of your leader affects the I.E.E. and the E.P.E.A. You also deplore the action of certain extremists in the E.T.U. in embarking upon this "foolish policy." What union is without this element to-day? What is the main cause of the chaos at present existing in the industrial world? I would refer you to the insane, panic-stricken attitude adopted by the Government at the outbreak of war towards the National Executives of organised labour throughout the country. When these executive were forced to sign the agreement with Mr. Lloyd George to forsake their privileges and their discipline over their various bodies, the extremist in the rank and file secured his chance. The National Executives for four years have been bound hand and foot by the Government, with the consequence that discipline and moral authority is a nonentity throughout organised labour. Towards the end of your article, it is very easy to discern your concern for the "really good men" in the E.T.U. I am frank enough to say that nothing would give you greater pleasure than to see a split in the ranks of the E.T.U., as a "Correspondent" suggests. But I am sanguine enough to say that the E.T.U. will weather this illness, even should it need the application of the surgeon's knife, but I am afraid those counting upon a post-mortem will be woefully disappointed. Regarding your E.T.U. correspondents who shelter behind the contemptible *nom-de-plume*, to throw their squibs at their "fellow members," I would remind them that if only they possess the manliness and honesty, they have branches in which their grievances may be ventilated and remedied, and a journal which will circulate their literary efforts throughout the kingdom. In conclusion, I trust you will publish this letter in the interest alone of truth and justice, as good journalism is usually held to be above prejudice and falsehood.

M. Boyle.

Newcastle-on-Tyne, *February 27th*, 1919.

[No doubt some branches of the E.T.U. are all that could be wished; but there are others. The claim of the E.T.U. to be a refuge from military service was recorded in the "Branch Notes" of the *Electrical Trades Journal* of September, 1917 ("Our slogan should continue to be that membership of our Union carries with it exemption from military service"). In our issue of November 16th, 1917, Mr. Webb stated that the above quotation, written by himself, represented the feelings of his Committee and the Union; incidentally, in the same letter he said that our comments had "always borne the imprint of fairness and tolerance." We do not wish to see the E.T.U. destroyed—we wish to see it a real electrical union, under wise and temperate leadership; as a matter of fact, our criticisms have been directed mainly at the London Branch, which seems to be the turbulent element. It will be remembered that at the meeting at the Albert Hall in December last. Mr. Lansbury attributed to the Electrical Trades Union the function of storm-troops to go "over the top" and lead the other unions in the proposed revolution. How many of its members want to do that? Are they willing to be the cat's-paw?—Eds. Elec. Rev.]

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

3,370. "Insulated joints for electric conductors." E. A. Walshaw. February 11th.

3,372. "Apparatus for obtaining continuous or direct-current from alternating-current circuit." A. Bopp et Cie. February 11th. (Switzerland, February 15th, 1918.)

3,407. "Electric switches." Cable Accessories Co., A. Crawford & F. H. Reeves. February 12th.

3,415. "Spark gaps for electromagnetic wave signalling systems." F. Lowenstein. February 12th.

3,414. "Sparking plug." H. Benoist. February 12th. (France, December 26th, 1917.)

3,419. "Producing and selectively transmitting harmonics of electric oscillations." Western Electric Co. (Western Electric Co., U.S.A.) February 12th.

3,428. "Ignition in internal-combustion engines." H. Brooker, P. A. Garrett & R. H. Moore. February 12th.

3,456. "Electric welding." British Arc Welding Co. & E. F. Spanner. February 12th.

3,462. "Receiving circuits for wireless telegraphy." H. J. J. M. de Regnauld de Bellescize. February 12th. (France, April 29th, 1918.)

3,476. "Electromagnetic relays." N. Blades, and British L. M. Ericsson Manufacturing Co. & A. E. Sutherland. February 13th.

3,528. "Electricity meters, &c." M. Anninger. February 13th.

3,537. "Apparatus for indicating amount of electric current passing through a network box link, &c." A. F. M. Gatrill. February 13th.

3,552. "Starting mechanism for internal-combustion engines." H. E. Weller & T. Weller. February 13th.

3,555. "Electric arc furnaces." W. E. Moore. February 13th.

3,556. "Furnace-charging apparatus." W. E. Moore. February 13th.

3,559. "Evacuation of thermionic tubes, &c." Osram-Robertson Lamp Works & C. F. Trippe. February 13th.

3,560. "Electric mercury switches." A. K. Toulmin-Smith. February 13th.

3,562. "Electro-mechanical means for maintaining a platform or body in a ship parallel with the horizon." H. E. Rorke. February 13th.

3,569. "Electrical oscillatory circuits." W. J. Lyons & Selective Signal Co. February 13th.

3,592. "Electric lamps." Edison Swan Electric Co. & P. Freedman. February 13th.

3,601. "Device for destroying rats, mice, &c., by electrocution." J. Fell. February 13th.

3,619. "Thermic telephones, &c." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. February 14th. (Germany, February 15th, 1918.)

3,620. "Apparatus for manufacture of thermic telephones, &c." Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. February 14th. (Germany, February 15th, 1918.)

3,641. "Electric couplings." W. C. Lea. February 14th.

3,642. "Manufacture of electrodes for soldering and depositing metals by the electric arc." Alloy Welding Processes, Ltd., & E. H. Jones. February 14th.

3,645. "Protective devices for electrical circuits." Western Electric Co. (Western Electric Co., U.S.A.) February 14th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

14,516. Dynamo-electric machine for transforming alternating current into continuous current or vice versa, and applicable also as a double-current generator. La Cour. October 14th, 1914.

1917.

6,642. Sparking plugs. T. Crosbee & Sons, T. S. Rogers & H. R. Wilks. May 10th, 1917. (122,654.)

12,051. Means for communicating to and from aircraft. T. Harvey and T. G. Tulloch. February 21st, 1918. (122,657.)

12,938. Insulation of the windings of electrical machines and apparatus. R. L. Cleaver & Sandycroft, Ltd. September 10th, 1917. (122,659.)

15,583. Automatic arc lamps. W. Engelke. October 26th, 1917. (122,660.)

15,978. Dynamo-electric machinery. Electromotors, Ltd., B. Longbottom and E. Greenhalgh. November 2nd, 1917. (Addition to 999/17.) (122,665.)

19,023 Signal devices applicable as stopping and turning indicators for vehicles. E. B. Roedding & E. Roedding. December 22nd, 1917. (122,670.)

19,331. Systems and apparatus for the electric transmission of power. E. M. Fraser. December 31st, 1917. (122,675.)

1918.

534. Sign telegraphs and other like electrical advertising devices. H. K. Harris. January 9th, 1918. (122,676.)

1,193. Mechanical movements for electric switches. J. W. McKenzie (Despard and Gordon). January 21st, 1918. (122,682.)

1,620. Dynamo-electric machines. H. Pieper. January 28th, 1918. (122,689.)

1,627. Dynamo-electric machines. Submersible & J. L. Motors, Ltd., and H. K. Whitehorn. January 28th, 1918. (122,690.)

1,632. Dynamo-electric machines. Submersible & J. L. Motors, Ltd., and H. K. Whitehorn. January 28th, 1918 (122,691.)

1,765. Electrodes of electric batteries. M. Robin. January 30th, 1918. (122,697.)

1,929. Generation of power, light, and heat from the sea tides. J. W. Seckerson. February 2nd, 1918. (122,706.)

2,116. X-ray fluorescent screen attachment for the localisation of foreign bodies. W. J. Barnicoat. February 6th, 1918. (122,711.)

2,526. Apparatus for producing flashes by the electric volatilisation of fusible wires. J. Courtier & P. Courtier. February 12th, 1918. (122,719.)

5,009. Dynamo-electric machines. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 21st, 1918. (122,741.)

5,381. Automatic telephone systems. Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) March 27th, 1918. (122,747.)

6,055. Bases for incandescent electric lamps. H. C. Ghijsen & Naamlooze Vennootschap Vitrite Works. April 9th, 1918. (122,558.)

6,215. Telephone receivers. E. M. C. Tigerstedt. March 31st, 1917. (114,850.)

6,817. Method and means for protective apparatus on alternating-current system. A. G. Collis and Crompton & Co. April 23rd, 1918. (122,344.)

8,811. Overload electric switches. P. G. van Wijk. March 7th, 1918 (122,350.)

8,867. Electrically-heated perforator. A. B. Campbell. May 29th, 1918 (122,771.)

9,430. Electrical installation systems. Ateliers H. Cuenod Soc. Anon. June 21st, 1917. (117,445.)

THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch 132, Bay Street
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank. Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

GOVERNMENT REORGANISATION OF ELECTRICITY SUPPLY IN GERMANY.

THE latest scheme of special importance reported from Germany relates to the preparation of Bills for the consideration of the Legislative Chamber for the purpose of regulating the supply of energy throughout the country. The question of nationalising the supply of electricity was discussed on various occasions prior to the war, but it was only during the course of actual hostilities that an official announcement was made, as we mentioned some months ago, that the Government of the day had no intention of proceeding to expropriate the electricity works in Germany. In the meantime, the Revolution has wrought many changes in that country, but it has not effected any alteration under the so-called new *régime* in the determination not to transfer electricity works to the State. The present great scheme aims at the establishment of a uniform organisation for the utilisation of the sources of energy contained in coal, peat, mineral oil, and water-falls, and the distribution of the energy in a more economical manner than the present for the benefit of the whole community. The project is due to the initiative of the war-time creation known as the "Imperial" Economic Board, which was formed to deal with practically all economic matters, and the words "Imperial" and "Empire" are still continued, because the Germans are reluctant, perhaps for ulterior reasons, to abandon them. Indeed, when we read that the Bills have been forwarded to the Federal States—representatives of which constituted the formerly all-mighty Federal Council with which the Kaiser and the industrialists controlled Germany—particularly Prussia, Saxony, and Bavaria as being chiefly concerned, and that after hearing their views the Bills will be submitted to the new Parliament, it looks as if the old Germany still exists, and, leopard-like, finds it impossible to change her spots.

The Bills undoubtedly have a two-fold object. In the first place, it is hoped to rehabilitate the country commercially and financially by effecting considerable economies in the production and distribution of energy for the welfare of the whole empire, and thus avoid the enormous waste of energy which has been in progress, stimulated by the electrical manufacturing firms in their aims for securing a multiplicity of connections and business. The second object, which is not less important, is to offer a substitute for the wild schemes of nationalisation or socialisation which have become prevalent in Rhenish Westphalia, particularly in the coal mining industry, and in this way divert the minds of the turbulent section of the population, if possible, from the destructive tactics which are being followed in the matter of industrial works, some of which have been seized by the workmen and continued in their own interests. It is recognised, at least by the Imperial Economic Board, that the appointment of a Nationalisation Commission by the late Government was a mistake, inasmuch as it has resulted in great harm to the country, and has probably prompted the mad socialisation schemes which have been carried out in individual cases in the West. The action in this direction has merely changed one producer for another, and capital in bulk for individual capital, and placed in possession men who are inferior technically to the rightful owners, and who lack commercial experience, but who in their efforts to gain profits are considerably more regardless of general interests than the actual or former proprietors. This state of affairs is leading to the ruin of industries, and rendering impossible any competition in international markets.

The consumption of electricity throughout Germany increased five-fold between 1907 and 1917, whilst it has risen ten-fold in the case of the public supply works taken separately in the same period of years. The rapidity of the development was such that, in the words of the Economic Board, the Government neglected to take advantage of the appropriate moment for intervening in the industry and obtaining influence and the power of jointly determining matters. As a consequence, the disadvantages have arisen that works have been scattered all over the country in a completely unsystematic manner; private monopolies have been created on the one hand and communal one-sidedness on the other—each small community, through ambition or envy, striving to have its own electricity works; and a preferential supply has been given to profitable districts, whilst the others have been neglected. Under these circumstances, it is scarcely surprising to learn that there are over 4,000 separately-owned supply undertakings throughout the country, and this large number is said to represent an enormous waste of energy, whereas 100 large works would be able to satisfy the entire needs of the country. The Bill, therefore, proposes to advance the interests of the sound undertakings which already exist, and systematically to abandon the uneconomical works, which can no longer be permitted to cause such a large waste of energy. It is intended to divide the empire for the purpose of electricity supply, not according to political boundaries, but into supply districts organically limited according to technical and economic interests; and the supply works in these districts will be formed into a combination, and will no longer compete with each other, but will co-operate in satisfying the demands of consumers. The combinations or groups thus formed will be constituted by the State, although it is proposed to leave scope within the combinations for free initiative and strong personality, subject always to the welfare of the State. It is hoped in this way to secure the maximum efficiency in the production and utilisation of electrical energy. The question of water power is to be dealt with in a further Bill, which has yet to be prepared. The Government contemplates the creation of Departments to establish the previously mentioned combinations, in which the interests of consumers and of the skilled workmen will be represented; wages questions will be jointly settled by the employers and the workmen; and the whole of the industry will be supervised by the Imperial Economic Board, assisted by a Council formed of interested parties.

The details of the coal and electricity Bills have not yet been published. Sufficient has been stated, however, to show the general trend of the projected legislation. The idea of State control of the supply industry from a comparatively small number of huge generating stations is not new in itself. It was proposed for Germany, as our readers will remember, by Herr Klingenberg some time ago; and the big-station scheme was also suggested for London by the same engineer at an earlier date in a paper read before the Institution of Electrical Engineers. But that was before *we* expected the Zeppelins; perhaps not before Herr Klingenberg anticipated their paying us a visit. On the other hand, another German authority states that the scheme "breathes the spirit of Rathenau," and consequently it is regarded with the greatest distrust; and with this quotation we will leave the subject for the present.

Lighting Problems.

Now that the lighting restrictions are removed, there is only the question of rationing to be lifted before the shops are at liberty to revert to their former conditions of lighting. But the question is, will they, and ought they, to be once again *in statu quo ante bellum!* It will be remembered that for some time before the war outside shop lighting had threatened in some parts to become a public nuisance. Flame arc lamps had become the order of the day or night, and certain classes of tradesmen had emulated each other in trying to get the greatest number of arc lamps over the smallest area. In some of the streets in London (for instance, in some parts of the Strand) the glare of these outside lights had become an intolerable nuisance to the passing public. If we remember rightly, there was a movement in progress to impose stringent regulations with regard to outside lighting, so as to safeguard the comfort of the ordinary pedestrian. The coming of war, of course, cut it all short. The question now is: is the matter of lighting to be allowed to revert to its former lawless state? From the point of view of display of goods, and, in fact, every other point of view as well, the best form of illumination is obviously concealed lighting in which the sources of light are altogether outside the range of vision, and the goods in the shop window *only* are illuminated. The increased efficiency of metallic-filament lamps ought to make this form of lighting more popular than ever. There is an opening here for the Illuminating Engineers' Society to make good its *rôle* of leadership in the science of illumination, and to guide the fashion of lighting into proper channels. What better opportunity could be afforded than the present, when people are accustomed to very moderate lighting, and when there would therefore be no opposition from the public to any restrictions that were made for the public good?

The Salaries of Technical Staffs.

We noted with interest that the *Electrician*, in its last issue, drew attention to the low salaries offered to the technical staffs of engineering colleges in recent advertisements, and we have pleasure in supporting the protest of our contemporary against this short-sighted policy. Instances are quoted in which technical assistants are offered £150 to £175 per annum, and for the head of the electrical engineering department of a Municipal Technical College the salary named was £300 per annum.

That scientific training is an essential part of the development of an engineer in any branch of the profession is known nowadays even to the layman; but what sort of instruction can be obtained for the wages of an unskilled labourer? The salaries paid to technical teachers have never erred on the side of generosity, even in peace time—but apparently the managers of our educational institutions think that the same old rates can be maintained even in these days, when the sovereign is worth only ten shillings. It may be argued that plenty of candidates will be found willing to accept these rates, for the sake of the opportunities of technical study that such posts afford; but what a ghastly mistake it is to enroll men as teachers who themselves are in need of instruction! It is emphatically not a business proposition; as our *confrère* suggests, it is more or less of a fraud upon the students, and it is very certain that the nation will pay dearly in the future for niggardly economies of this kind in the present.

LARGE ROLLING MILL PLANT.

Messrs. Siemens Brothers Dynamo Works, Ltd., have completed recently at their works at Stafford the first of two reversing mill motors having a peak power of 19,000 h.p. This motor has just passed successfully through its tests at the works, and we give herewith some particulars and illustrations of the machine.

The motor has been built to drive a 36-in. roughing and finishing mill on the North-East Coast, and there is now in course of construction a second motor of similar size and type to drive a 34-in. roughing and finishing mill in the Sheffield district.

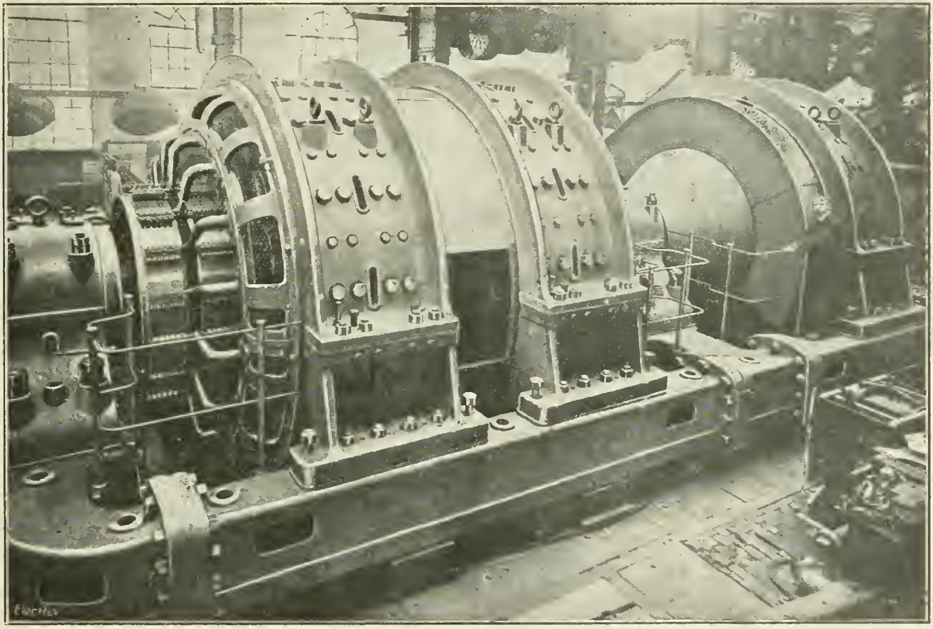

Fig. 1.—A Siemens 19,000-h p. Rolling-Mill Motor.

The motor just completed is shown in fig. 1. It will be seen that it comprises three units rigidly coupled together and mounted on a combined bedplate. The advantages derived from this design are referred to later.

The total of 19,000 peak-load h.p. is obtained at speeds ± 60 to 140 r.p.m. The pressure across the armatures is 1,400 volts, and the weight of the complete machine is approximately 300 tons. The diameter of the shaft in bearings is 24 in., and that of the shaft extension 27 in.

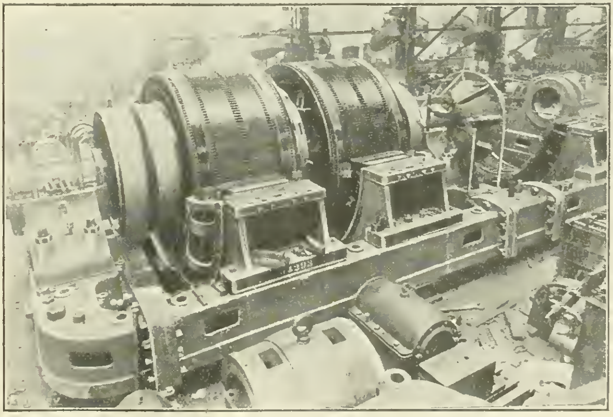

Fig. 2.—Two of the Three Armatures, Showing the Coupling.

Figs. 2 and 3 are interesting as illustrating the machine in course of manufacture and erection on the test bed; fig. 2 shows two of the three armatures in position, and the coupling for connecting the third armature. Between the two armatures is seen the special coupling piece for connecting them together: this coupling registers the two spiders and provides for a drive in either direction through special keys. This illustration also shows the double commutator which is a special feature in the design of these motors.

In fig. 3 is seen one of the armatures with the core plates built up, but before the armature windings have been fitted. This illustration shows the central air gap and end plates which have been specially designed for providing ample ventilation. The cast-steel spider fitted with driving bosses at the periphery is also shown.

Each armature is provided with its own shaft, the drive, as explained above, being transmitted through the spiders of the armatures. Thus great rigidity is secured, and deflection between centres is thereby reduced to a minimum.

The completed frame with commutation poles and compensating windings is shown in fig. 4. The gap in the centre of the main pole-piece, which corresponds with a similar gap in the armature, is a special and notable feature. The gap acts as a passage-way for the forced-draught ventilation, and provides an efficient means of cooling at the centre of the compensating-winding bars. The frame itself is constructed of cast-steel.

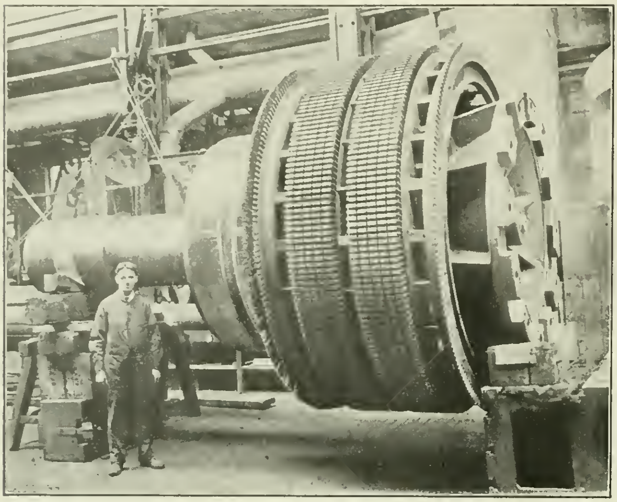

Fig. 3.—Armature with Core Plates, but without Winding.

The drive is on the well-known "Ilgner" principle, the power supply being converted by means of a separate motor-generator set fitted with a heavy flywheel. This set consists of a three-phase driving motor, having a continuous rating of 3,750 h.p. on a 2,750-volt, 40-cycle, three-phase circuit, and running at a speed of 400 r.p.m. This motor is direct-coupled to, and mounted on, the same bedplate, with two variable-pressure generators mounted one on each side of the flywheel, and capable of supplying the necessary power to the mill motor. The flywheel is of cast-steel, and of the built-up type. It weighs 40 tons, and has a diameter of 15 ft.

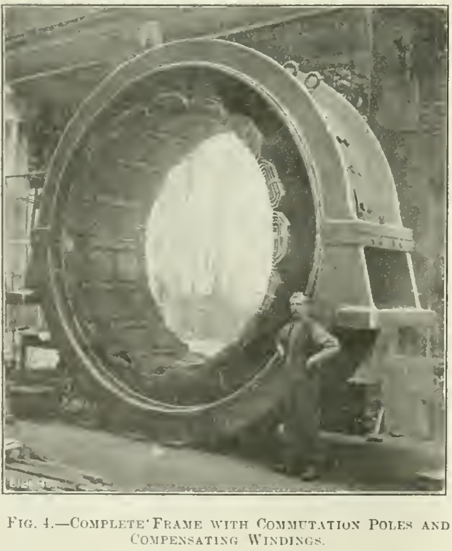

Fig. 4.—Complete Frame with Commutation Poles and Compensating Windings.

As the mill is entirely controlled by varying the fields of the exciters supplying respectively the fields of the variable-pressure generators and the mill motor, the main controller is of small dimensions.

The manufacturers claim that in dealing with such a high-powered motor the three-armature design possesses advantages over a double-armature machine of necessarily greater dimensions. These advantages are summarised as follows:—

As the diameter of the armatures is smaller than would be necessary in the case of a double-armature machine of the same power, the inertia is reduced, and the operation of the mill is improved owing to the more rapid acceleration obtained.

The distance between the centres is shorter, and the weight on the bearings is less than in the case of a two-armature machine.

The total weight of the motor is divided into less weighty parts, thus facilitating handling, &c.

This type of machine fulfils the requirements of standardisation of parts, as it is apparent that, by employing one, two, or three of the separate units composing the whole motor, either 6,500, 13,000, or 19,000 h.p. at 60 r.p.m. is available. It follows, therefore, that with motors made up of one, two, or more units, each unit of uniform design and of uniform size and power, almost any size of mill can be driven, and the spare parts being all of standard pattern, the number of these to be kept available is reduced to a minimum.

The whole equipment follows closely the lines of the plant supplied by Messrs. Siemens Brothers Dynamo Works, Ltd., for electric winding in large collieries. In addition to the two 19,000-h.p. machines, Messrs. Siemens Brothers have in course of construction at Stafford two others of 12,000 h.p. and 6,400 h.p. respectively.

(To be concluded.)

THE DETERMINATION OF STANDARDS.

By Major E. A. Pells, R.E.

The efficiency of any job is the relation between the actual result of the job and the standard; the value of all efficiency work, therefore, depends upon the accuracy with which the standard is arrived at in the first instance. Standards constitute the foundation upon which all efficiency work rests; and until definite standards are set, there exists nothing from which the degree of efficiency can be measured. To arrive at the standard for any job, time studies must be made. It is a matter of debate as to who was the originator of this idea, but the palm is usually given to F. Winslow Taylor, as his papers before the American Society of Mechanical Engineers were the first published matter describing the system. It is useless, however, to begin time studies before the lay-out and routing has been brought as near to perfection as possible, unless for the purpose of comparison. Therefore, the first thing to be done when it is decided to determine a standard for any particular job is to make a sketch of the lay-out and routing, and carefully consider it with a view to improvement. If alterations are made, a short period should be allowed to elapse to enable the workers to fall into the improved methods of working, before studies are made. This time may be utilised very usefully in preparing instruction cards for the operations performed, and to assist in this, long-time studies may be made.

A long-time study may be of a whole working day or of any other working period, and observers should get all the details possible regarding the job observed, noted down, also all waste time, especially those few minutes which creep in, which are often regarded as rest periods and not taken into account. It is obvious that if this is not done, the efficiency engineer will get a false appreciation of the time values, and there will be, when short-time studies are made and the standard time is being determined, a lot of time which cannot be accounted for. Efficient observers are not made in a day or two, and it is far better to get down too much detail of the work in hand than not enough.

Short-time studies may now be made, and this should always be done on the best operative available, although it is just as well to let the worker know that his actual times will not be the standard times, as this prevents misunderstanding and usually leads to better results. My own method is also to time an average worker or two, as the results obtained are often of great assistance as to the real value of the best operative's times. The time data having been carefully collated and analysed, it is necessary to eliminate all actual waste time shown, as this is usually an irregular factor dependent directly upon the supervision. The rest factor is then added; this varies in ratio to the fatigue of the job, and may be anything from 12 per cent. to 50 per cent., but is usually somewhere about 20 per cent. Any other factors directly dependent upon the job under consideration are now brought in, and the standard can be fixed; should there be the slightest likelihood of immediate improvements, it would, perhaps, be advisable to describe it as an "experimental standard."

In considering factors for the determination of standards, good results can only be obtained by long and careful investigation. Accurate time study is most important, and cannot be hurried through.

Finally, no progress has ever been made in this world by people who are perfectly satisfied. There must be definite ideals at which we aim, and in efficiency methods these are provided by carefully compiled and calculated standards.

PLANNING A WORKS RESEARCH ORGANISATION.

At Birmingham, on February 5th, Mr. A. P. M. Fleming's paper (an abstract of which appeared in our issue of January 31st) was read and discussed before the South-Midland Centre of the Institution of Electrical Engineers.

Dr. C. C. Garrard said that a researcher should have his mind free from routine work and consideration of output in order that he might be able to concentrate entirely upon the particular researches in hand. A works laboratory was essentially a part of the production department; it was simply an organ of control for the use of the management. He was strongly of the opinion that the research department, if started, should not be an adjunct to the works laboratory. Scientific research should have the utmost publicity, so that all might benefit. A works' research department was established for commercial reasons, and it was unreasonable to expect the publicity which was necessary for a scientific research. The organisation of the development department must be different from those of the research department and works' laboratory; the former should be departmentalised, and would perform, among other duties, those mentioned under "Technical Processes" in the paper.

Dr. Kapp said it was natural to consider what universities and technical colleges could do to promote scientific research directed towards immediate use in industry. A research in electrical engineering carried out on a small scale might in many cases be misleading. It was simply a question of power at the works disposal. He needed only to mention the development of electric welding as applied in shipbuilding, where for spot welding a current of many thousands of amperes was required at something like 300 to 400 volts. The help a university could give to industry by way of research must be on the whole indirect. The training of men to work in laboratories would be the direction in which universities could be of real assistance to industry. In the case of small firms, laboratories of adequate size might be established on the principle of a trading company with the firms as shareholders. Any firm which was a member of the company could have its research done by the staff of the laboratory, the cost being charged to the firm ordering the research. By sharing valuable information among all the members of an industry the nation as a whole would benefit.

Mr. W. Wilson thought the need for research in the engineering industry of this country was most urgent, and the paper was especially welcome on this account. The inclusion of routine testing in the research organisation was unwise; this was an essential part of the works' cycle, and should be administered under the works manager. Industrial research itself was divisible into two grades, each of which should be treated separately, and be under separate management. Their functions were distinct; they required a different class of man to carry out the work; and many factories only required the lower grade (using the adjective as representing its position in the scheme), particularly to-day, when the products of their industrial establishments were becoming specialised. If progress and improvement were not desired in any respect, nothing further was needed in addition to the ordinary works routine testing. But as soon as the necessity was recognised for a continual advance in the direction of perfection, then a special department was required, which would be responsible for the developing of new ideas into "manufacturable" commodities, the solution of many of the problems that arose from time to time in the factory, the carrying out of such modifications as might be necessary in the patterns, types, or models of the product, and the making of experiments to determine what new departures and modifications were justified. The head of such a research department, which might be termed the "development" section, must be thoroughly versed in the actual products, as well as the methods and processes, of the particular shops dealing with them, and in addition with the use and performance of these products in the field.

Mr. H. V. Kramer thought that it was rather too premature to discuss details of building and plans of the laboratories, and he would like to see more thought given to the great principle which must govern this problem. Personally, he did not see how the erection of large laboratories would tangibly assist the needs of large mechanical and electrical manufacturing concerns, without some intermediate link being formed between the present works organisation and its facilities for design and production, and that of the laboratory. He would rather like to see, first of all, attention paid to the erection of a number of experimental workshops, complete with a well-equipped test room or small laboratory, specially equipped for the production of first constructions to make up specimens of new apparatus developed by each department of a large works, and so create a valuable addition to the present incomplete system existing in almost every large manufacturing establishment. With this experimental workshop and laboratory, a small research library and test-record intelligence department, should be connected, of, however, a purely specific value to the department. Then, and then only, the departmental manager of large works might be in a position to give tangible form to ideas from the staff of his department, or from the suggestions made to him by his clients or his salesmen, concerning the needs of the particular line in which he specialised. It would enable him to produce samples quite irrespective of and without interference with the regular routine productions for which the machinery of his particular department was laid down. In this way a clean cut would be established between the purely routine productive side of business, and the creative or research side for development. He was sure that a central laboratory of any of the types shown in the paper would not entirely be able to meet the variety of demands in this first and most important logical point, which was common to all works which were laid out for quantity production. He admitted, however, that in addition to the experimental workshops attached to every department, with or without small laboratory facilities, some scientific higher institution such as a central research laboratory, was essential.

At Manchester, on February 11th, Mr. A. P. M. Fleming delivered his lecture, which was followed by a discussion before the North-Western Centre of the I.E.E.

Dr. E. W. Marchant said that nearly all the large scale research work that was being carried on at the present time seemed to be done in America. If manufacturers did not take it up soon on a much larger scale they would ultimately feel the effects industrially in a very serious way. It was necessary to have a library if the laboratory was not to repeat work which had been done before. It was as essential as almost any other part of the institution—perhaps even more essential. Some people were capable of doing a particular kind of work much better than others, and an enormous saving could be effected if only the right people were chosen, but how far it was possible to carry that process it was difficult to say. If they were to get the very best type of person into research work it was necessary that the opportunities for advancement and the prospects held out for such work should be of an extremely generous kind. In the past the prospects in electrical engineering were not sufficiently good. The method of eliminating vibration of a table by india-rubber feet which rested on the top of two piers, worked extremely well; for a certain class of vibration it was excellent, but other methods would have to be adopted where the vibration was very severe. He welcomed the suggestion that it might be possible for the works to place facilities at the disposal of university students; that would be a tremendous step in advance.

Mr. B. Welbourne said that he thought a great deal about the necessity for having a central library in this country to co-ordinate the whole of the published scientific literature of the world and make it available for engineers and scientists generally. He suggested that it would be a worthy war memorial to establish such an institution. The training of men by the universities was a fundamentally important question. The research worker was born, not made, and he thought the amount of really pure research work done in the works organisations would be very small; it would be left largely to the existing research worker, the pure scientist. Personally, he preferred to use some other phrase in place of "research. One could carry on industrial research under the heading of experimentation.

Dr. Miles Walker asked the author what he proposed to do with what might be called the "greater research." The researches that he spoke of certainly provided for such things as testing materials, and so on, but he believed they would not make much progress in the future unless they had research on big machines which must be done in the factory itself, and backed up by a board of directors prepared to spend a good deal of money in investigating what was the most useful line to go upon. In the next fifty years there would be changes in electrical engineering quite as great as those which had happened in the last forty years, and there would be entirely new types of machines performing entirely new functions for industrial purposes. If this country was to be in the forefront of manufacture it would have to do something in the way of developing, and those things could only be done by organised methods. Every large manufacturing concern ought to have a department whose business it was to see what kind of plant was likely to be required by manufacturers for all sorts of purposes, and see if there was anything that could be done better than it was done before. If this country was to stand forward as a progressive country, manufacturers must be prepared to expend some of their profits in experimenting on those lines. He protested most emphatically that research workers could be made. It ought to be possible to give everyone who had any spark of genius a suitable training so that he could be made into a research worker.

Mr. R. W. Bailey said the question of the supply of staff was the most important one that had to be tackled. The suggestion that works apprentices should pass through the sections of the research work other than routine testing was excellent; it gave an opportunity to select men whose educational record had been dealt with previously. He was strongly of opinion that a period in the workshop was essential before the post-graduate training was given.

Mr. J. S. Peck, who was connected with various committees dealing with research, said that very little progress was being made; most of the time was spent in disputing as to whether the income tax was going to be remitted on certain moneys which were subscribed by the different organisations. There seemed to be a great deal of talk and very little result. They had got to do something in the way of research, but it was a difficult matter to show that fine buildings and equipments were necessary. If there was a very big balance at the bank they could afford to make experiments, but most of the electrical manufacturers in this country were not in that position.

Mr. J. P. Bedson regretted that in this country the financial or the capital element of a business was too much under the control of the capitalist, and the intelligent expansion of a business could not always be secured. A paper like Mr. Fleming's should be read before the directorate or the financial men of large undertakings such as the Westinghouse. He hoped that the seeds were being sown in fertile soil. It was not on the technical side alone that education was needed; the financial side needed it as much.

Mr. A. Saxon thought that the author had made out a good case backed up by definite and well considered plans which were sufficiently flexible to meet most industrial requirements. All agreed that research work would pay. In view of the shorter working week (which seemed likely to be still further shortened) scientific research must come to the aid of the industry by the development of new processes, labour-saving appliances, and the selection of the most suitable materials so that an economical output might be obtained.

Principal Maxwell Garnett said there was room for close co-operation between the engineering industry and the colleges that were concerned with the training of engineers for research and management. Anything that increased that co-operation would increase the number and develop the qualities of the industrial research workers of the future. The Government research department was now prepared to make grants of £200 or £300 a year to a man who had to sacrifice an income exceeding that amount in order to go back for training in research work.

Mr. Lester thought it was very important to give a very large place to pure research work, even in industrial organisation. When routine work was introduced into the research laboratory, the research work that it was possible to do there was being limited. The same equipment might be used for both purposes, but there must be individuals whose first duty was to look after research, and who, if they did any routine testing at all, kept it in the second place. It would have to be a very big undertaking that could undertake to set up an adequate library for technical research; it was a better plan for laboratories to be placed within easy reach of suitable libraries. The question of salaries was very important. It was extremely difficult to get men who had the necessary brains and powers of observation, and when found they must be paid an adequate amount.

Mr. Strohmeyer said the establishments which had been described seemed to him to be very large for the works which they were supplying with information. If those institutions were to serve as cinder sifters they would require enormous staffs. A very large number of experiments had to be made with comparatively small results. The inventor had not been mentioned, but he should be part and parcel of those institutions. He believed that the universities objected to allowing any research work outside their own buildings to count as work for degrees. The National Physical Laboratory applied to the University of London to allow students to go to their laboratory, and that the work done there should count as post-graduate work, but it was said that it could not be done.

Mr. Chadwick said that one or two research institutions in America really did pay for themselves out of the sale of by-products produced during the investigations. That was quite independent of any help given to the works. If the Government had adopted a more liberal policy and provided more scholarships and grants they would have had a far greater supply of technically trained men.

Mr. Shipley complained that when a firm was notified about bad finish or workmanship, instead of the complaint being treated in a courteous way, the usual reply was that "the complaint was the first ever received in the history of the firm." He appreciated the necessity for a good library in the intelligence department. Owing to the lack of such libraries at Liverpool they had had to set up one for themselves. They had employed it not so much on research work as to help the engineers at their work.

Mr. Drummond Paton explained that one of the most successful institutions of this kind originated at Wigan about eight years ago. The scheme was brought before the directors, the Mining Board, and the university, but they could get none of them to realise the advantages of it. It was now in operation in the Mining School at Treforest. Such institutions were of small value if they were merely on a voluntary basis. Some driving power was necessary to make them national assets.

Mr. J. G. Pearce said there had been an unexpected unanimity in regard to the proposals for combining routine testing and research. One speaker suggested that such a policy was undesirable; that idea frequently rested on a misapprehension. It was thought by some that the research men would be continually interrupted in order to perform routine tests, but the proposal was exactly the reverse of that. The research men should be enabled to make use of the routine-testing department, and carry out the tests for which they had equipment and experienced staff. The economy of that procedure was obvious. This country was not so far behind as it might have been, because the whole of the research had been carried out in what they were pleased to call their routine testing laboratories.

Mr. Phillips did not agree that a central library or bureau was at all advisable. If intelligence departments were to be of any value at all they would have to be found in every town.

Mr. Fleming, in reply, said that they had undoubtedly done much more than one would be led to think by the lack of evidence. The Americans had taken hold of the research idea, and had spent money lavishly on it, and they had reaped their reward. He pleaded for the removal of research work from the manufacturing departments of the concern to laboratories where it could be done economically. Co-ordination of libraries was badly needed, and could, he thought, be arranged. With regard to the design and development of switchgear for dealing with large amounts of power, and of large machine work, it could not be expected to be done in a laboratory. A very important point was that when those machines were tested at the customers' premises it was most essential that they should be tested by qualified men to get the best results. The point that had been raised as to whether university students could carry out research satisfactorily in a works on account of not being able to use the work for degree purposes might apply in some cases, but it did not apply at Manchester, and he thought it did not hold good in certain other universities.

CARBON BRUSHES: CONSIDERED IN RELATION TO THE DESIGN AND OPERATION OF ELECTRICAL MACHINERY.

At Glasgow, on February 11th, Mr. P. Hunter-Brown's paper (an abstract of which appeared in our issue of December 27th, 1918) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers.

Mr. Cowie agreed that it was desirable to have, say, three qualities of brushes to meet all cases, but he knew this could not be done. All the troubles did not come from the brushes, and he cited cases in support of this contention. One of the weakest parts of brushes was the method whereby the leads were fixed to the brush. Some machine manufacturers insisted on putting their own type of connections on to the manufacturer's leads. This had resulted in confusion even when samples of replace parts were sent direct to the brush people, and in one case during the war almost shut down one of the biggest shipyards. Not enough attention was paid to the design of brush holders, first with regard to stiffness, and secondly, to getting the maximum wear out of the brush. He agreed that sub-divided brushes were much more satisfactory from the running point of view than one big block of material. At the same time it should be remembered that the machine manufacturer who did sub-divide was competing in an open market, and the extra parts meant loss of money so far as he was concerned. One of the finest brushes for slip-ring work was of the copper variety, but this would not run satisfactorily unless artificial lubrication was applied to the slip rings.

Mr. Inglis said that by grouping brushes in grades they could cut down the number of grades required. For turbo-generators he found that two grades were quite sufficient; for continuous-running motors for all speeds, three grades; and for reversing, D.C. motors, two grades. His experience had been that if they could not get sparkless commutation with those grades, the machine should be examined and put right. He invariably looked for trouble in the design of the machine, either electrically or mechanically. He disagreed with the author's system of bedding brushes. It was quite good practice to put on half the brushes at a time, allowing them to bed themselves down before the others were taken out. In the use of insulating material on the top of the brush he had found fibre to give trouble, especially in cases where there was a good rise in the temperature. They usually worked loose and fell out. If good heavy flexibles were fitted on properly he did not see that there was any necessity for insulating material. He advocated standardisation of brushes. There was no reason why the number of brushes should not be kept down to the minimum if manufacturers agreed to certain widths, depths, and thicknesses.

Mr. R. B. Mitchell also supported standardisation of brushes, remarking that where small motors were used one or two types of brushes could be employed almost invariably.

Mr. W. H. Flood said the present-day troubles were mainly due to the imperfect design of the brush-holders; each maker seemed to have his own pet idea, and they found quite opposite designs used on machines of the same output and speed and with commutators running at the same peripheral speed. He suggested the standardisation of armatures and proportions of commutators for all sizes of machines listed to run at standard speeds. This would materially assist in decreasing the number of types of brush. Personally he would like to see the number of grades reduced to about four, including a special grade for slip-ring use. The partial vacuum sometimes produced under a brush should, he thought, only appear in the laboratory, as in practice they did not find it possible to maintain such a fine degree of bedding and adjustment as to obtain this effect. The undercutting of mica had its advantages, but where a machine was running quite satisfactorily, he did not believe in undercutting because it was the fashion; but he found there was a tendency to-day to do so when an armature came in for repairs. The staggering of brushes was a very important point, but some makers of small machines did not leave sufficient commutator to satisfactorily carry this out. It was up to the designers to produce the correct form of brush-holder; he had during over 20 years' experience found the brush-holder very largely at fault.

Mr. Robertson said there was often trouble with pin type connections. The best type was the screw, but care had to be taken that the nut was not put in too tightly. They had types where flexibles were put on to a shoe and over the copper brushes. The only bad fault was that the flexibles were soldered to the shoe piece. He thought it the best plan to remove mica wherever possible, and if commutators were kept clean they gave no trouble. He favoured standardisation of brushes wherever possible.

Mr. A. Page trusted that there would be two developments from the work Mr. Brown had put into the paper: First, a higher degree of standardisation, and second, the abolition of the barbarous methods in vogue to-day with the men who had the upkeep of electrical machinery in their hands. He did not, of course, refer to places where skilled attention was available.

Mr. W. B. Hird objected to the manufacturer being saddled with the whole responsibility of standardisation. His firm had only one style of brush-holder and one size of brush in use for many years, except in extraordinary cases.

Mr. P. Hunter-Brown, in reply, referred to the committees already considering the question of standardisation. It had been rather difficult to reconcile the conflicting opinions on the subject. It would not be long before a standardised holder would be adopted by many firms. There would be more than one size, and the minimum would probably be two widths of brushes and three or four thicknesses to each width. There had been a tendency lately to abolish the use of the large brush. Graphite brushes could be successfully used on slip rings, but there they had to be careful, and not take the current density as the only guiding factor. As to lubrication, boiling in wax was sometimes effective, but they sometimes got a flood the first few days and a famine later. It was better to get a type of brush which possessed natural lubricating qualities.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Deliver!

There is a popular saying in the States, "We can deliver the goods." It has never attained much popularity in the electrical industry over here. Its terseness would have to be destroyed by the qualifying phrase, "if you wait long enough." When I was still at college, I once heard a customer say to a branch manager of —— that —— had only once been known to deliver an order on time, and then they sent the wrong apparatus. Instead of an indignant denial, the meek reply was that no other firm had done even that. At the time I thought this was mere badinage. Now I know it to be very near the sober truth.

Of course, manufacturers are badly handicapped at present, and are fighting against difficulties. New and unskilled men, labour troubles, lack of raw materials, influenza (oh! blessed word, how many delays has it covered?)—any buyer will know these excuses and others by the dozen. Each one, truly, has its weight. Each one has to be got over. Each one *can* be got over. There is, to my knowledge, one firm which can, and does, deliver in the time it promises, and that time is far less than its competitors dare dream of. (I do not belong to this firm, nor will I mention its name—that will probably be found on another page, inserted at the usual rates.) On a recent contract all the material except some switchgear could be obtained in eight weeks. For the switchgear three firms quoted; one asked 14/17 weeks, a second 10/12 weeks, the third, the one in question, 12/14 *days.* I knew from past experience that this delivery would be kept, whereas the other two firms were very uncertain, and would need constant worrying if they were to deliver anywhere near the proper date.

There must be a reason why one firm can deliver, and so far as one can see, it is a triumph, not so much of organisation as of drive, of concentration on the one vital point of delivery. Success in this case is achieved not by the piling of system upon system, form upon form, watch-dog upon watch-dog, but by the simplification of routine and the realisation that delivery is a serious responsibility. In many a firm the manufacturing information is often not sent into the shops until after the delivery date has passed. What notice will the works take of "Urgent," "Rush Job," and other stereotyped expressions in such a case? Moreover, it is often known that the job cannot be started for several weeks, unless it be taken out of its turn. This means putting on one side other jobs already late, and complete disorganisation of the whole system. This disorganisation is the prime cause of high prices. Further, no firm that is consistently late in delivery can ever be satisfactory to its customers or its shareholders.

Lateness in delivery is not the only trouble. It is difficult to get many firms even to quote rapidly. From eight recent quotations for comparatively simple and standard apparatus, the average time between inquiry and quotation is 12 days. These quotations were obtained from four firms, and relate to three separate jobs, varying in value from £300 to £2,000. A ninth inquiry, issued six weeks ago, for gear which is quite standard except that the primary voltage is 30,000, has as yet elicited nothing but three successive promises that a quotation shall be sent in two or three days.

At the same time, on a Spanish contract it was considered advisable to send an inquiry to a continental manufacturer. The reply was received in eight days, and, in view of the length of time necessary to settle a foreign contract, the tender was open for acceptance within 90 days, in place of the usual month.

For a final case: Competitive tenders for electrical gear worth about £1,000 had been received, and the order was about to be placed when another manufacturer asked permission to quote. The inquiry was sent to him, and the order was held up. The quotation arrived in 17 days. Surely it was not expected that the order would be held up quite so long?

Of course, one must sympathetically realise the difficulties of the manufacturers on this point as well. The sales organisation has other duties besides quoting. It has, for instance, to placate the angry customer who cannot get delivery. Moreover, there is a manufacturers' association to attend, and one must meet one's competitors. How often in the restaurants near Kingsway does one see a galaxy of sales managers who, if only they were to meet their customers, might do some really big business! Of course, for many of them the offices in King's House are more comfortable than their own, or even than their customers'. The poor customer can rarely afford comfort in his office when he has paid for his electrical equipments. And so, while all around are firms striving to install British electrical goods here and abroad, the electrical manufacturers sit and while away the time in academic discussion of the division of their own problematical profits. They organise and re-organise the industry, while the firms they represent are in chaos.

Let them beware the premature counting of chicks. They may divide their profits as they will—if they do not deliver

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promptly there may be no profits. They may decide how orders are to be apportioned among themselves. If they do not quote quickly and reasonably, there will be no orders.

If they can contemplate even that with equanimity, then let them bestir themselves for very shame. By their lack of initiative they are stifling other industries, they are hindering the progress of the century, they are making our longed-for reconstruction a hotch-potch, a mere patchwork of existing iniquities.

Imperial.

London, *March 7th*, 1919.

Engineer Surveyors' Salaries.

Like one of your correspondents, I have been with a very prominent engineering insurance company for 16 years, and my salary is £280, including a war bonus of £50. This is about the usual salary paid by the three most important—the Vulcan, National, and British—engineering insurance companies. This is very different to the scale paid to the Ocean Co.'s surveyors, as per Mr. Forsyth, and I must thank him in the name of all surveyors for stating this scale. It is up to the Executive of the Engineer Surveyors' Association to bestir itself, and demand this scale from all the companies. I was surprised at the tone of the recent letter from Mr. Thrapnell, the Secretary. Another very unfair point the E.S.A. should take up, and get abolished, is the agreement between the several companies not to employ each other's surveyors. This stops competition, and keeps the salaries down. The E.P.E.A. has worked wonders for its members; let us see the Engineer Surveyors' Association Executive doing something for its members.

Electric.

March 8th, 1919.

The Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain.

The formation of an association with the above title advocated in your issue of February 28th would scarcely seem necessary now that the technical staffs, not merely of company, but also of municipal undertakings, are strongly organised in the Electrical Power Engineers' Association, and that the commercial staffs appear in a fair way shortly to secure equally strong representation in the Chief Commercial Officers' Association and the Clerical Assistants' Association.

Sectional associations, such as that proposed for a specific object, only lead to duplication of effort which, in the opinion of many, would be much better applied to strengthening existing organisations.

This and similar questions affecting the future position and prospects of technical staffs have received the attention of the National Executive Council of the E.P.E.A., and a deputation from the Council has already put the views of the Association before the Board of Trade at an interview on the 12th ultimo with the permanent officials and Sir John Snell, the electrical adviser to the Board of Trade, in connection with the new Bill.

Certain information was given in confidence to the deputation as to the protection to be included in the Bill for employés of electricity supply undertakings, and these matters will continue to receive the closest attention of the Council, which, I have no doubt, would gladly co-operate with other representative associations to secure adequate protection of the interests of the officials as a whole under the national electricity supply scheme.

C. Vernier.

Gosforth, *March 4th*, 1919.

An Association for Technical Staffs.

Referring to the letter under this heading, signed "Five of Them," I have to advise you that if the gentlemen in question or other interested persons will get into communication with me, I should be happy to give them information which may be of some service.

Norman Wyld.

25, Victoria Street, S.W. 1, *March 9th*, 1919.

Strike Prosecutions.

Recently, certain Bolshevist trade unions created a certain amount of panic in London by threatening to plunge that city in darkness.

Your paper has had a great deal to say on this matter, both in the editorial and "Correspondence" columns, apparently being under the delusion that those who made the threats had the power to carry them out; whereas such is not the case.

The people of London may rest assured that no such thing as "total extinction" will take place in that city, or county; for there is in existence a strong organisation, with a rather long name, which, while properly safeguarding the interests of its members, fully recognises the duty it owes to the community; and is ready to assist the forces of law and order to overcome any anarchist outbreak that may occur.

It is mainly due to the existence of this organisation that London has been practically free from strikes, as regards the electrical industry.

Other organisations have glibly talked of "striking," and even at the present moment are busy voting on that very question, but the National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers are banded together to prevent, as far as possible, the recourse of the workers to this primitive and dangerous weapon.

Such being the case, I was confounded when my attention was drawn to a certain article in the Electrical Review of February 28th, 1919, which, among other inaccuracies, stated that the president of the Camberwell branch of the Electrical Workers' Union, being out on strike, attacked another man who was proceeding to work.

Now, sir, a lie which is half truth is the very worst of lies, and, as the secretary of the Camberwell branch of the Electrical Workers' Union, I demand from you an apology for the libellous statements contained in the article mentioned, both to Mr. Weeks and to my branch.

I may state that Mr. Weeks, our president, has been taxing his strength to the uttermost during the past six months, working in the interests both of employers and employés; and, I am glad to say, his efforts have been crowned with complete success, perfect harmony resulting between the two classes.

He has just arisen from a sick bed, having been nearly killed by his assailant, and an article like that in the Electrical Review is not conducive to helping on the recovery of one of his temperament.

Further, he is one of those who gave up all, and went out to fight in the cause of liberty and justice, and, when incapacitated for further service abroad, he was discharged; he then took up the fight in the industrial world.

I do not think there is any need to mention the Camberwell branch again, unless it is to say that it could be swelled to double its membership if it would agree to take in those who are thoroughly disgusted with the Bolshevist tactics of an organisation which has been so ably advertised in your paper.

Arthur J. Nicholls,
Secretary,
National Amalgamated Union of Enginemen,
Motormen, &c., Camberwell Branch.

London, S.E. 6, *March 7th*, 1919.

[The error in question was corrected in our last issue, p. 270.—Eds. Elec. Rev.]

The Re-settlement of Officers.

The leading article in your issue of January 24th, *re* re-settlement of officers, caused me a certain amount of amusement. It appears to be a universal opinion that England's educated and highly trained gentlemen are all officers. Surely there are absolutely no grounds for this assumption. You must remember that on the outbreak of war the authorities were very particular, as they are in peace times, about granting commissions, and many men not having the necessary influence preferred to join the ranks from purely patriotic motives rather than await the pleasure of the W.O. These, too, in many cases did not join the R.E., because, as you mentioned, electricity does not figure very largely in the training of that corps.

As the war progressed, and the shortage of officers made itself felt, commissions were easily had, with the result that quite a number were given to men of "fine personal appearance, plenty of swank and bluff," and whose sole idea in taking a commission was to improve their surroundings, wear a smart uniform, and be able to go where a mere ranker could not—in short—for social reasons. Now, is it right to help this class of man more than, say, a man of equal or even better education who has the "guts" to stick the rough and tumble of the ranks?

The educational standard necessary to qualify for a New Army commission is equivalent to that required by a youth aspiring to the exalted position of office boy to a business firm. If your writer has had any extensive experience of the present-day Army officer and his duties, or rather his interpretation of them, and the execution thereof, he must be fully cognisant of the mentally dulling effect of the stereotyped labour.

I do not wish to belittle our officers in any way, but, in Army parlance, three-quarters of them are absolute "wash-outs." Take the engineering branch of the Army; it is justly called a d——d good firm to work for, because you have unlimited funds for your work and no "sack." Would a civilian employer encourage an engineer who starts a job and does his thinking afterwards? There is no doubt that many an officer has had praise for work he could never hope to carry through but for the able men under him. In fact, some of the suggestions made would make an angel weep.

I am writing from personal experience of the Army in Egypt; we may have had better brains in France, but certainly none trickled to this front.

The Army has a system of training a man, regardless of any previous qualifications, to fill vacancies which occur. This may be all right, because he usually has a qualified man on whom he can lean in days of trouble. What will be the result when he gets back to civilian life? Many a poor employer will get burnt, I am afraid. Again, from your advertisements, all officers seem to want managers' jobs. Do they imagine that the Army system will still hold good, of being able to give orders and not show how a job is to be done? I have seen a fair amount of work in the engineering line carried out in the Army, and not once have I seen even a diagram of connections or a working sketch. If a fully qualified electrical man enlisted in the R.E.'s he would be laughed at for saying he was an electrical engineer; only officers can be so called, he is simply an electrician, though he may have been a station engineer with good technical training and plenty of experience.

I must apologise for having written at such length, but these matters cannot be discussed in a few words. It is well known that liquids find their own level, so, I say, allow these temporary gentlemen to find theirs, without any preference because they happen to have been officers.

Fed Up.

Alexandria, *February 18th*, 1919.

[While we sympathise with our correspondent, we think he might have been good enough to read our article carefully before he so fiercely assailed it. There are both officers and men in the Army; why should we write only about the men—as we have done so often—and be forbidden to champion the cause of the officers also? Everyone knows that many—very many—educated and highly trained men enlisted in the ranks—all honour to them. We are familiar, too, with the type of officer who should never have received a commission, and with the mental paralysis to which Army routine is apt to give rise. But there are other regiments besides the Royal Engineers, and it is well known that, especially in the earlier years of the war, the subaltern was called upon to face fearful risks in leading his platoon to the attack, and the mortality in the class of young officers was very heavy. Their self-sacrifice will ever be held in remembrance, and those who survived the fiery ordeal have a just claim to special consideration.

Returning to the article, this was written specially with regard to the issue of a pamphlet on the subject named in the title, and naturally it did not deal with matters outside the scope of the text. It will be remembered that the future prospects of no fewer than 400,000 men "*of the officer type*" (including therefore a large proportion of the N.C.O.'s and men) were in question. We referred in it to the many "wealthy men and men of position" in the ranks; we endorsed the remark in the pamphlet to the effect that the average young officer would have to make up his mind to fight for his bread and butter on the merits of his training, education and character; we fear that many who come back will, as our correspondent suggests, have to undergo a painful disillusionment—but we see no reason why all our solicitude should be allotted to the men to the exclusion of "the officer type," and we are quite sure that the men who followed their leaders over the top with sublime trust and reckless daring would be the last to wish us to adopt that course.—Eds. Elec. Rev.]

Educational Reform.

As a small supplement to Colonel O'Meara's recent extremely important paper, perhaps I can usefully call attention to the fact that amongst other counteracting advantages the war has certainly aroused parents to the desirability of a changed educational curriculum at our public schools, as well as at Oxford and Cambridge.

Soon after hostilities set in there occurred, it will be remembered, a general discussion in the Press on the subject, with the result that a committee was formed which had for its special object a reformed public school education. I became a member of this committee, of which Lord Desborough was chairman.

The first step taken was to apply to all the parents of the leading public schools (27 in all) inquiring whether they would favour a fuller education in science and modern languages, even though involving a smaller amount of time being spent on Greek and Latin. As the largest and perhaps the most conservative school, Eton may be usefully quoted as an example. Out of some 900 parents circularised, 536 replies were received, of which 512 favoured such a change; 12 were against, and 12 neutral. In other instances the result was still more striking.

The next step taken was to form a deputation to attend at the Headmasters' Association of that year. The deputation was exceedingly well received, and seems already to have had some effect at several of the public schools.

Whilst a firm believer in the public school as the best means of forming character—for which the Allied Forces have much to be thankful—I cannot help thinking that most of what Colonel O'Meara so ably pleads for will be more readily brought about with the changed school curriculum that I refer to.

I would like further to warmly endorse some of Mr. Highfield's remarks in the discussion relative to the great improvement effected in many of the younger generation by their experience at the Front. Many have undoubtedly become for the first time competent to manage men effectively, and this is really one of the most important characteristics of a successful engineer. Having sometimes to select candidates for important positions in Australia, I am usually struck with the small proportion who are imbued with any such capacities as compared with those eminently efficient technically.

Charles Bright.

London, S.W., *March 11th*, 1919.

Early Wireless Telegraphy.

As an old telegraph engineer, and for years employed on the R.E. engineering staff, P.O. telegraphs, where I received my early training, I am naturally interested in the letters in the Electrical Review relating to the pioneers of this wonderful discovery. It has been for years the impression with many of us interested in this branch that Mr. Marconi, when he first arrived in this country, was given every assistance by the British Post Office, even suitable positions at coastguard stations were placed at his disposal, and I think rightly so, as there is no doubt the energy Mr. Marconi put into the work advanced wireless several years. But in fairness to the late Sir William Preece, I might mention that under Mr. Preece's instructions a party of us engineers with the then Lieut. Bagnold, R.E., in charge, experimented in 1884 in signalling across the Solent without wires, and signals were transmitted and received, but on account of the unsuitable apparatus then in use they were almost inaudible. This would be years before Mr. Marconi came to this country. A short paragraph on our experiment can be found in the first number of the *Military Telegraph Bulletin* of 1884, a paper which was printed and published by the R.E.'s, and circulated in the service, and I understand a copy of it is in the library of the Institution of Electrical Engineers.

H. G. Andrews.

Bournemouth, *March 10th*, 1919.

How NOT to Obtain a Situation.

Undoubtedly applying for a position is an art possessed by few. Some have it in speech, and some in literature. Carelessness in either gets its due reward. No doubt, as "Static" writes, there are fools amongst the applicants, but there are also fools, designing fools, amongst the advertisers. Look down the "vacants" and note the fund of information given for the guidance of applicants. Nothing to show type, size of plant, location of the works, or anything else of an informative nature, and yet it is expected that the salary that could be accepted will be stated.

Recently, I believe, Wolverhampton advertised for a shift engineer: "State salary, &c." What was the object? There are shift engineers there doing the same work that is required to be done by the new man, and paid a salary. Why not state it?

Again, the slackness in acknowledging an application or notifying the result is all conducive to indifference on the part of the applicant.

Two Sides.

March 9th, 1919.

Electrified Seed.

As long as it was possible to pretend that "Wide Awake" was in earnest, I was willing to answer his questions, but I am not willing to take part in a farce.

Charles Mercier.

Parkstone, *March 10th*, 1919.

Correction.—We regret that the name of the writer of the letter on "Telephone Facilities at the Patent Office" in our last issue was printed as "A. H. Moore"; it should have been "A. H. Morse."

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

Further contributions as under have been received in response to the appeal made by Mr. Hunter, the chairman of the Institution :—

Jane Ellis	£1	0	0	E. L. Joseph	£1	1	0
E. H. Harrison	0	10	6	E. Williamson	0	10	6
Small Electric Motors, Ltd.	2	2	0	W. Ratcliffe Small . ..	10	10	0
H. G. Richardson & Co. ..	1	1	0	Justus Eck	3	0	0
A. C. Robinson	0	10	0	British Elec. Equip. Co. ..	1	1	0

Westinghouse War Relief Fund.—We have received a copy of the financial statement of the British Westinghouse Employés' War Relief Fund from August, 1914, to December 31st, 1918. The total contributions for the period were £63.150, of which £41.359 was contributed by the employés, and £21.791 by the company. There was paid out to dependents £45.097; set aside for a Disablement and Dependents' Fund, £12.764; while £2 890 has been spent in donations to local and national funds and Christmas gifts. The number of families in receipt of weekly relief is now 820; 3,516 of the company's employés joined the Forces: 269 have lost their lives, and there are 117 widows on the list. The statement was adopted at a meeting of delegates, held in the Women's Canteen at Trafford Park on February 10th.

BUSINESS NOTES.

Our Letters from the Forces.—In thanking us for sending the ELECTRICAL REVIEW to him during three years' absence from home with the Forces, a demobilised correspondent writes :—"I feel, in common with other members of the detachment with which I have been employed, that it is due to the REVIEW that we are able to return to 'civvy' life without feeling absolutely lost, as by its aid we have been able to keep *au fait* with developments in the electrical world. Having cooked Fritz's goose in the way of fighting, we are now going to have a good old go at him on the commercial side, and we are indebted to the REVIEW for keeping us in trim for this fight, which looks like being as big a job as the other."

Lead.—MESSRS. JAMES FORSTER & CO., in their report dated March 8th, state :—

No transactions have taken place on the open market, but considerable business has been done privately this week at round about £28 10s. for prompt delivery.

For March shipment £28 is asked, and for forward the price is better by £2 to £3 on the week, there being buyers at £26 for May and £25 10s. for June.

Interest in the metal has been decidedly quickened by the lower prices, and has certainly not been lessened by the shutting down of the Fremantle Mines (Australia) and the threatened like action in Spain, owing in both cases to the cost of production exceeding price obtainable; in the latter case, combined with political unrest. The shutting down of the Spanish mines for any considerable time would quickly neutralise the existence of large stocks.

The large stock held by the Government (now 100,000 tons) will continue to weigh with buyers; but, on the other hand, the consumption of lead will be far and away above anything we have seen in the past as soon as the Government Building Scheme is under way, and apart from that an enormous increased consumption for electrical purposes and of white lead—the necessity of which is felt in every building and home in the country—is bound to come. On the whole, we can see little reason for lower prices unless the Government throw their lead on the market.

Foreign Trade.—THE FEBRUARY FIGURES.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

IMPORTS.	*February,* 1919.	*Inc. or dec.*	*2 months,* 1919. *Inc. or dec.*
	£	£	£
Electrical goods, &c. ...	136,859	+ 80,983	+ 26,265
Machinery	1,269,275	+ 162,938	+ 770,886
EXPORTS.			
Electrical goods, &c. ...	246,391	+ 89,846	+ 244.285
Machinery	1,554,108	+ 228.777	+ 700.795

Prices Advancing in Germany.—It is reported from Berlin that the prices for raw materials and semi-finished articles used by the electrical trades experienced a further increase in February, and still further advances have been notified as being in prospect. The higher wages also have brought about an augmentation in the costs of production of the electrical firms. Nevertheless, the Central Union of the Electrotechnical Industry, at a meeting held on February 20th, decided to abstain from raising prices on that occasion, but to leave the matter until the further meeting of the Union later in the present month. It is then expected that the quotations for manufactures will be increased by a very considerable extent.

Trade with Belgium. — Apart from the enormous quantity of raw materials which will be required in connection with the economic reconstruction of Belgium, a large demand will also arise for a long time for manufactures of various kinds until the country is able to reassume the pre-war position as a result of the rehabilitation of the works and factories destroyed or rendered useless by the enemy. These circumstances have already been appreciated in certain trades in Great Britain, but the electrical industry appears to have made no indication of desiring to participate in the business. The British Vice-Consulate at Brussels, for instance, has informed the Belgian public that numerous British manufacturers wish to get into communication with persons in Belgium who would undertake eventually to represent them in different parts of that country, and those interested have been invited to forward applications to the Vice-Consulate, together with references. The list of trades published by the Consulate, however, does not include any electrical manufacturers. Is it to be assumed, therefore, that British electrical firms have no interests to promote in Belgium ?

Metal Prices.—The Minister of Munitions announced last week the following increase in the maximum price of tinplate for home sales as from March 1st, 1919 :—

Coke Tinplate.—I.C. 20 × 14 112 sheets 108 lbs. 33s. 10d½. basis, per box, net, f.o.t. at makers' works.

The maximum price for home sales of bar iron, marked bars, rolled edges, iron strip, sheared iron tube trip, and iron plates and sheets, was advanced 30s. per ton, on March 6th.

A Rugby Dinner.—The supply department of the British Thomson-Houston Co., Ltd., held their annual dinner in the Royal George Hotel, Rugby, on February 27th. Mr. J. A. Phillips was in the chair, and following on the dinner a smoking concert took place. Mr. W. J. Cusack, in proposing the toast of the department, made reference to the amount of war work handled by the supply department, it being stated that this amounted to nearly twice the pre-war output. A welcome was extended to those members just returned from the Forces, two of whom had gained the Military Cross, and a vote of thanks was accorded to the members of branch offices who had returned to head office and given a helping hand during strenuous years.

The French Electrical Industry.—The representative trade associations, or chambres syndicales, in France are now being given through their respective presidents, an effective and permanent representation in relation to the Government authorities, and they will thus be able to set forth their wishes officially to the Government and with the official recognition of their status by the latter. For this purpose the Minister of Commerce has decided to group the industries or trades in 20 classes, two of which have just been constituted. The first group deals with public works and buildings, and comprises over 200 chambres syndicales. The second comprises electricity, public lighting and tramways, and it includes all the chambres concerned with these branches. As the provisional bureau for this group there have been elected, as president, M. G. Cordier, president of the Union des Syndicats de l'Electricité, as vice-president, M. M. Meyer, president of the Syndicat Professionel des Industries Electrique, and, as members, MM. Jnug, de Seynes Berthelot and Masse. A combination of this nature should be of value to the industry in its relations with the Government on matters affecting the trade. Besides being grouped officially, the electrical industry is one of the constituents of the Union of Metallurgical and Mining Industries, Mechanical Construction, Electricity, and Accessory Industries, and as such has participated in the protest which has been raised by the Union against the insinuations recently made in Parliament alleging profiteering, together with other charges, on the part of the iron and steel, mechanical and electrical engineering and motor-car industries during the course of the war. The Union has repudiated the charges, and states that the industries in question have worked in perfect agreement in the general interest of the country. The Legislative Chambers have now sanctioned an inquiry into the question, with particular reference to the iron and steel industry.

Stocks of Non-Ferrous Materials.—The following particulars are published of the stocks (exclusive of old metal and scrap) in this country in possession of the Minister of Munitions on March 1st, 1919 :—

Copper	51,373 tons	Soft pig lead	100,063 tons
Spelter G.O.B.	27,444 ,,	Nickel	2,332 ,,
,, refined	8,860 ,,	Antimony regulus ..	4,325 ,,
Aluminium	13,004 ,,		

New French Company.—La Société des Constructions Electriques du Rhone (Procédés Dick, Kerr) is the name of a new company which has lately been formed in Paris, with a capital of £320,000.

"Paragon" Thermo-Electric Ship Propulsion (Patents).—Mr. William P. Durtnall, inventor and patentee of the above system of ship propulsion, and speed-reducing from high-speed prime movers such as steam turbines or internal-combustion engines to ships' propellers, has asked us to mention that certain patent specifications have been since 1912 sold by the Patent Office Sales Department (inadvertently), not bearing the official stamp; recently whilst travelling in France he came across such an unstamped document. Mr. Durtnall, on his return, immediately took steps to draw the attention of the Comptroller-General to this error, and that official has acknowledged the matter by the issue of an officially-stamped and signed document, a lithographic copy of which we have examined; the patent referred to was No. 19,903/1911, applied for by a Swedish firm.

New Works.—It is stated that the skating rink at Stacksteads, Bacup, has been purchased by Mr. S. O. Ashworth, of Waterfoot, for the IRONCLAD SWITCHGEAR CO., LTD., electrical engineers, of Manchester, of which he is a director. It is expected that work will be commenced in about two months' time, provided the necessary machinery and shafting is procurable.

Trade Commissioner at Sydney.—The B. of T. has approved the appointment of Major G. Fetherston, D.S.O., M.C., as Trade Commissioner at Sydney. The new Commissioner has had much commercial experience in the hardware, shipping, and general agency business in New Zealand. He will remain at the London headquarters of the Department of Overseas Trade for a short period before taking up duty in Australia.

Export Restrictions Relaxed.—The *London Gazette*, of March 7th, contains a notice of further relaxations of export restrictions.

Trading With the Enemy.—A further list of names of bodies and persons in foreign countries with whom trading is prohibited, or whose names have now been removed, is published in the *London Gazette* for March 7th.

Excess Profits Orders.—The Board of Referees has considered an application by Messrs. Stanley, Wasbrough, Doggett and Baker, of 1, Albemarle Street, W., on behalf of makers of permanent magnets for an increase of the statutory percentage respecting the business of making permanent magnets in the United Kingdom. The Board has made an Order increasing the percentage in the case of any trade or business carried on or owned by a company or other body corporate, to 11 per cent. with additional percentages in the case of other trade or business, as specified in the Order.

A similar Order made in respect of the Chile Telephone Co., Ltd. ("the business of supplying telephone service throughout the Republic of Chile, South America"), increases the percentage to 7½ per cent., with additions in specified cases.

Exports to China.—In the *London Gazette* for March 7th there appears a further list of firms, &c., in China to whom exports may be consigned.

Bankruptcy Proceedings.—HENRY WILLIAM HILL, instrument maker and electrician, 58, Rossiter Road, Balham (late 64A, Battersea Rise, London).—According to the statement of affairs lodged by the debtor in this case the gross liabilities amount to £287, of which £284 are expected to rank for dividend. The assets are set down at £10, or a deficiency of £274. The failure is attributed by the debtor to "decline of business by reason of being unable to obtain materials and labour owing to the war." It appears that in 1910 the debtor commenced business in partnership with others in South London, and shortly afterwards the business was turned into a limited liability company. Debentures were issued, but about March, 1913, a Receiver was appointed, and the debtor remained as manager for the purchaser of the concern. In August, 1913, debtor started in partnership with another man, and the business of electrical engineers was carried on. The partnership was dissolved in August, 1914. In the same year the debtor commenced business on his own account as an instrument maker and electrician, with a capital of about £10, and that business he carried on up to the date of the Receiving Order. Early in 1917 debtor found he was unable to obtain materials and labour, with the result that business declined and creditors began to press for payment of their debts. In order to pay pressing liabilities he borrowed money from friends, and gradually disposed of the assets. At the date of the Receiving Order a number of creditors had obtained judgment, and he filed his own petition. At the first meeting of creditors, held on March 3rd at 132, York Road, Westminster Bridge Road, S.E., the matter was left in the hands of the Official Receiver to administer in the usual way.

CHARLES MAYFIELD, electrical engineer, 19, All Saints' Road Clifton, Bristol.—This public examination took place at the Guildhall, Bristol, on March 7th. Debtor admitted a deficiency of £1,342. He had carried on business at Clifton since September, 1916, having previously been engaged in munition work in London. He understood invention and research work, and his earnings averaged about £2 a week. Money was advanced for the purpose of developing patents, and provisional specifications were lodged, but, owing to various difficulties, the patents were not proceeded with. He had an agency for music, art, and science, and wrote some film plays as well as revues. He brought out some inventions, including a luminous candle, but they were of no value to anybody. The result of his having been in business for upwards of two years was the deficiency of £1,342, a loss of practically £600 per annum. He attributed his position to heavy expenses in experimenting and developing his inventions, inability to develop his electrical business on account of the war, and law costs and interest on loans from money-lenders. The examination was ordered to be adjourned.

Calcium Carbide Order Suspended.—The Calcium Carbide Order, 1917, has been suspended by the Ministry of Munitions as from March 7th.

Catalogues wanted for South Africa.—MESSRS. MAYTHAM TIN AND STEELWARE, LTD., of East London, write as follows under date February 10th, 1919:—"We shall be glad if through the agency of the ELECTRICAL REVIEW you can have a supply of catalogues and price lists sent us. We are interested in all lighting accessories, heating and cooking utensils (electrical), and small motors. We particularly want to get in touch with makers of ironclad high-voltage switches, with the cartridge or "Zed" type fuses. Since the Armistice we have not received a single catalogue, and, owing to the smallness of stocks in hand, we are anxious to refit. Prices should be quoted us for cash against documents in London. Only genuine British firms are wanted. No neutral or naturalised alien of any nationality need worry us."

Dinner.—A Victory dinner and concert was recently held at Luton by MESSRS. L. WEEKES, LTD. (incorporating the British Electric Calibrated Fuse Co. and the Safetee Controlling Appliances Co., Ltd.). A large company of employés and friends sat down to dinner, Mr. Lawrence Weekes presiding. Among the toasts was "The Employés," proposed by the chairman. After referring to the important activities of the concern during the war, he said he was confident that they would grow and succeed in Peace trade better than they had done in War trade. He hoped that the employés would continue to earn big wages and bonuses, but they must keep the output at the maximum. They were now reduced to a 47-hour week, and he had another idea of giving them a complete Saturday holiday. He was out to make money as well as the employés. Establishment charges mounted up more than they realised, and the total was spread over the amount of output. They must double the output, go on employing more labour, and so increase the benefits all round. The toast was responded to by Mr. W. Simmons, the oldest employé, and Mr. A. Thurley. "The Firm" was proposed by Mr. A. Smith, and responded to by Mr. Coom (a director), who, in the course of his remarks, said that negotiations were in progress for new works, where they hoped to have their own sports ground, pavilion, &c. The new Peace Trade included foreign trade, and they must be able to quote competitive prices; the lower the price the greater would be the work. He announced that the following Saturday morning would be a holiday. Other toasts were "The Staff" and "The Visitors."

Manufacture of Tramcars in Australia.—The Melbourne, Brunswick, and Coburg Electric Tramway Trust is installing a complete plant for the manufacture of electric tramcars and accessories. The Trust is proceeding with the construction of six cars for its own use, and has an order for eight cars for a neighbouring municipality. It is estimated that a saving of £200 per car will be effected over imported cars.

The Coal Crisis and Industry.—Last week-end the following notice was posted in the works of VICKERS, LTD., at Sheffield:—

"The company has not been able to accumulate more than a few days' stock of coal, and if the threatened strike of miners takes place it will be impossible to carry on in the departments which are large coal-users. Other departments will be kept going as long as possible, but the company regret to have to give notice hereby to determine the services of all workpeople on March 22nd, 1919; and unless the supply of coal is assured, engagements from that date will only be from day to day."

The *Daily Telegraph* says that the intention of this notice is regarded as purely precautionary. The company wish to prepare the men for all eventualities, but it is not anticipated that any such measures will be found necessary.

The Overseas Trade Department and Exporters.—In order further to assist exporters to recover their trade in goods of which the export is, or has been, controlled, and generally to ensure that no openings for trade are lost to British exporters owing to ignorance of existing export facilities, the Department of Overseas Trade, in concert with the War Trade Department, has made arrangements for bringing to the notice of exporters, through the medium of the Press, trade journals, Chambers of Commerce, and trade organisations, and by special notes direct to firms on the "Special Register" of the Department, information regarding changes affecting control over exports. Firms not already on the Special Register who desire to receive such information direct from the Department may apply for admission to the Special Register to the Comptroller-General, Department of Overseas Trade (Development and Intelligence), 73, Basinghall Street, E.C. 2. The annual fee for admission to the Special Register is £2 2s., which [illegible] the supply of the *Board of Trade Journal.*

It is understood that, owing to the necessary formalities and consequent delay in connection with the obtaining of export licences, exporters find themselves at a disadvantage when dealing with orders requiring immediate acceptance. The Department will, therefore, on request, undertake to ascertain from the War Trade Department, and reply by telegram or telephone, at the earliest possible moment, whether licences will or will not be granted for such orders. In the event of an applicant being promised a licence, he will be enabled to deal with the order straightaway with the knowledge that upon application being made formally to the War Trade Department the licence will be granted. Inquiries should be made by telegram rather than by telephone, and should be addressed to "Orders c/o Advantage, Stock, London." They should give, in addition to the name and postal or telegraphic address of the applicant, the quantity, value and description of the goods comprised in the order, and the name and address of the ultimate consignee if the goods are destined for a neutral country. In the case of orders from Allied or British territory, or from territory in the occupation of troops of the associated Governments, the consignee need not be stated; the country of destination will, of course, need to be given. A reply of 24 words (1s. 6d.) must also be prepaid. Applicants are requested in their own interest to confine their inquiries to orders needing a very urgent decision, since the fewer the inquiries the more promptly can answers be given.

British Industrial Delegation in Paris.—According to *The Times*, there arrived in Paris on Wednesday, last week, a delegation from the Federation of British Industries, who have gone to France to confer, under the auspices of M. Clementel and the British Ambassador, with important industrial interests of France. The object of the visit is to discuss the methods by which British industry can co-operate in the industrial reconstruction of France and in dealing with post-war trade problems. Included among the delegates, whose headquarters are the Hôtel Continental, Paris, are Mr. G. H. Locock, assistant director, F.B.I., Mr. S. P. Leigh, secretary, F.B.I. delegation; Mr. G. F. Hall, travelling representative; Mr. D. A. Bremner, British Engineers' Association; Mr. D. N. Dunlop, B.E.A.M.A.; Mr. C. H. Dade and Lord Vaux of Harrowden, representing the B.E.T. Co. and the British Electrical Federation respectively; and many others.

Australia and British Goods.—Cables from Melbourne state that a proclamation has been issued by the Minister of Customs prohibiting the importation into the Commonwealth of all goods other than those of British origin.

Strike.—The strike of transformer workers and semi-skilled men at the works of Messrs. Ferranti, Ltd., electrical engineers, Hollinwood, and the British Westinghouse Co., Ltd., Trafford Park, Manchester, has been settled, the men who struck in sympathy returning to work on Thursday, last week, pending negotiations. Later in the day a joint meeting of the local branch of the Electrical Trades Union and the Engineering Trades Employers' Association was held, at which an agreement was arrived at, whereby the minimum rate for transformer workers will be 35s. per week on the pre-war rate. It was also agreed that there should be a grading scheme whereby the minimum should be reached in 18 months. The men have been on strike about a month, and recently it was decided to take a ballot on the question of a general strike of electrical workers in the city and district. As a result of the agreement, of course, the ballot becomes inoperative.

Reconstruction Problems.—No. 15 of the series of pamphlets issued by the Ministry of Reconstruction deals with the important subject of "Juvenile Employment."

Australian Copper.—Australian newspapers just to hand show that there was a heavy collapse of copper shares on the Sydney Stock Exchange early in January when it was known that the contract of the British Government with the Australian metal producers for the supply of copper had terminated. It was estimated at that date that the depreciation in the value of scrip within a few months had been nearly one million, the chief being in Mount Morgan, which had gone back by £250,000. According to the Sydney *Sun* for January 12th, Mr. A. A. Boyd, general manager of the Mount Morgan G.M. Co., had received advice from the company's Melbourne office to the effect that all attempts to make a sale of copper had been unsuccessful, and that there was no immediate prospect that the company's output of copper could be disposed of.

Mr. Boyd said it appeared as if the company would be unable to secure freight for any of its copper for the next six months. It also appeared that the vessels then going to Australia were under British control, and would lift preferentially different materials already purchased by the British Government. "This means," said Mr. Boyd, "that practically none of our 1919 copper will be saleable until fully nine months after production, and then almost certainly at a lower price. For the present it is the intention of the directors that mining and treatment shall proceed as usual. How long this might continue depended largely upon the exercise of rigid economy, together with an increased efficiency in productive operations, and on the future of the copper market. It was only by co-operation on the part of the employé and employer that the copper industry could be successfully conducted through the trying period ahead."

Large Sydney sharebrokers endorsed the opinion of Mr. Boyd. Many were inclined to think that the market might go still lower, unless the Federal Government was able to arrange for the sale of production with the British Government for delivery throughout this year. Mr. J. L. Wharton, chairman of directors of the Hampden-Cloncurry Co., stated that his company was in a similar position to the Mount Morgan Co. Very large quantities of copper were awaiting shipment at the Electrolytic Refining and Smelting Co.'s works at Port Kembla. As soon as vessels arrived from Great Britain to load Australian wool, there would be an opportunity of clearing off this surplus.

The Mount Cuthbert officially stated that it did not intend to resume copper production at present. It was the intention of the Board fully to overhaul the machinery and effect extensive repairs while the smelter was idle. Practically the whole of its 1918 output of copper, which had been electrolytically refined, was lying at Port Kembla, but the greater portion of that tonnage had been paid for by the British Munitions Department, and only the November output was unsold.

Catalogues.—Messrs. Higgs Bros., Summer Hill Street, Birmingham.—36-page illustrated catalogue of their c.c. and a.c., electric motors, and c.c. dynamos. Specification information, effectively coloured sectional views of complete machines, half-tone vews of machines and parts thereof, dimensioned drawings, tabulated powers, speeds, prices, code-words, &c., are all given. The matter is set out in a businesslike way. The list contains particulars of new ranges of machines recently put on the market. The firm concentrate their attention upon the design and manufacture of electric motors, and they rightly claim to be specialists on small and medium-sized machines.

Liquidations and Dissolutions.—Robertson Electric Lamps, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Fraser, 31, Copthall Avenue, London, E.C. Meeting of creditors, March 18th.

Perry & Co., electric light fitting manufacturers and electricians, 21, Grafton Street, London, W.—Messrs. R. Wason, J. St. John Smith, and B. G. St. John Smith have dissolved partnership. Debts will be attended to by Mr. R. Wason, who will continue the business under the same title at the same address.

Under the Trading with the Enemy Amendment Act, the Board of Trade has ordered the realisation and distribution of the assets of the undermentioned business :—

Calor Co., Ltd., 133-6, High Holborn, London, W.C.—Holders of patent rights for the manufacture of fuel briquettes. Controller, H. A. Booty, 14, George Street, Mansion House, E.C. 4.

R. Wolf, Ltd., 7, Laurence Pountney Hill, London, E.C. 4., engineers and merchants.—The Board of Trade has ordered, under the Trading with the Enemy Amendment Act, 1918, the realisation and distribution of the assets in this case. Controller, A. Dangerfield, 56, Cannon Street, E.C. 4.

Government Electrical Equipment to be Sold.—It is announced that the Disposal Board of the Ministry of Munitions has completed its organisation for the disposal of the quantities of electrical apparatus and equipment that were manufactured to help win the war and are now becoming available for the requirements of peace-time development. The electrical material as it comes to hand for purposes of sale will be grouped under the following headings :—

(*a*) Lighting accessories and fans; (*b*) cables; (*c*) bell materials; (*d*) electrical instruments; (*e*) telegraph materials; (*f*) telephones, C.B. and magneto; (*g*) telephones, field and intercommunication; (*h*) wireless apparatus; (*j*) searchlights, arc lamps and equipment; (*k*) plant.

Intending purchasers should write to the Disposal Board (Electrical Section, Caxton House, Westminster, S.W. 1), stating in which of the above headings they are interested. Advice of impending sales will be widely advertised through the Press, and notifications will also be sent direct to prospective purchasers as material becomes available.

Trade Announcements.—Mr. A. Williams has resigned his appointment as resident engineer and manager to the Urban Electric Supply Co., Ltd., Berwick-on-Tweed, and has commenced business as a general electrical engineer and wiring contractor, at 30, High Street, Berwick-on-Tweed. He will specialise in country house and farm installations and general maintenance. He desires to receive lists and catalogues of complete lighting sets, materials and specialities.

The Agricultural Electric Discharge Co., Ltd., have removed their registered offices from Gloucester to Birmingham. All communications should be addressed to 51, Great Charles Street, Birmingham.

Mr. W. H. Browning, for the past seven years employed by Messrs. White, Jacoby & Co., has left that firm and opened an electrical repair shop at 7, Imperial Mews, Barking Road, East Ham, E. 6.

As from March 24th all communications for the General Accessories Co., Ltd., should be addressed to 125, High Holborn, London, W.C. 1.

Mrs. Harry Bibby, widow of the late Mr. H. Bibby, electrical engineer, Bold Street, Warrington, is continuing the business.

Book Notices.—*The Decimal Educator.*—Vol. I, No. 3. London : The Association. Pp. 32. Price 6d.—The popularity of this journal, and the increasing feeling in favour of the Association's objects, are shown to a marked degree not only by letters from supporters in various parts of the country, but also by the fact that the rapid increase in the printing number, and consequent reduction in the cost of production per copy, has warranted the reduction in price by one-half. The number before us contains a portrait of James Watt, F.R.S., and among the articles such interesting subjects as "Decimal Coinage in Foreign Trade," "Swiss Metric History," "Teaching Metrics to the Young," "The Metric System in the United States," and "Decimals in Catalogues" are dealt with. There are also a number of interesting notes, as well as some manufacturers' views on the desirability of the substitution of the metric system in place of that in use in this country at the present time.

The first copy of *Ways and Means*, the new weekly review of industry, trade, commerce and social progress, published by Mr. Ernest Benn, made its appearance on March 8th (6d.). The opening notes on matters of the moment are followed by editorial articles on the mining industry, industrial organisation, Dope, and the Recollections of a Glutton. The last of these makes our hearts lighter and our pockets heavier as we indulge in retrospection, dreaming of the good old days of beef-steak puddings at the popular price of 4d. We rise to greater dignity and more seriousness when we study the signed articles by other men of eminence—"Industrial Councils : A Reasoned Policy," by the Right Hon. J. H. Whitley, M.P.; "The Responsibility of Trade Unions in Relation to Industry," by the Right Hon. J. R. Clynes, M.P.; "The Financial Situation," by Sir George Paish; and "How we Supplied our Allies with Coal," by Sir Daniel M. Stevenson. Gluttony or no gluttony, we have before us "a feast of fat things" which should satisfy the most voracious appetite for good matter on industrial subjects of the first importance. We wish the journal, which seems to us to cut quite new ground, every success.

The Aircraft Identification Book. By R. Borlase Matthews and G. T. Clarkson. London : Crosby Lockwood & Son. Price 3s. 6d. net.—The popular interest in aviation justifies the appearance of this book, which is designed to assist the observer to identify any of the types and makes of aircraft that he may meet with, except the latest British apparatus, examples of which have not been captured by the enemy. For this purpose analytical tables and diagrams are provided on a uniform system. The subject is admittedly difficult, as the art has progressed so far that many types emanating from different makers differ very little in external aspect; however, the authors have indicated the minor details of construction by which even these can be distinguished from one another. A mass of information of a general character is also given, and it is safe to say that the student of aviation, whether professional or amateur, will find the book an invaluable companion.

The *Engineering Index*, which for so many years formed an important feature of the *Engineering Magazine*, has been taken over by the American Society of Mechanical Engineers, which will extend it and make it "the most complete in the world." The transfer was primarily due to the change of name of the magazine to *Industrial Management*, together with the corresponding change of policy on the part of that journal.

"Arithmetic for Engineers." By C. B. Clapham. Pp. xi + 465; 167 figs. London : Chapman & Hall, Ltd. Price 7s. 6d. net.

Italian Companies.—The Società Varesina per Imprese Elettriche has decided to augment its capital from 7,225,000 lire to 12.325,000 lire, and to issue bonds to 3,000,000 lire.

The following companies have increased their capitals :—Le Forze Idrauliche de Trezzo, from 6.000.000 to 10,000.000 lire; Elettrica Milani, 3,000,000 to 10,000 000 lire; Elettrica Italia Centrale, 10,000,000 to 12,000.000 lire; Elettrica del Pellino, 700,000 to 1,000,000 lire; Elettrica Trevigiano, 1,200,000 to 2,000,000 lire.

The Accomendita Società Eserazi ed Applicazioni Telefoniche has converted itself into a Società Anonima, with a capital of 1,000,000, raisable to 2,000,000 lire.

Non-Ferrous Metal Industry Act.—A further list of licences granted under this Act is published in the *London Gazette* for March 11th.

LIGHTING AND POWER NOTES.

Accrington.—Alderman Sprake, at a T.C. meeting, criticised the proposal to spend £60,000 on extensions at the electricity works, and to call in an expert to advise on the scheme suggested. He said an expert could talk them into believing almost anything. In view of the proposal in favour of large power-stations, he did not think it was wise to involve themselves in an expenditure of £60,000. Alderman Higham, replying, said the department had applications for connections to works which would take about 1,000 H.P. more than they had available at present. The works compared most favourably with any other works in the kingdom. If they got value, and were meeting a necessary demand, it made no difference whether the amount was £60,000 or £600,000. The estimated saving to be effected by the new plant was expected to amount to the whole of the interest and sinking fund on the proposed outlay.

Australia.—Brisbane.—The municipality has accepted the tender of the City Electric Light Co. for the lighting of South Brisbane with electricity; at present the district is lighted with gas.

New South Wales.—A report by the chief electrical engineer on the proposed hydro-electric scheme in the Grafton district, states that 100,000 H.P. could be developed in the neighbourhood of the Clarence River Gorge. An initial scheme, to provide 6,000 KW., at a cost of £240,000, is recommended.

Tasmania.—The Ulverstone Council has been authorised to borrow £1,000 for the extension of its E.L. undertaking.—*Tenders.*

Bacup.—Extensions.—The Electricity Committee has been empowered to arrange for the supply of electricity to Britannia Quarries, Tanneries, &c., including agreements with the consumers and the Whitworth U.D.C. It has also in hand a scheme for extension of supply to Victoria Mill.

Battle.—E.L. Scheme.—Mr. Tasker has submitted to the U.D.C. an amended estimate for an E.L. installation for the town, the outlay being reduced from £25,000 to £17,600, and the revenue advanced from £1,500 to £3,279; the matter is to be reconsidered.

Blackburn.—Proposed New Station.—A deputation has been appointed to interview the B. of T. in support of the Corporation's scheme for erecting a new generating station on the Whitebirk site. The scheme has been in abeyance owing to the war, but its urgency is such that pressure is to be brought on the Board for liberty to proceed.

Brandon (Co. Durham).—E.L. Scheme.—The U.D.C. proposes to apply for powers to construct an electricity works at an estimated cost of £5,500.

Canterbury.—Price Increase.—The T.C. has fixed the charges for electricity, from March 31st, as follows:—Lighting, flat rate, 6½d. per unit, maximum demand rate, 7d. and 3½d.; outside arc lamps, 6d.; motor-generators, 3d.; gas compressors for lighting, 6d.; power and heat, 3d.; to power consumers there is to be a rebate of ½d. per unit if over 500 units per quarter are consumed, and 1d. if over 5,000.

Colchester.—Mains Extensions.—The T.C. has decided, subject to the consent of the B. of T., to extend the electricity mains, at a cost of £318, to the pumping station at Stanway for the Lexden and Winstree R.D.C.

Continental.—Spain.—Strike.—Although some minor strikes have been settled, the electricity works are still idle, and the company announces that if work is not resumed shortly it will bring 5,000 workmen from Great Britain.

On Saturday last the Government called up all reservists who are employés of the Canadian Lighting Co., and is taking steps to compel them to return to work as if on military service.

Proposed National Supply.—The Permanent Electrical Commission (a department of the Ministerio de Fomento) has been directed to report on the possibility of the construction, by the State, of a national network for the distribution of electricity.

Sweden.—A new undertaking has been formed at Stockholm by mining concerns interested in the electrical utilisation of water power, with the title Aktiebolag Berglagens Gemensamme Kraftforwaltning, the capital being £250,000.

Among the new companies formed in Sweden in connection with electricity supply, the majority intending to utilise water power, are:—The Ötervattsbackens Kraft Aktiebolag, of Bjurholm; the Harlosaortens Elektricitetsverk Aktiebolag, of Harlosa; the Bredby Elektriska Aktiebolag, of Bredby; and the Hallsta-Rimforsa Elektricitetsverk Aktiebolag, of Rimforsi, the last-named having a capital of £100,000.

Italy.—The Società Emiliana di Esercizi Elettrici is increasing its capital from 3,150,000 lire to 10,500,000 lire in order to defray the outlay connected with the construction of its hydroelectric stations at three falls in the provinces of Parma and Modena.

Dartford.—Proposed Extensions.—The U.D.C. has applied for a loan of £3,500 for cables, &c., for the supply of electricity to the Joyce Green works of Messrs. Vickers, Ltd.

Ellesmere Port.—Prov. Order.—The Mersey Power Co. has informed the U.D.C. that it intends applying to the B. of T. for an order to supply electricity to the works in the district.

Faversham.—Proposed New Plant.—The electrical engineer has reported that it is impossible to fulfil the agreement to supply electricity to J. Pollock, Sons & Co. without additional plant, and the T.C. has decided to apply for a loan for the purpose.

Gelligaer.—Proposed Joint Purchase.—The Gelligaer, Bedwellty, and Mynyddislwyn Councils are considering the purchase, jointly, of the Rhymney Valley Electricity and General Supply Co.'s undertaking.

Henley.—Proposed E.L.—It is stated that the Council is endeavouring to obtain sanction to a loan for an E.L. scheme.

India.—Bombay Electrical Schemes.—Hydro-electrical developments near Bombay, in the Western Ghauts, were described recently at a joint meeting of the British and American Electrical Institutes of Bombay, during the Engineers' Conference.

In the hydro-electric developments near Bombay, in the Western Ghauts, the highest land is at the very edge of the Ghauts, with a rapid descent toward the West, and a very gradual one toward the East. Near Lonarla this higher ground is broken in such a manner that water impounded in lakes, made by placing dams across the lower end of valleys, can be led by open duct to a fore-bay from which the down-take pipes can be taken to the power house approximately 1,700 ft. vertically below the fore-bay. This natural type of development, comprising lakes Gostling, Sydenham, and Wellington, is capable of supplying 50,000 H.P., or 135 million units, in Bombay during 3,600 hours per year.

It was realised, however, that this undertaking would be insufficient, and the Andhra project was decided upon, where water is to be drawn off near the head of the valley through the scarp of the Ghauts by means of a pressure tunnel, with suitable surge chamber, the point of draw-off being 115 vertical height above the lowest point in the river. The lake will impound 5,000 million cb. ft. of water below, and 12,500 million above, the draw-off level. This will supply 65,000 H.P. The Andhra project is well in hand, the tunnel being three-fifths driven and the foundations of the dam completed. The transmission distance to Bombay will be 56 miles.

The investigation of this project led to, and was followed by, that of the Nila Mula, the reservoir of which will be situated 30 miles west of Poona. With a development similar in charactor to the Andhra project, 150,000 H.P. can be produced. The surveys for this project are completed, and the grant of the concession is now under consideration by the Government of Bombay. The transmission distance to Bombay will be 70 miles.

Following the Andhra and the Nila Mula explorations, and based on similar methods of development, came the great Keya project further down the Ghauts in a southerly direction. This development is of such magnitude as to supply 300,000 H.P. day and night throughout the year. This is now under survey, and is expected to lead to the creation of a new and important industrial centre where electrochemical work on a large scale will be undertaken.—*Board of Trade Journal.*

Isle of Arran.—E.L. Scheme.—The Marquis of Graham is interested in a scheme to supply the isle with electricity.

Kilmarnock.—Year's Working.—For the year ended May 15th, 1918, the income of the Corporation Electricity Department amounted to £45,940, compared with £33,809 in the preceding year. The expenditure was £25,678, against £17,863. Capital charges absorbed £20,938 against £13,721, and there has been carried forward £5,475, against £5,626. Units generated totalled 12,763,587, against 10,002,714, of which 456 630, against 357,403, were sold for lighting; 9,962,842, against 7 619,344, for power; 362,769, against 353,130, for traction; 49,870, against 36,920, for public lighting; 691,752, against 560,360, were used on the works; 656,247, against 645,127, were used in converting machinery; and 579,247, against 423,710, were used in transformation, distribution, &c., and were unaccounted for. The maximum load recorded was 3,800 KW., against 3,250 KW. The load factor was 32·54 per cent., against 29·60. The capacity of the plant was 10,000 KW., against 4,500 KW. The generating cost per unit sold was ·406d., and the total cost was ·568d. The average price received was 1·017d.

Korea.—Water Power.—A scheme for utilising the water power of the Sampang River for the production of electricity is to be commenced during the next few months. The scheme will, in the first instance, supply power to a chemical works on that river. Generating plant will be installed in the town of Sampangli and at Sokkyoli and a total of 7,000 H.P. is anticipated. About £10,000 will be spent in electrical machinery.

Leeds.—Price Increase.—From the next meter-readings the price of electricity is to be increased from 40 per cent. to 60 per cent. over pre-war charges. The new charges will be 1·6d. per unit for power and 5½d. for lighting.

Lichfield.—Prov. Order.—The Walsall T.C. has informed the R.D.C. that it is seeking powers to extend its area of supply of electricity to include portions of Hammerwick and Burntwood, in the R.D.C.'s area.

London.—Hackney.—The Electricity Committee has recommended the B.C. to apply for sanction to a loan of £16,500 for extensions in connection with the electricity undertaking, including switchgear, £9,055; E.H.T. cables, £11,270; L.T. feeders, £5,370; motor converters, £10,300; A.C. motor, £2,650; buildings, £5,600.

The electricity mains are to be extended to Rossington Works, Rossington Street, at a cost of £200.

St. Pancras.—The B.C. is to invite plans, &c., for the erection of blocks of flats on a site in Prince of Wales Road, to contain provision for two, three, and four-room self-contained flats to have gas, electricity, and hot water services.

Lytham.—Proposed E.L.—The U.D.C. has appointed a deputation to discuss with the St. Anne's Council the question of a supply of electricity to Lytham.

Manchester.—Coal Supplies.—In reply to a statement that the electricity department could not carry on for three days in the event of a coal strike, Mr. S. L. Pearce, the borough electrical engineer, has stated that he would not anticipate any difficulty in maintaining the present output for at least a few weeks.

Monkwearmouth.—Motor-Generator Wrecked.—On February 27th a 5,000-volt motor-generator was practically wrecked at the Whickham Street sub-station. By a mistake in starting up, the generator was switched full-on immediately, with the result that one end was completely smashed. The building was damaged by the flying metal, and the wood-work of another generator in the same building was damaged, but the running of the machine was not affected, and the supply to the district was not interrupted. Nobody was injured.

Rochdale.—Extensions.—The D.R. cotton mill has asked the Corporation to arrange for a further supply of 1,500 kw. of electricity by the end of April, an additional 1.500 kw. by the end of July, and a total of 7.500 kw. by the end of 1919. The Corporation is seeking powers from the Director of Electric Power Supply to enable it to extend its plant to meet the demand.

Rotherham.—Extensions of Supply.—The borough electrical engineer has reported that in addition to the amount to be supplied to the Yorks. E.P. Co., the Sheffield Corporation, and Messrs. Steel, Peech & Tozer, there is a further demand for 16,800 kw., to be connected by March 20th, 1920.

St. Helens.—Purchase of Plant.—The T.C. has authorised the purchase of second-hand motors at the sale at the Haymarket National Shell Factory, Liverpool, at a cost not exceeding £500; also three transformers, at a cost not exceeding £950.

South Africa.—Kingwilliamstown.—The B.C. is considering a scheme for the extension of its electricity undertaking, at a cost of £25,000.—*British and S.A. Export Gazette.*

South Shields.—Price Increase.—The Electricity Committee has decided to increase the charges for electricity, except for public lighting and traction, by 50 per cent. over the rates in force in September, 1918, as from April 1st next.

Swansea.—Electricity and Housing Schemes.—It was reported at a meeting of the Electricity Committee that the cost of supplying electricity for driving haulage and other machinery in connection with the Town Hill housing scheme would amount to from £2,500 to £3,000. It was explained that the supply could be used later to light the houses, and the engineer (Mr. J. W. Barr) was instructed to confer with the Housing Committee on the matter.

Uruguay.—E.L. Scheme.—The State Electrical Board has decided to install an electric lighting service in Villa Dolores (Department of Colonia).—*Review of the River Plate.*

United States.—Survey of Power Resources.—Secretary Lane of the Interior Department has sent to Congress requests for an appropriation of $50,000 for a survey of the power resources all over the United States, and for an appropriation of $200,000 for a report on the power supply for the industrial region of the Northern Atlantic seaboard, extending in general from Boston to Washington. The request for the $200,000 appropriation has been approved by the Secretary of the Treasury.

Water-Power Legislation.—The water-power conferees of the Senate and House of Representatives have held another meeting, and are again deadlocked upon the same question which has prevented the passage of a water-power Bill for five years—namely, the question of the charge to be made. Senators insist that no charge shall be made for the use of water, on constitutional grounds, while the House conferees are insisting that a proposed Federal Power Commission shall have the right to make a charge for water.—*Chem. and Met. Engineering.*

Wallasey.—Proposed Extensions.—The Electricity Committee has applied for sanction to a loan of £90,000, for the extension of the electricity station, and the provision of new mains.

Wellingborough.—Extensions.—The Northampton E.L. and P. Co. has obtained the sanction of the R.D.C. to erect an overhead main to supply additional power at Rushden. The supply of power and light to villages en route is to be considered. The new riverside power station was opened last week, and power is to be supplied to Irthlingborough and other boot-making centres in the district.

Wigan.—Proposed Loan.—The Corporation has decided to apply to the L.G.B. for sanction to borrow £101,250 for extensions at the generating station.

Workington.—Prov. Order.—The T.C. has decided to apply for a prov. order for electricity supply.

TRAMWAY AND RAILWAY NOTES.

Australia.—Prahran.—Year's Working.—The report of the Prahran and Malvern Tramways Trust for the year ended September 30th last states that, under agreement with the Trust, the Melbourne E.S. Co. is to install two 500-kw. generators. During the year 6,546,500 units were used, at an average cost of 1·307d. The total receipts for the year amounted to £204,692, and the working expenses to £118,128. After meeting capital charges, there was a balance of £6,147. Car-miles run totalled 3,021,021, and 28,370,193 passengers were carried. The total capital expenditure at the end of the year was £793,342.

Barrow.—Proposed Purchase.—The T.C. has decided to consider a report on the question of the purchase of the tramway system in the town; the Council's option to purchase expires at the end of this month, and cannot be renewed for another seven years.

Meters.—As the Council is unable to obtain prepayment meters for certain temporary houses, it has been decided to demand a deposit of 10s.

Electric Vehicles.—The Health Committee has agreed to purchase two 3½-ton electric wagons, at £1,252 each. The Council was informed that the vehicles would cost £200 more than petrol trucks, but the cost of running by electricity would be £200 a year less.

Continental.—France.—Railway Electrification.—A further step has been taken in connection with the inquiry which is now proceeding respecting the adoption of electric traction on the railways. The Administrative Sub-Committee has examined proposals for the conversion of the systems of the Midi, Paris-Orleans and Paris-Lyons-Mediterranée Railways, comprising a total length of 5,084 miles (hydro-electric works, fixed transformer stations, and rolling stock), and representing an estimated expenditure of £96,000,000. The Technical Sub-Commission has in preparation a report recording the experience already gained in France and abroad in the electrification of main lines. This report, which is intended to facilitate a comparison of the various systems of traction in use, is to be distributed shortly. The report will serve as the basis for discussion, which, after being verified by the representatives of the Special Committee, will lead to a decision as to the best method of traction for the French main lines of railway.

Italy.—A Government decree has authorised the Società Anonima per Imprese Elettriche Piacentine to construct and work an electric tramway in the city of Piacenda.

Dewsbury.—Proposed Extensions.—The Electricity and Tramways Committee has decided to submit to the L.G.B. revised estimates for the construction of the proposed Dewsbury Moor and Shaw Cross tramways, and linking-up line, as follows:—Dewsbury Moor, £51,393; Shaw Cross, £53,486: Market Place, £2,723.

Dublin.—Tramway Manager Fined.—In the Dublin Police Court, Mr. G. Marshall Harriss, general manager, Dublin United (Electric) Tramways Co., was fined 1s. for the overcrowding of a tramcar, and the conductor of the car was cautioned. The magistrate, Mr. Lupton, said the people who stood in the cars, and caused the overcrowding, were those who ought to be prosecuted.

Edinburgh.—Tramway Electrification.—In connection with the proposal for the electrification of the tramway system, when it is transferred to the Corporation, a deputation from the Tramway Committee is to visit London to inquire into the operation of the conduit system.

India.—Railway Electrification.—Two great railways which terminate at Bombay are now seriously considering the electrification of their local services and Ghauts traffic, which should result in very extensive electrical engineering applications. It is now generally admitted that existing conditions render this necessary, as a means of enabling them to cope with the increased traffic in the near future.—*Board of Trade Journal.*

Kirkcaldy.—Rail Welding.—The Tramway Committee has recommended the T.C. to purchase rail-welding plant and a motor-generator, with magnetic clutch, at a cost of £485.

Year's Working.—There was a net deficiency on the operations of the Corporation tramway undertaking, for the year ended May 15th last, of £3,356, against £3,163 in the previous year. The revenue was £11,115, against £9,201; and working expenses were £10,005, against £8,019; interest accounted for £1,863, against £1,650; sinking fund charges for £1,451, against £1,409; and depreciation for £1,160, the same as for 1916-7. Passengers carried totalled 2,990,539, against 2,483,155; 245,828 car-miles were run, against 239,296; and 362,769 units, against 353,130, were used. The total operating costs per car-mile were 9·767d., against 8·073d.; and the average revenue per car-mile was 10·88d., against 9·23d.

London Electric Railway Co.—Extension of Time.—Application has been made by the London Electric Railway Co. to the B. of T. for an order to extend the time for the construction of the tube railway from Hampstead to Edgware.

Monmouthshire.—Western Valleys.—Railless Electric Traction Act, 1913, and Extension Order, 1914. The B. of T. has extended the time for the completion of the trolley-vehicle equipment for a further period of 12 months.

Peterborough.—Proposed Light Railway.—It is proposed to construct a light railway from Kimbolton to Peterborough.

Prescot.—Proposed Purchase.—Subject to the approval of the B. of T. and the Light Railway Commissioners, the Tramways Committee has agreed to purchase the undertaking of the Liverpool and Prescot Light Railway Co., for £18,000, as from June 30th next.

Smoking on Duty.—According to the daily Press, the Commissioner of Police has been asked by the London and Provincial Union of Licensed Vehicle Workers to allow tramcar drivers and conductors to smoke while on duty, and he has promised to obtain the views of the tramway authorities.

South Shields.—Year's Working.—The annual report of the Corporation tramway undertaking shows a revenue for the past year of £51,276, an increase of £7,288 over the preceding year. The expenditure increased by £7.329, this amount including £5.000 reserved for repairs to permanent way and overhead equipment. The wages bill increased by £1,930. After providing for interest and redemption, there was a balance of £4.755, of which £4.350 has been placed to the credit of the borough rate. The Committee recommends the Council to apply for sanction to a loan of £26,000 for extensions in Mile End Road and Harton Road.

New Plant.—The T.C. has agreed to apply for L.G.B. sanction to a loan of £1,450, for the provision of four generators for charging the three municipal electric vehicles.

Stockport.—Proposed New Service.—The Tramways Committee has appointed a Sub-Committee to arrange terms with the Manchester Tramways Committee for a tramway service from Manchester to Stockport, *viâ* Reddish.

Railless Traction.—The Tramways Committee is considering the question of replacing the railless tramway system on the Offerton route by motor-'buses.

St. Helens.—Tramways Purchase.—The T.C. takes over the tramway system from the company this year, and has resolved to enter into negotiations with the company for the purchase of the company's tramcars. The Council also decided that a general manager of the tramways be appointed, and that an advertisement be issued inviting applications.

A Sub-Committee was appointed to obtain and consider information as to comparative costs of the running of tramcars, motor-'buses, electric 'buses, railless trolley-'buses, and the cost of road repairs.

Thames Valley.—Floods.—Portions of the Thames Valley are still flooded, and tramway cars were held up on Friday last at Raynes Park on the route between Tooting and Hampton Court.

Tramway Men's Wages.—At a meeting at the Ministry of Labour, on Thursday last week, between the representatives of the employers and the National Transport Workers' Federation, considerable progress was made towards a settlement. An agreement on the wages question was practically reached a fortnight before, and it is now stated that the employers submitted proposals which admitted the principle of a 44-hour week, but accompanied by certain conditions. A further meeting is to be held on March 18th.

Wakefield.—Extensions Scheme Abandoned.—A Sub-Committee has reported that, owing to the prohibitive cost of materials, the proposed tramway extensions to Alventhorpe and Flanshaw are impossible at present.

TELEGRAPH AND TELEPHONE NOTES.

Cable Delays.—According to a statement appearing in the Australian newspapers just to hand, it was stated by the Acting Prime Minister early in January that during the preceding few months the Government had been obliged to take important information from the newspaper telegrams. Government messages often took three or four days. A member of the House of Representatives said that private cable messages took as long as six weeks. Another speaker urged that better business arrangements for the dispatch of information of great value to the industrial world should be made in England, where there was a High Commissioner with a large staff.

According to the *Evening News* Mr. Hughes has cabled, informing Mr. Watt that the Marconi Co. has offered to erect full-power stations in Australia, capable of communicating with Great Britain. It is understood that an objection has been raised to competing with the Pacific cable.

Cable Repairs.—The Guam-Manila and Manila-Hong-Kong cables have been repaired. Cable communication with the Philippines, Hong-Kong, China, and Siberia *via* Commercial Pacific Cable has been restored.—*T. and T. Age.*

Canada.—A resumption of the commercial wireless service between this country and Canada is announced by the Marconi Co. Permission has not yet been given for transmission of messages to the United States.

From March 10th wireless telegrams at the full ordinary rate for places in Canada may be filed at the Marconi Co.'s offices, or at any postal telegraph office in the United Kingdom.

Spain.—Marconi's Wireless Telegraph Co., Ltd., has been authorised to establish commercial wireless communication with Spain, as from March 13th. Telegrams should be filed at the company's offices or at any postal telegraph office in the U.K. The charge per word will be 2½d., with a minimum charge of 10d. per telegram. This represents a reduction of ½d. per word on the present cable charges.

Telegraph Censorship.—The Governments of the U.S.A., Canada, and other parts of the Empire, have withdrawn their control of cable and wireless messages. All regulations concerning the censorship of wireless messages to and from ships in the West Atlantic and Pacific have been removed by Canada and the U.S A. The same rule applies to commercial coast stations, while the restrictions regarding code and cipher messages have also been abandoned.

An agreement between the U.S.A. and Great Britain abolishes the double censorship, and telegrams in future will be censored solely in their country of origin. The new arrangement comes into force on March 13th.

Telegraph Communications Board.—The Postmaster-General in a written answer to Sir Henry Norman, states that he is aware of the steps taken by the French and American Governments in the erection of State owned high-power wireless telegraph stations in France and America. As regards the question of taking similar steps in the British Empire, he says that the War Cabinet has recently appointed a Telegraph Communications Board, with Lord Milner as chairman, whose duty it will be to consider this question as early as possible.—*The Times.*

Wireless Telegraphy.—Mr. Roy A. Weagant, chief engineer of the Marconi Co., announced at a recent meeting of the Institute of Radio Engineers, New York, that he had discovered a device eliminating "static" trouble from the operations of wireless telegraphy. The essence of the invention was founded on realisation that static waves move in a vertical direction, consequently perpendicular to wireless waves. This fact, he explained, makes possible, by a proper arrangement of electrical circuits in receiving instruments located between two aerial loops, to balance out or cancel static currents which have been received at different times in the two loops, and are, therefore, out of phase, and remain in circuits operating wireless receivers, which record incoming messages. Practice, he added, had shown elimination of static influence by the device to be not a matter of chance, but reliable and consistent. Prof. Michael I. Pupin, of Columbia University, considers the invention a distinct accomplishment and a great step forward.—*Evening Standard.*

West Indies.—Marconi's Wireless Telegraph Co. has been authorised to transmit wireless telegrams at the full ordinary rate for Bermuda, British West Indies, and British Guiana. Such telegrams may be filed at the company's offices or at any postal telegraph office in the U.K.

Wireless Telephony.—The *Morning Post* announces that Mr. Daniels, Secretary for the United States Navy, had a conversation on Tuesday by wireless telephone with a pilot flying by aeroplane from Washington to Hampton Roads, and communication was established at a distance of over 150 miles.

According to the *Daily Telegraph* plans are under way, say Marconi officials, for the installation of a wireless telephone system between London and New York.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

May 19th. Municipal Council. Boiler-house equipment. Specifications, on February 17th, from Messrs. Preece, Cardew, Snell and Rider, 8, Queen Anne's Gate, S.W. (January 31st.)

April 28th. Municipal Council. Power transformers. Electrical Engineer, Town Hall, Sydney.

Queensland.—March 26th. P.M.G.'s Department. Telegraph and telephone material, schedules 447/451 and 453. (February 21st.)

May 15th. Department of the Treasury, Brisbane. H.T. switchboard, storage battery and motor-generator set for the Electric Power House, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Aylesbury.—Corporation Electricity Department. One 1,000-KW. generating set complete ; two 500-KW. rotary converters. (February 14th.)

Bradford.—March 22nd. Corporation. Steel girder tramrails, tiebars, bolts, &c., copper rail bonds, &c. Mr. W. H. S. Dawson, City Engineer.

Dublin.—March 19th. B. of G. Supply of electrical fittings for three or six months. Specification from the office of Master of the Workhouse.

Ipswich. — Corporation Electric Supply Department. Pipework in connection with the new steam turbine. (See this issue.)

London.—Marceh 27th. West Ham Union. B. of G. Six months' supply of electrical fittings. Mr. T. Smith, Clerk to the Guardians, Union Road, Leytonstone, E.11.

OFFICE OF WORKS.—One 300-KW. Belliss generating set, or two 150-KW. Belliss generating sets. (See this issue.)

Warrington.—March 19th. B. of G. Electrical goods for three months. Mr. A. Bottomley, Clerk, Bewsey Chambers.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Bradford.—Tramways Committee :—

26 tramcars, complete, at £1,980 each ; 52 traction motors, complete with controllers, resistances and circuit breakers, at £246 each.—Dick, Kerr and Co., Ltd.

25 tramcar trucks, at £157 15s. each.—Boving Engineering Works.

Sunderland. — Electricity Committee. Accepted on Wednesday :—

E.H.T. cable.—B.I. & Helsby Cables, Ltd.

House service meters.—Ferranti, Ltd.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 14th. At 5.30 p.m. At the Imperial College of Science, South Kensington, S.W. Paper on "Some Characteristics of the Spark Discharge, and its Effect in Igniting Explosive Mixtures," by Mr. C. C. Paterson and Dr. N. Campbell.

Royal Institution of Great Britain.—Saturdays, March 15th and 22nd. At Albemarle Street, W. At 3 p.m. Lectures on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Royal Society of Arts.—Monday, March 17th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture on "Fuel Economy," by Prof. W. A. Bone, F.R.S. (Lecture II.)

Wednesday, March 19th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Distribution of Heat, Light and Motive Power by Gas and Electricity," by Sir Dugald Clerk, F.R.S.

Junior Institution of Engineers.—Friday, March 14th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "A History of the Locomotive," by Mr. E. Hooper.

(**North-Eastern Section**).—Tuesday, March 18th. At the Mining Institute, Newcastle. At 7.15 p.m. Paper by Mr. E. F. Oakford.

National Association of Supervising Electricians.—Tuesday, March 18th. At 7 p.m. At St. Bride's Institute, Ludgate Circus, E.C. Paper on "A.C. Induction Motors," by Mr. J. M. Seddon.

Illuminating Engineering Society.—Tuesday, March 18th. At 7.30 p.m. At the Trocadero Restaurant, Piccadilly, W. Tenth anniversary dinner.

Liverpool Engineering Society.—Wednesday, March 19th. At 8 p.m. At the Royal Institution, Colquitt Street. Paper on "Welfare Work," by Mr. J. A. Davenport.

Industrial Reconstruction Council.—Wednesday, March 19th. At the Saddlers' Hall, Cheapside, E.C. Lecture on "The Functions of Government in Relation to Education," by the Rt. Hon. H. A. L. Fisher, M.P., President of the Board of Education.

Chemical Society.—Thursday, March 20th. At 8 p.m. At Burlington House, Piccadilly, W. 1. Ordinary scientific meeting.

Belfast Association of Engineers.—Thursday, March 20th. At 7.45 p.m. At the Municipal Technical Institute, College Square. Paper on "The Improvements of Towns and Houses," by Mr. P. C. Cowan.

Institution of Electrical Engineers.—Monday, March 17th. At the Chartered Institute of Patent Agents, High Holborn, W.C. At 7.30 p.m. Informal meeting. Discussion on "The Future of Trade Unions as Affecting the Engineering Industry," introduced by Mr. F. Pooley.

Thursday, March 20th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Discussion on Mr. Addenbrooke's lectures on "Dielectrics in Electric Fields."

Friday, March 21st. At 1, Wimpole Street, W. 1. At 8 p.m. Joint meeting with the Royal Society of Medicine (Electrical Section). Papers on "Some Notes on Electrical Methods of Measuring Body Temperatures," and "Some Notes on the Electro-Cardiagraph," by Mr. R. S. Whipple.

(**Scottish Centre**).—Tuesday, March 18th. At 207, Bath Street, Glasgow. At 7.30 p.m. Discussion on "Regulations for Arc Welding," and on the President's Address to the Territorial Centres.

(**Students' Section**).—Tuesday, March 18th. At 7 p.m. At Finsbury Technical College, Leonard Street, E.C. Experimentally illustrated lecture on "Oscillatory Electric Discharges," and also an "Exhibition of Ancient and Modern Illuminants," by Mr. R. P. Howgrave-Graham.

Institution of Mechanical Engineers.—Friday, March 21st. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Jig Tools and Special Machines with their Relation to the Production of Standardised Parts," by Mr. H. C. Armitage.

Electro-Harmonic Society. — Friday, March 21st. At 7.45 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking Concert.

Electrical Power Engineers' Association (Glasgow Section).—Saturday, March 22nd. At the Trades House Restaurant, Glasgow. Dinner.

Manchester Association of Engineers.—Saturday, March 22nd. At the Grand Hotel. At 6.30 p.m. Annual meeting. Paper on "Development of Reinforced Concrete," by Mr. B. Taylor.

NOTES.

National Electricity Supply.—The hon. secretary of the Incorporated Municipal Electrical Association, Mr. H. Faraday Proctor, has sent a circular regarding the "Ministry of Ways and Communications Bill," to all members of Parliament, stating that the Association views with very grave concern the proposal that the future control of electricity supply be taken out of the hands of the Board of Trade and be placed under the control of the Ministry of Ways and Communications. It is inferred from an answer given recently by the Parliamentary Secretary of the Board of Trade that the Bill to give effect to the recommendations of the Electric Power Supply Committee has been drafted, and it is urged that legislation as framed on the recommendation of that Committee should proceed immediately, viz., before any decision is reached to transfer the control of the electricity supply industry to any other Ministry.

"As the consumption of coal by railways is only 8 per cent. of the total home consumption, whereas the consumption by factories is 31·8 per cent., mines 10·6 per cent., iron and steel industry 16·4 per cent., and the domestic user 18·5 per cent., the consumption of electricity by railways is never likely to exceed, say, 10 per cent. of the national electricity supply in aggregate. In view of the foregoing figures it is difficult to see how the interests of the general manufacturing community, who are by far the largest users of electricity, can be adequately protected by the proposed Ministry of Ways and Communications, whose predominating interest will undoubtedly be railways. It is therefore strongly urged that the control of the electricity supply industry should be vested in that department of the Government most closely in touch with the general trade of the country, namely, the Board of Trade. To place the future control of the electricity supply in the hands of a Ministry whose chief interests is centred in the railway system of the country would be most inappropriate, and a menace to other industrial and domestic users whose interests are many times greater than those of railways."

"Every endeavour should therefore be made on the second reading of the Bill to secure the elimination of those portions relating to electricity supply contained in Sec. 2 and Sec. 6."

A Government Rolling Mill.—An interesting article in the *Engineer* describes the Government rolling mill at Weston Grove, Southampton. Since the Armistice the mill has been employed, temporarily, on the melting of scrap metal returned from France, and is turning out, for disposal to the trade, standard Government brass ingots of guaranteed analysis. At the height of its activity it was producing 21½ million brass and 19¼ million cupro-nickel cups per week, without resorting to night-shift working. The maximum number of employés was 2,200, of whom two-fifths were women. The first excavating work on the site was started in May, 1916, and by November of that year the first machines were at work. The factory has its own power station, which is situated near the shore and jetty. It contains two turbo-alternators ; one set by the British Thomson-Houston Co. and the other by Messrs. Fraser & Chalmers and Messrs. Siemens. Both sets are similar, running at 3,000 R.P.M., and generating 3,000 KW. at 3,300 volts, three-phase. The turbine and switchboard attendants are women who carry out the routine duties, but, in the event of difficulty, the shift engineer is at once summoned. Within the turbine room itself is a transformer house, where the voltage is stepped down to 440 volts. There are similar stations elsewhere in the works. The L.T. current is used for lighting and driving the smaller motors ; while the larger motors exceeding 300 H.P., such as those driving the sets of rolls, are operated by H.T. current. The boiler house contains five Stirling boilers fitted with under-feed stokers, and each capable of generating 25,000 to 30 000 lb. of steam per hour. The coal is supplied to the boilers from overhead concrete bunkers, fed by a belt conveyor, and in its descent is passed through automatic weighing machines. Without alteration to the grates, coke dust to the extent of 25 per cent. of the total fuel supplied to the boilers has been used quite successfully.

Industrial Foremen Visit Westinghouse Works.—On Saturday afternoon, the 8th inst., a party numbering upwards of 300 of the leading representatives and foremen of eight important engineering firms in the district were received and entertained by the British Westinghouse Co., at Trafford Park. The function was organised by the Westinghouse Foremen's Association, and enabled a specially-large number of practical engineers to foregather within the works of a large industrial manufacturing concern for the commendable purpose of mutual discussion and dissemination of ideas on matters relating to methods of production, machine tools, labour-saving devices, and works administration. Addressing the gathering, Mr. Mensforth (general manager, British Westinghouse Co.) remarked that the result of such visits was of the greatest value. He emphasised the fact that the Westinghouse Co. was not a one-product factory, but was rather a general engineering organisation. There was no other factory in Europe with the same range of production under one roof. The war had taught us the value of co-operation and team work. It was as wrong in principle to hoard knowledge as it was to hoard food. Industrial foremen had a tremendous influence upon industrial conditions. He accorded a most hearty welcome to the visitors.

After the works had been viewed, tea was served in the staff canteen, and in the evening the Westinghouse foremen entertained the visitors to a smoking concert in the Westinghouse Club, where a programme given by "The Jollies" Concert Party was heartily enjoyed.

Fatalities.—At the inquest into the death (mentioned here last week) of C. Knighton (64), a workman employed by Messrs. Howard & Bullough, at Accrington, it was stated in the medical evidence that the cause of death was syncope from heart disease, accelerated by congestion of the lungs. There was no evidence that the work that he was doing had anything to do with his death, and there were no signs of electric shock. As the note appearing in our last issue may leave a wrong impression, we may state that Mr. J. Yeadon, foreman electrician at the works, said he examined No. 21 motor after the occurrence, and found a fuse out. It was a 12½-H.P. motor at 400 volts. The fuse had been out since the previous Saturday, and this prevented the motor starting. There was no current on the switch handle, and everything was in order.

While following his employment as chief engineer of the North (Military) Camp at Ripon, on March 6th, Mr. Ernest Pogson (30), died from the effects of an electric shock received whilst trying to trace a wire in a cubicle with his left hand ungloved. His right hand was resting upon some iron framework, and one foot was on a rubber mat, but the other was not. A fellow workman immediately got the insulating switch-stick and pulled Mr. Pogson off, himself receiving a shock in so doing. The engine connected with the dynamo was running light at the time; Mr. Pogson had been asked if it should be stopped, but replied that it was all right. It was stated that the work could not be done inside the cubicle with a glove on; and that the fatality wovld not have occurred if the engine had been stopped. A verdict of "Accidental death" was returned.

Institution and Lecture Notes.—Society of Engineers.—At a meeting of the Society on March 10th, a paper was read by Mr. Alfred S. E. Ackermann, B.Sc. (Eng.), recording the results of 95 experiments made to determine the relationship between the horizontal pressure and the depth at any given point in clay. The main series of tests were conducted by forcing into the clay various bodies representing tapered and parallel piles, some with a blunt, and others with a pointed end, and in some of the experiments thin disks of metal were forced into the clay. Observations were made of the conditions attending each test, and the results are fully discussed in the paper.

Among the general conclusions arrived at by the author, are the following:—

For tapered bodies gradually forced into clay, the load necessary to produce a given penetration is proportional to the area of the surface of contact between the clay and the body.

Clay containing a definite percentage of water, and at a definite temperature, has a definite pressure of fluidity, and when this pressure is reached and maintained, the clay yields indefinitely as a dense viscous fluid, unless it be restrained from flowing, or caused to rise, so as to produce a statical head of clay.

For equal depths, tapered piles support a larger load per unit volume of the pile, than piles having parallel sides.

With a view to increasing the resistance of piles, they should be corrugated as well as tapered.

With a given quantity of material of which to make piles, a larger number of small piles is more efficient than a smaller number of large ones.

Pointed piles are more efficient per unit volume than blunt ones. The resistance to penetration is considerably greater, the lower the temperature of the clay.

When forcing a disk into clay, the sides of the hole do not crush in (unless a certain critical depth be attained).

Dr. Hele-Shaw, F.R.S., in the discussion, called attention to the lack of information on the subject until the publication of the paper. He considered Mr. Ackermann had done valuable work in demonstrating the existence of a pressure of fluidity for clay.

Mr. O. M. Crosthwaite showed the agreement of his and other experimenters' results with cylindrical piles with those of the author.

Institution of Electrical Engineers.—On Thursday, last week, Mr. G. L. Addenbrooke delivered the second of his lectures on Dielectrics. He said that a special container was devised to apply mercury electrodes to the surfaces of the dielectrics, his electrostatic instruments had to be developed to suit the special circumstances, special resistances were built, and standard condensers were set up. Arrangements were made to provide alternating currents of suitable wave form at frequencies from one cycle in four seconds, or even lower values, up to 400 per second, the very low frequencies being obtained by means of rotating electrodes in a dish of electrolyte with a pressure of 120 volts (R.M.S.) across it. These apparatus were completed four years ago.

Dealing with "homogeneous" solid dielectrics, he found that a high specific resistance was always accompanied by low losses in the dielectric, but the A.C. losses were always higher than the D.C. losses—especially in the case of materials of very high D.C. resistance. Drying the substances under test greatly increased the specific resistance and reduced the losses. Similar results were obtained with liquid dielectrics. Experiments were made on the effects of surface leakage; the losses were found to be far greater with A.C. than with D.C., and generally the phenomena were similar to those found to take place through the substance of the dielectric There was abundant scope for further research in this direction.

Returning to the former subject, with homogeneous dielectrics it was always found that the A.C. losses increased with the frequency—rapidly near zero frequency, more and more slowly up to eight cycles per second, after which the increase became steadily proportional to the frequency, apparently without limit. Glass behaved like paper, celluloid, and gutta-percha in this respect. Celluloid was a very convenient substance for experiment. Experiments on capacity were carried on simultaneously with those on dielectric losses, and it was found that the capacity changed inversely as the frequency, although the dielectric constant of the material, when thoroughly dried, was proved to be constant. Large changes of capacity were always accompanied by large changes in the losses. There was no doubt that the changes were due to the presence of moisture.

On Monday evening next the first of the "informal meetings" will be held at the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., at 7.30 p.m. A discussion on "The Future of Trade Unions" will be introduced by Mr. F. Pooley.

National Association of Supervising Electricians.—On Saturday last a Bohemian concert was held at the Caxton Hall, attended by about 250 members and friends of the Association. An excellent musical programme was provided, and a most enjoyable evening resulted. During the evening the president (Mr. J. S. Highfield), after congratulating the members on the steady growth of the Association and its popularity with the foremen, supervisors, and managers of the electrical trades, presented the hon. sec. (Mr. C. J. Banister), on behalf of the members, with a gold watch and chain, suitably inscribed, as a token of their appreciation of his efforts since the formation of the Association.

Junior Institution of Engineers.—At a meeting at Newcastle-upon-Tyne, on the 4th inst., Mr. L. C. Grant read a paper on "Electrical Disturbances in Supply Systems." The author dealt with surging troubles and their causes; he referred to H.T. kicks and breakdowns, and also directed attention to lightning and similar troubles.

Physical Society of London.—A discussion on "Metrology in the Industries" is being arranged for the meeting of the Physical Society at the Imperial College of Science, Imperial Institute Road, South Kensington, on Friday, March 28th, at 5 p.m. Sir Richard Glazebrook, C.B., F.R.S., has promised to introduce the discussion, and it is expected that several leading authorities on fine measurements will take part. Visitors are invited to attend this meeting.

NATIONAL ELECTRICITY SUPPLY.—Mr. S. L. Pearce, chief engineer of the electricity department, Manchester Corporation, speaking at a luncheon of the MANCHESTER ROTARY CLUB, last week, on the Government scheme for central stations, said the problem before the country was how best to bring about a scheme of reconstruction that would enable the best use to be made of existing plant, while keeping in mind the national aspect of the question, and so avoiding too great a waste of capital that had already been spent.

Outlining the definite proposals in the Government Committee's last report, he mentioned that one of the first duties of the Commissioners would be to make a most careful survey of the country, and decide into how many areas the country should be divided. He was opposed to Government subsidies generally, but he thought that during the period of reconstruction the sinking fund might be suspended, and the payment of interest out of capital might also be sanctioned during the first two or three years. It was hoped that the Bill would be introduced soon, but a very disturbing element had crept in, because it was proposed to take the business out of the hands of the Board of Trade, which had dealt with it up to the present. He could see no argument for placing electricity under railway control, and he hoped that the efforts that were being made to secure that electricity should not be under the control of the new Ministry would be successful.

In a lecture at the ROYAL DUBLIN SOCIETY'S Theatre, Dublin, Prof. Pierce F. Purcell dealt with the Irish peat resources, and described three ways in which electrical energy might be obtained from peat. He said the Irish bogs were estimated to contain sufficient peat to produce about 5,000 million tons of air-dried peat fuel, and at the present rate of consumption to last over 700 years. He estimated that the consumption of peat in Ireland was about seven million tons per annum. The amount of heat energy contained in the peat in Irish bogs was many times greater than that contained in the Irish proved coal fields.

Melting Points of Elements.—Circular of the Bureau of Standards, U.S.A., No. 35, gives a table of melting points of a large number of elements, some of which are used by the Bureau as standards for calibrating thermometers and pyrometers. Amongst the latter are mercury, −38·87; tin, 231·9; lead, 327·4; zinc, 419·4; antimony, 630·0; aluminium, 658·7; silver, 960·5; copper, 1,083·0; nickel, 1,452; iron, 1,530; platinum, 1,755; and tungsten, 3,400—all in degrees Centigrade.

The British Association, 1918.—The British Association for the Advancement of Science will resume its annual congresses this year, after an interval of two years, owing to war conditions. The gathering takes place under the presidency of Sir Charles Parsons, at Bournemouth, from September 9th to 13th.

Power Plant destroyed by Fire.—A correspondent says that fire broke out on Monday night in the power house, a 50-ft. square building at the shipbuilding yard of Sir James Laing and Sons, Ltd., Sunderland. Practically the whole of the electrical installation was destroyed.

Royalties for War Inventions.—The King has approved the appointment of the undermentioned as members of a Royal Commission to determine what awards and royalties shall be paid to inventors in respect of the use of their inventions by Government departments during the war:—Mr. Justice Sargant (chairman); Mr. Halford J. Mackinder, M.P.; Mr. Robert Young, M.P.; Prof. the Hon. R. J. Strutt, F.R.S.; Sir James J. Dobbie, F.R.S.; Mr. W. Temple Franks, C.B.; Mr. G. L. Barstow, C.B.; and Mr. A. C. Cole

Thermal Expansion of Molybdenum.—Scientific Paper of the Bureau of Standards, U.S.A., No. 332, gives particulars of the determination of the expansion of molybdenum as a function of temperature. The specimen tested was of 99·85 per cent. purity, and its density was 10·114 gm. per cm.^{3} at 15° C. The experiments covered the range between − 142 and + 305° C.; the most probable equation applicable between 19° C. and 305° C. was found to be :—

$$L_t = L_o (1 + 5{\cdot}01\, t \times 10^{-6} + 0{\cdot}00138\, t^2 \times 10^{-6}).$$

Parliamentary.—Middlesbrough Corporation is making application to Parliament for powers to acquire, complete, and carry on the undertaking of the North Ormesby, South Bank, Normauby, and Grangetown Railless Traction Co., and to establish a Joint Trolley Vehicle Board.

Co-partnership and Profit-sharing.—The Labour Co-partnership Association is holding a series of conferences and discussions at Kingsway Hall, Kingsway. Two have already been held, and on Tuesday afternoon next, March 18th, Mr. Horace Bowden, borough electrical engineer at Poplar, will speak on "A Combination of Municipality and Co-partnership: Poplar Electricity Department." Mr. E. O. Greening deals with a "Great Paris Store," on Wednesday, March 26th; on Tuesday, April 1st, "A Printing Business" will be considered; and on April 9th, the Right Hon. C. W. Bowerman, M.P., the president, will introduce "A Combination of Trade Unionism and Co-partnership: The Co-operative Printers." All the meetings commence at 4.30.

Electric Smelting.—Mr. W. L. Morrison, plant superintendent of the Western Reduction Co., Portland, Ore., read a paper on "Electric Smelting" at a joint meeting of the National Electric Light Association and the American Institute of Electrical Engineers. Electric smelting, he said, apart from the steel and iron industry, was a new industry in the North-West. Several installations were producing ferro-manganese in some form or other. The energy used in the production of ferro-silicon was so great per ton of metal produced that a difference of 0·05d. per KW.-hour above what other manufacturers were paying, would put one out of business, other things being equal. In the case of electrical steel furnaces, a small variation per KW.-hour made very little difference, for there was used only 600 to 800 KW.-hours per ton of steel, while ferro-silicon required 7,000 to 9,000 KW.-hours per ton of metal; moreover, electric furnace steel sold at a higher price than ferro-silicon.

Manganese and chrome required very much the same kind of furnace for their production. The simplest form of furnace was the single-phase furnace, which consisted of a large pot with a terminal in the bottom, either a water-cooled iron plug or a conducting hearth of carbonaceous material. A tap hole was placed at the bottom of the lined crucible for removing the molten metal and slag. A carbon electrode was suspended in the pot, this forming the other terminal, which was movable to regulate the current in the furnace. Various modifications of this furnace were used, depending on the size of installation, the more common type being the three-phase furnace in which three or six electrodes were used.

The production of tungsten and ferro-molybdenum is carried out in a somewhat different way from that of manganese and chrome on account of their high melting points when nearly pure. The common alloys run from 70 to 85 per cent. tungsten or molybdenum.

The process for producing the ferro is almost universally carried out in a single-phase furnace, or pot, averaging from 25 to 100 KW., the commonest size being about 50 KW. The pots vary in size from 10 in. inside diameter up to 24 in., and from 24 in. to 36 in. high. The pots are placed on large terminals, either of iron or carbon material. After the operation is completed the pots are removed and new ones started.

The metal is allowed to accumulate in the pots by tapping the slag from time to time through an opening punched in the lining of the pot at the top of the metal. The ore and flux are charged into the pot intermittently after the tapping of the slag. At the end of the operation, when the pot has become too full for economic operation, it is removed and broken open, the button of metal being removed and crushed. The weight of the buttons varies from 500 to 3,000 lb.

One ton of tungsten or molybdenum requires 8,000 to 10,000 KW.-hours per net ton of metal. One net ton metallic chrome (60-70 per cent.) alloy requires 10,000 to 14,000 KW.-hours. One long ton 80 per cent. ferro-manganese requires 3,500 to 5,000 KW.-hours.

Appointments Vacant. — Lecturer in Electrical Engineering, for the Bristol University (£300, rising by £10 to £350); electrical engineer (£300), for the Clacton U.D.C. electricity undertaking; assistant electrical engineer, for the City of Peterborough electricity department; instructor in electrical installation work for training discharged soldiers and sailors (£4), for the Surrey C.C. Education Committee; managerial assistant (£500), and chief assistant electrical engineer (£750), for the Corporation of Bradford electricity department; meter room assistant (£225), for the Wolverhampton Corporation electricity department; assistant engineer (59s. 6d. and quarters), for the South of Ireland Military Hutted Camps. See our advertisement pages to-day.

The Western Australian Government (Minister of Railways) is inviting applications (which have to be sent to the Agent-General for Western Australia, 115, Strand, W.C. 2) for the appointment of Commissioner of Railways; the undertakings to be under his control include the Perth Electric Tramways, and the Government electrical works.

Educational Notes.—University College, London.—The annual report states that whereas in normal times the total number of students, day and evening, amounts to about 2,200, the number last session was 1,071. The fee revenue last year only amounted to £13,581, as compared with a normal fee revenue of between £29,000 and £30,000 a year. The financial position continues to be a difficult one, and unless further help from the Treasury is forthcoming, there will be a deficit on the College establishment account of nearly £13,000 at the end of the current session.

The report refers to the many war activities of the College, and shows that special courses have been arranged in all faculties to meet the needs of students returning from war service.

The total number of past and present members of the College who have undertaken war service now stands at 2,650; 253 have fallen in the War.

Australian Metals.—According to the Melbourne *Age*, rapid and important development of new industries in connection with zinc production in Australia is forecasted in a report furnished to the Acting Prime Minister by the Electrolytic Zinc Co. of Australasia, which, as the result of the availability of hydro-electric power in Tasmania, started constructional and investigational work at Risdon, near Hobart, in January, 1917. In March of that year the first small unit in connection with the electrolytic process for the production of high-grade zinc from Australian ores was in operation, and in January, 1918, the first larger unit, designed to produce 25,000 lb. of zinc daily, was started. It has since operated continuously. The process may now, says the report, be said to be completely established.

The industries already operated by the company at Hobart are electrolytic zinc, 12 tons daily, to be increased to 100 tons daily as soon as power is available; and zinc oxide of all grades and for all purposes. In connection with the manufacture of metallic aluminium it is anticipated that the erection of a plant to produce 4,000 tons annually will be undertaken when power is available, this material being essential in the manufacture of aeroplanes. So far £300,000 has been spent in connection with the Electrolytic Zinc Co.'s undertaking.

The *Sun* states that a local industry, which has been much helped by the war, is the manufacture by the Electrolytic Refining & Smelting Co., Port Kembla, of bluestone (copper sulphate). The industry has developed to permanency as one which can profitably supply the demand, and a plant, which will be on a parity of quality with the other departments of the works, is being constructed. This is the first copper sulphate manufactured in Australia, and the output will be sufficient for the supply of all that is needed in the Commonwealth. The company has obtained a contract to supply the post offices throughout the Commonwealth for 12 months, and also the Victorian railways.

Power Factor of Arc-Type Electric Furnaces.—In *L'Elettrotecnica* of September 25th an account was given of investigations which consisted in (1) ascertaining how the power factor varies with variation in the strength and density of the current and the potential difference applied; (2) ascertaining how the power factor varies with variation in the nature of the charge and in the furnace-bath. The following is a *résumé* of the author's conclusions:—(1) The power factors of arc furnaces depend not only on the inductive action in the circuits, but also on the physical and chemical phenomena inside the furnace. (2) In these furnaces, assuming constant cross-section of electrodes and constant potential difference applied, the power factor increases with increase in effective strength of current. (3) When the cross-section of the electrodes corresponds with effective current-strength, the power factor diminishes with increase in effective value of potential difference. (4) Assuming constant current and potential difference, the power factor varies when the cross-sectional area of the electrodes is varied and increases with increase of current-density. (5) With constant potential difference and current-density, the power factor increases with increase in the cross-sectional area of the movable electrode, *i.e.*, with increase of current employed in the furnace. (6) The potential difference being constant, the variation of power factor relative to a given variation in current-density is, within wide limits, greater with electrodes of greater diameter. (7) The power factor of the furnace (other conditions being equal) may diminish considerably when working with uncovered arc instead of with covered flame. (8) To a high power factor corresponds regular working of the furnace as regards arc stability. (9) Working with high power factors is characterised, acoustically, by quietness of the arc, *i.e.*, it generally emits a characteristic "hum," and often a sound the pitch of which corresponds to the current-frequency. (10) The power factor depends also on the values of the potential differences applied to the extremities of the internal resistances of the furnace (electrodes and bath) and to the extremity of the arc proper. It increases when (other conditions being equal) the first potential differences increase with respect to the second. (11) The power factor depends (in some cases to a considerable extent) on the nature of the furnace charge, on the nature of the bath, and on the nature of the chemical reactions going on in the crucible. Other conditions being equal, then, the power factor increases with increase in the ionising force of the charge and of the bath, and may have a very high value when chemical reactions of special character take place in the crucible.

The Transport Bill.—The Bill for the establishment of a Ministry of Ways and Communications will not be debated until March 17th, owing to important alterations in the draft, the result of strong opposition to certain features of the scheme.

The Caledonian Canal.—The *Times* states that plans for the enlargement of the Caledonian Canal are under the consideration of the authorities.

Briquetting Anthracite Duff.—Mr. C. H. Steel, of Kidwelly, has sent us the following particulars of his method of treatment of anthracite "duff":—

There are dumps of this waste coal in and around this district, of millions of tons, which can be obtained by payment of a small royalty of a few shillings per ton. In its present state it is impossible to burn it, but by a simple addition, when made into briquette form, it will burn equal to bituminous coal. The briquettes, to obtain the best results, must not exceed 4 lb. in weight. The cost of materials, less labour, should not exceed six shillings per ton; and with the cost of transport and labour it should be possible to put it on the market at a cost of under 10s. a ton. It is much better than bituminous coal in use. It does not clinker, and a "clean" fire can be made by simply raking over; the ash, which resembles wood ash, falls through the bars. It is an ideal fuel to use with forced draught, being cleaner, and having greater heating power than bituminous coal.

It will also burn in an "open grate," although the results are not so good as with a range or boiler. The binding agent can be anything. The trials were carried out with linseed meal as the "binder," which further demonstrated that it was not pitch that was burning. By using pitch, and with my briquette-making process to make the briquettes, about 7½ per cent. of pitch need only be used, although it means having special plant.

As there are vast quantities of material at hand, and more to be obtained, there are huge profits to be made, and owing to the need for economy with coal it is a national asset. If I could get someone interested who had a plant at present or who had sufficient influence to have one erected, there would be a fortune in the formula and process.

There are a great many patent fuels on the market at present, some using anthracite "duff" and bituminous small mixed; but when in the furnace the anthracite simply falls through the bars into the ashpit absolutely unburnt. I have had some experience with this kind of briquette, having been at sea and using nothing else as a fuel for nearly two years. Any manufacturer could produce a very cheap and highly efficient briquette under my process, which would capture the market.

Should any reader desire further particulars, I will be pleased to give them all details and a demonstration if requested.

Literary Style.—In an editorial on the relations between editors and engineers, the following comments are made by *Chemical and Metallurgical Engineering*:—Few engineers can write with Macaulay's clarity, Stevenson's absorbing interest, or Clemens's wit; but, indeed, where is the editor who can? And there is a lurking suspicion in the mind of the man on the job that the further up in the clouds of literary expression the writer flies, the poorer his vision of the ordinary details of making the enterprise earn dividends!

Perhaps we editors are fussing too much over nomenclature; too much horrified at the split infinitive; insisting too strongly on our individual predilections for those intangible elements of "style." The other fellow's style may be as good as ours—a shiny boot, while correct for city wear, is a poor working shoe. When we rub elbows with the busy successful engineer with a coveted store of knowledge, our sins are visited on our own heads when he declines to put it on paper "because he can't write." Ten to one, *if he would only dictate his thought to a stenographer* in the abandoned way he would word a business letter, we would find so much meat in the effort that we would gladly thresh it into shape and put the finishing literary "polish" on it without which it would not gain acceptance, even though it might add only a little to the intrinsic merit of the contribution.

The words we have italicised embody precisely the same thought that we expressed in our issue of December 14th, 1917. We are constantly meeting with the practical expert who is brimming over with information, but says he "cannot write an article." He need not write it—let him "talk" it, in the presence of a shorthand writer; we will do the rest.

Industrial Research.—In a leaflet issued by the Department of Scientific and Industrial Research, attention is drawn to the Government scheme for aiding industrial research carried out by manufacturers in co-operation. For this purpose it is necessary to form "research associations" of firms engaged in the production of similar articles. Each firm subscribing to a research organisation will have the following privileges:—

1. It will have the right to put technical questions and to have them answered as fully as possible within the scope of the research organisation and its allied associations.

2. It will have the right to recommend specific subjects for research, and if the committee or board of the research organisation of that industry considers the recommendation of sufficient general interest and importance, the research will be carried out without further cost to the firm making the recommendation, and the results will be available to all the firms in the organisation.

3. It will have the right to the use of any patents or secret processes resulting from all researches undertaken either without payment for licences, or at any rate on only nominal payment as compared with firms outside the organisation.

4. It will have the right to ask for a specific piece of research to be undertaken for its sole benefit at cost price, and, if the governing committee or board approves, the research will be undertaken.

No firm outside the organisation will have any of these rights. The documents and bulletins available for members of the organisation will not be published unless the controlling committee of the organisation decides that they shall be.

It is desirable that a Bureau of Information be set up for the industry, and if that is done each firm will receive a regular service of information, and will be able to obtain translations of foreign articles of interest to it.

The method of procedure recommended is the establishment of research companies with liability limited to a nominal sum, and working without profit. A draft Memorandum and Articles of Association have been drawn up by the department. Subscriptions to such companies will not be liable to income tax or excess profits tax. Financial aid will be given if required.

Particulars of the scheme are given in leaflets entitled "Research Association Nos. 1 to 4," which can be obtained from the department, Gt. George Street, S.W. 1.

The Channel Tunnel.—Mr. Bonar Law announced on Monday in the House of Commons that he was in communication with the Prime Minister in Paris upon the subject of the possibility of immediately beginning work on the Channel tunnel. The daily Press announces that both the British and French Governments have agreed to the construction of the tunnel, and that details are being discussed by a commission in Paris, on which Sir H. Ll. Smith, of the B.O.T., is the British representative. This commission is also said to be considering the building of tunnels—as announced in these columns some months ago—under the Bosphorus and from Gibraltar, connecting Europe with Asia and Africa respectively. A general agreement appears to have been reached as to the advisability of these projects. It is said that plans are being drawn up for the Channel tunnel by the S.-E. and C. Railway Co. in conjunction with Government officials on this side, and by the North of France Railway Co. and the French Government on the French side. It is reported that the French and British Governments are desirous of exercising control, and some form of joint State finance may be adopted. This matter is before the commission at Paris, and when it is settled operations will be begun on both sides of the Channel simultaneously. In addition to the railway the tunnel will carry telephone and telegraph wires, and it is also intended to install pneumatic carrier tubes for letters and parcels similar to those used by the G.P.O. The total length of the tunnel, including the approaches, will be 32 miles, of which about 21 will be under water. It is proposed to build two tunnels, each 18 ft. in diameter, connected by cross galleries at frequent intervals, and the railway will be electrically operated. The maximum depth of water on the route is 180 ft., and it is probable that the tunnel would descend to a level of about 280 ft. below the sea's surface. It is estimated that the work could be completed in five years. The cost before the war was calculated to be 16 millions, the working expenses, £450,000 per year, and the income over 1½ millions sterling. These estimates would, of course, have to be revised under present conditions.

Sir Arthur Fell is reported to have stated that the French Government is prepared to allow the generating station to be located on this side, and, in his opinion, it would probably be situated in Kent, about 10 miles from the coast.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Cardiff City Council has increased the salaries of Mr. A. Ellis from £500 to £750, for his services as tramway engineer and manager, and that of Mr. C. G. M. New, deputy electrical engineer, from £350, plus bonus, to £525 per annum. Mr. Ellis's salary from the electricity department is £500.

Consequent on Mr. Babb taking up the duties of general manager to the National Electric Construction Co. at Musselburgh, Mr. R. L. McCulloch has been appointed to look after the interests of the company at Bo'ness.

Worthing Electricity Committee has recommended that the salary of Mr. Geoffrey Porter, borough electrical engineer, be increased from £450 to £500 per annum next month, and in 1921 to £525, and to £550 as a maximum in 1923.

Mr. W. Billington, of the Salford Corporation tramways department, has been appointed general manager of the

Wigan Corporation tramways, in succession to Mr. F. Buckley, who has taken over the control of the Bury undertaking. Mr. Billington is also assistant secretary of the Municipal Tramways Association.

A proposal to increase the salary of the borough electrical engineer at Barrow from £600 a year to £800 was defeated at the Town Council meeting last week

Mr. J. D. Pember, electrical engineer for the Dartford U.D.C., has resigned.

Mr. J. H. Shaw, M.I.E.E., has resigned the position of deputy city electrical engineer at Bradford, in order to open a London office on behalf of the Davenport Engineering Co., manufacturers of cooling towers, Messrs. Hick, Hargreaves and Co., Ltd., manufacturers of condensing plant, &c., and Messrs. J. Shaw, Son & Greenhalgh, Ltd., manufacturers of high-pressure valves and boiler mountings. His business address will be at 89 & 90, Temple Chambers, Temple Avenue, E.C. 4.

General.—Mr. James Whitcher has left the B.T.H. Co. to join the consulting staff of Messrs. Kennedy & Donkin, Westminster. In his seventeen years' experience with the former firm as a leading designing engineer on main switchgear and electrical control, transmission, and distribution work, he has been in close practical touch with, and actual direction of, much of the development that has ensued in this important branch of electrotechnics; moreover, before specialising in this section, he had the advantage of ten years of responsible work in the broader ways of steam and electrical engineering, so that he is well prepared to share in the development of sound practice in the control and ditsribution of electrical energy.

Mr. G. T. McGlashan, lately chief sales engineer for Scotland, for the British Electric Plant Co., Ltd., Alloa and Glasgow, has joined the firm of Messrs. Edmiston, Brown and Co., electrical and mechanical engineers, 219, St. Vincent Street, Glasgow.

Roll of Honour.—Able Seaman H. Chew, R.N., who died in hospital at Plymouth from pneumonia, was an apprentice with Mr. Isherwood, electrical engineer, Blackburn.

Obituary.—Mr. J. P. Tierney.—There has passed away, from influenza, at Monkstown, Co. Dublin, Mr. Joseph P. Tierney, whom our correspondent describes as one of the best-known of Irish electrical and consulting engineers. He was formerly in the service of the Dublin United Tramways Co., and was the inventor of the controlled-point system. His services as consulting engineer were in great demand, and he was engaged with electric light installations in many Irish towns.

NEW COMPANIES REGISTERED.

Firth Tiertan Co., Ltd. (10,251).—Private company. Registered February 28th in Edinburgh. Capital, £2,000 in £1 shares. To carry on the business of manufacturers and dealers in rubber, asbestos, and insulating materials, &c. First directors: J. C. Sinclair, 47, Waterloo Street, Glasgow, rubber and asbestos manufacturer; F. Stevenson, Glenburn, Sheepburn Road, Uddingston Registered office: 47, Waterloo Street, Glasgow.

Rip Plugs, Ltd. (153,487).—Private company. Registered March 4th. Capital, £5,000 in 4,500 shares of £1 and 10,000 founders of 1s. each. Manufacturers of sparking plugs, importers, exporters, electrical engineers, manufacturers of devices and appliances for aerial and water navigation or progression, &c. The subscribers (each with one share) are: T. H. R. Key, 92, Kimberley Gardens, Harringay, N., engineer; A. Thomsen, 32, Cumberland Park, Acton, aerunautical engineer; E. Baumann, 32, Cumberland Park, Acton, aeronautical engineer; L. Ripault, 98, Hallam Street, W 1, engineer. Managing director: L. Ripault. Registered office: 23, Warren Street, W.

Anode, Ltd. (153,474).—Private company. Registered March 4th. Capital, £250 in £1 shares. Electricians, electrical motor, telephone and general engineers, optical, nautical, and other instrument makers, &c. First directors: P. W. Ernest, 10, Argyle Road, Hendon, N.W.; B. R. Walter, 199, Sandringham Dwellings, Charing Cross Road, W.C. Registered office: 172, Wardour Street, W.

Flexile Metal Co., Ltd. (153,532).—Private company. Registered March 7th. Capital, £50,000 in £1 shares. Manufacturers of and dealers in tubes, casings, and containers in metal, and other substances, electrical engineers, &c. The subscribers (each with one share) are: A. W. Rogers, 17, Prairie Street, S.W 8, clerk; Mrs. B. N. Lovitt, 11, Hornsey Park Road, N. 8. First directors to be appointed by the subscribers. Solicitors: Thorne, Priest & Co., 11, Great James Street, Bedford Row, W.C. 1.

C. H. Morse & Co., Ltd. (153,499).—Private company. Registered March 5th. Capital, £4,000 in £1 shares. Electrical, mechanical, and general engineers, manufacturers of motors, cycles and accessories, &c. The subscribers (each with one share) are: C. H. Morse, 64, Heathfield Road, Cardiff, engineer; R. J. Cuming, 108, Brunswick Street, Canton, Cardiff, engineer. Table "A" mainly applies. Registered office: 7, Exchange Chambers, Bute Docks, Cardiff.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Woking Electric Supply Co., Ltd.—Issue between February 5th and June 22nd, 1918, of £4,300 debs., part of a series already registered.

Eagle Electric Light & Power Co., Ltd. (163,514).—Private company. Registered March 6th. Capital £2,000 in £10 shares. As title. First directors: Major W. Taylor F. Lane, R. J. Cadel, A. E. Franklin, and E. Heavens. All of Faringdon, Berks. Solicitor: A. G. Haines, Faringdon, Berks.

Munster Electric Lighting Co., Ltd.—J. Hunter, of Liverpool, ceased to act as receiver on January 31st, 1919.

Bourne End Electrical Installation Co., Ltd.—A notice of the appointment of R. M. Blaikie, of High Wycombe, as receiver and manager, on February 20th, 1919, by order of Court.

CITY NOTES.

South London Electric Supply Corporation, Ltd. The gross receipts for 1918 were £74,827 and the expenditure was £43,881. £3,125 was brought forward, and the amount available is £34,371. There has been placed to depreciation £7,000, 6 per cent. is paid on the 6 per cent. cumulative preference shares, also debenture and other interest. £2,500 is to be put to general reserve, and, after paying a dividend of 5 per cent. for the year on the ordinary shares, £3,717 remains to carry forward. New connections added to the system are 30,032 (35-watt) lamps, or 1,050 kw., making 447,772 lamps, or 15,650 kw. Units generated 9,303,688; units sold, 7,112,252, against 7,549,945 in 1917; used on works, 389,363; expended in distribution, 1,802,073.

In June last the board addressed a letter to the shareholders embodying an offer from the County of London Electric Supply Co., Ltd., to purchase the whole or any portion of the ordinary shares of the company on the terms set out in the letter referred to. The shareholders generally availed themselves of this offer, with the result that the County of London Electric Supply Co., Ltd., became the holders of a preponderance of the ordinary share capital. The board has been reconstructed, and Capt. Bax, Mr. J. M. Henderson, Mr. F. J. Leslie, and Mr Algernon Turnor have resigned, while Mr. J. B. Braithwaite has been elected chairman, and Mr. H. B. Renwick managing director.

Annual meeting, March 18th.

County of London Electric Supply Co., Ltd. During 1918 capital expended in London districts was £75,950. Balance from revenue, after deducting expenses £179,430, plus £15,023 brought forward. Debenture and loan interest absorb £43.455; to reserve for depreciation, &c., £50,000; to reserve for deferred maintenance £15,000; written off preliminary expenses £5,000. Dividend on the preference shares 6 per cent. for the year; final dividend of 9 per cent., less tax, making 7 per cent. for the year, on the ordinary shares. To be carried forward, £15,516. Two of the original directors, Messrs. F. W. Reynolds and A. H. Sanderson, have died, and Mr. J. Shaw has resigned. Sir W. Guy Granet and Mr. J. Atherton have been appointed directors.

With a view to assisting in the further co-ordination of the electric supply of London, the directors in June last made an offer to the shareholders of the South London Electric Supply Corporation, Ltd., to exchange their ordinary shares on certain terms for ordinary shares of their company. The shareholders of the South London Co. largely availed themselves of this offer, and 10,578 ordinary shares of the company were issued accordingly. The South London Co.'s power house has been connected up with the Wandsworth power house, and considerable economies are resulting from the closer union of the two companies.

At the annual meeting, on March 17th, sanction will be asked to an increase of preference and ordinary capital, with a corresponding increase in borrowing powers. Applications received during year, 4,560 kw., making 73,692 kw. Units sold, 40,326,263, an increase of 2,731,002. Consumers increased from 27,998 to 28,400. The results obtained during the year are again satisfactory. The cost of coal, wages, and materials has still further increased. The S. London Electric Supply Corporation has declared 5 per cent., and the Bournemouth & Poole Co. 5 per cent. The units sold by the Coatbridge & Airdrie Electric Supply Co., Ltd., increased from 10,072,535 to 11,469,820. During the war 482 of the employés of the County and associated companies have been on service. Thirty men have been killed in action and 51 wounded.

City of London Electric Lighting Co., Ltd. The report for 1918 states that the capital expended was £4,931, and £5,524 was written off in respect of buildings, plant, and works dismantled. Total revenue £389,859, less expenditure £248,252, leaving £141,607, plus £17,573 brought forward. Interest on loans and debenture stock £25,346; interest transferred to debenture stock premium redemption account £1,701; leasehold redemption account £330; employés' provident and benevolent funds, &c., £1,616; special contribution to benevolent fund £2,500; stores written down £329; transferred to reserve account £50,000; preference dividend 6 per cent.; ordinary dividend 8 per cent.; carrying forward £20,019 The increase in gross revenue is £38,673 over 1917. Net revenue advanced by £7,627. The average price obtained per unit sold for private supply was 3.27d., against 2.61d. in 1917. Units generated 31,731,491, against 35,375,929 in 1917. Units sold 26,656,655, against 29,697,392 in 1917. Maximum supply demanded 18,900 kw. in 1918, against 20,910 in 1917. Units sold for power 10,900,690; heating 3,893,447, together equal to 57.96 per cent. of the total units sold for private supply. Annual meeting, March 19th.

Bruce Peebles & Co., Ltd. The profit for 1918, including interest on investments and transfer fees, and after deducting administration expenses, the amount required for debenture service and provision for excess profits duty, amounts to £15,657. Of this, £6,000 has been applied to depreciation reserve account, and £976 has been written off preliminary expenses. The preference dividend of 7½ per cent., less tax, requires £3,830, and a further dividend at 2½ per cent. per annum for the year, less tax, making up the full dividend of 10 per cent. in terms of the scheme of arrangement, requires £1,277, leaving £3,574 to be carried forward. Effect has been given in the balance sheet to the scheme of arrangement for the reorganisation of the company's capital approved at meetings of first mortgage debenture holders, unsecured debenture holders and shareholders, held in February last and confirmed by the Court. The balance of profit and loss account at

December 31st, 1917, amounting to £15,827, has been included in a suspense account, to which has also been added the provision made for excess profits duty for the current year. The excess profits duty in respect of the years 1917 and 1918 will be charged against the suspense account when finally ascertained. A new workshop, 200 ft. long, 65 ft. span, has been erected during the year, and provided with the requisite plant to cope with the satisfactory and increasing demand for heavy steel works plant which the company is now manufacturing. Annual meeting, Edinburgh, to-day.

Charing Cross, West End & City Electricity Supply Co., Ltd. The report for 1918 shows the following results:—

West End Undertakings.—Gross earnings £193,858, against £165,136 in 1917. Expenses, excluding depreciation, £132,946, against £103,268 in 1917. Net earnings £60,912, against £61,869. Including £8,258 brought forward and £4,794 interest accrued. £73,992 is available. Interest on debenture stock, £17,829; depreciation, £22,000; preference dividend, £18,000; ordinary dividend, 4 per cent., £16,000; leaving £162 to be carried forward. Connections to West End mains 753,052 (30-watt) lamps; lighting, 460,449, heating 64,566, power 228,037 (9,170 H.P.). Units generated, 1,515,174; bought, 15,276,229; sold, 11,590,966; used on works and lost, 5,200,437.

City Undertaking.—Gross earnings £238,075. against £212,542 in 1917. Expenses £199,250, against £147,153. Net earnings £38,825, against £65,388. Including £18,000 brought forward, £56,825 is available. Interest on debenture stock, loans, and advances, £29,750; preference dividend, £18,000; leaving £9,075 to be carried forward. Connections to city mains, 807,443 (30-watt) lamps; lighting, 327,198; heating, 99,592; power, 380,653 (15,307 H.P.). Units generated, 36,595,375; sold, 29,985,073; used on works and lost, 6,610,302. Annual meeting, March 20th.

Underground Electric Railways Co. of London, Ltd. There was a good deal of criticism of the board at the annual meeting last week on the question of reserves, but the chairman, Lord George Hamilton, took up a very definite attitude. Referring to the policy of the operating companies in making reserves for depreciation and renewals, he said that in the difficult years ahead of them they could not hope to maintain their present position unless their financial reserves were adequate for the rehabilitation of permanent way, and for making good the wear and tear of their electrical plant and the necessary replacements of the rolling-stock. No boards could accept the responsibility of directing their companies if outside interference had the power of curtailing the maintenance of the reserves necessary for the continuous working of their enterprises. On this point they were not prepared to make any concession. Sir Robert Perks and others objected to the large sums paid to reserve, which they thought was already in excess of reasonable requirements, while so much of the capital went without a return. The chairman said that the board were not going to give up their power of putting to reserve what they considered necessary to protect the company's interests, and if the 6 per cent. income bondholders thought they had a good case they could take the matter to the courts.

Oxford Electric Co., Ltd.—Sir Henry Mance stated at the annual meeting that the wages bill was now 100 per cent. higher than it was before the war. Coal had had the most adverse effect upon their returns for the year, and its price was possibly to be raised by another 30 per cent. If that advance should be made the company would have to put up their charges proportionately. They hoped that the Government would withdraw as soon as possible the order for restricting the consumption of electric current, and representations were being made to them for that purpose. The colleges were now resuming their normal life. At present he saw no reason to fear that the company would be prejudicially affected by any electricity supply measure the Government might adopt.

Bournemouth and Poole Electricity Supply Co., Ltd.—The revenue balance, after deducting generating and distribution costs and other charges, is £32,461, plus £2,079 brought forward. Debenture and loan interest, less tax, absorbs £7,791; leasehold and special redemption funds and interest, £2,221; to reserve for depreciation, &c., £8,000. The dividends on the ordinary shares amount to 5 per cent. for the year, and £1,299 is carried forward. Two directors, Messrs. A. H. Sanderson and F. W. Reynolds, have died. Mr. J. A. Hosker is now chairman, and Mr. H. B. Renwick, deputy chairman. Applications received at December, 12,596 KW., an increase of 425 KW. Units sold, 4,513,956.

British Insulated and Helsby Cables, Ltd.—The directors recommend a dividend of 8¾ per cent. (1s. 9d. per share) on the ordinary shares for the past half-year, making 12½ per cent. for the year on the revised capital, place £80,000 to reserves and depreciation, and carry £99,000 forward. Last year, 7½ per cent. and a bonus of 10 per cent., making 25 per cent. for the year, were paid on the old capital; £248,500 was added to reserves, depreciation, &c., and £84,792 carried forward, after providing for estimated excess profits duty. One new fully-paid ordinary share was afterwards allotted for each ordinary share held.—*Financial Times.*

Davis & Timmins, Ltd.—Net profit for 1918, including £32,013 brought forward, after allowing for depreciation, &c., and excess profits tax (1917), £77,659. There is put to general reserve £2,000 and to income tax account £7,919. The dividend on the ordinary shares totals 8 per cent. for the year (free of income tax), also a bonus of 17 per cent. out of the profits (free of income tax). There is carried forward, subject to special taxation, £52,389.

Automatic Telephone Manufacturing Co., Ltd.—Profit for 1918 £41,331, plus £11,550 brought forward. After writing off £8,000 for depreciation, and paying 6 per cent., less tax, on the ordinary shares, £11,281 is to be carried forward.

Gandy Belt Manufacturing Co., Ltd.—Dividend 17½ per cent. for the half-year on ordinary shares, making 25 per cent. for 1918.

Globe Telegraph & Trust Co., Ltd.—Interim dividend on ordinary shares 2s. per share, free of tax.

Direct West India Cable Co., Ltd.—Interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax, for the past half-year.

Halifax and Bermudas Cable Co., Ltd.—Interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax, for the past half-year.

Edison Swan Electric Co., Ltd.—The company in meeting on March 10th confirmed the resolutions altering the articles, bearing upon the new issue of capital.

Ransomes, Sims & Jefferies, Ltd.—Dividend on ordinary shares 8 per cent. per annum, free of tax, leaving £41,437 to be carried forward.

Clones Electric Light & Power Co., Ltd.—Net profit £296. Notwithstanding great reduction in current consumption, revenue increased by £202 over the preceding year. Dividend 5 per cent.

Llanelly and District Electric Lighting & Traction Co., Ltd.—Dividend on the ordinary shares 5 per cent., less tax: to reserve and renewals, £4,000; carrying forward £2,057.

Western Telegraph Co., Ltd.—Second quarterly dividend 3s., free of tax, at the rate of 6 per cent. per annum.

STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE securities are roughly gradeable into one class where labour troubles enter, and another class into which they do not. These categories take the place of the labels "Peace Stocks" and "War Stocks" that prevailed at armistice-time. The present movement of investment is all in favour of colonial and foreign securities, all against the domestic variety. From various parts of the country the same tale comes, from the North of England, the Midlands, the South-Western and Welsh Counties, "Sell industrials," meaning shares in home companies. Iron, coal, steel, armament *et hoc genus omne*; railway stocks, ordinary and fixed-charge; anything, it little matters what. So does the cloud of the strike-fear lower over the Stock Exchange markets.

Electric lighting companies are scarcely affected. This seems the more singular in that the spring dividends do not make a very exciting list. It must be admitted, of course, that they are better than might have been expected, and something of a decline in prices took place in advance. On the whole, however, the market is not at all a bad one. Shareholders, so far as can be judged, take the view that their affairs can hardly get worse than was the case during the war, and that recent reports, fortified by intelligent anticipation, afford encouragement for the future.

The directors of the County of London Electric Supply Co. state in their report, just out, that they feel "the results obtained during the past year are again satisfactory. The cost of coal, wages, and material has still further increased during the year. Total units sold during the twelvemonth were well over forty millions, an increase of 2.731,002 units as compared with 1917. Net profit, before deduction of debenture stock interest, came to £179,400, an advance of £26,000. The dividend for the year is again 7 per cent. Holders of South London Electric ordinary largely availed themselves, the report states, of the offer to exchange, on certain terms, into the County of London Co., and 10,158 County ordinary shares were accordingly issued. Sanction is to be sought at the forthcoming meeting to an increase of the company's preference and ordinary share capital, with corresponding additional powers for borrowing.

The Charing Cross report shows net earnings of £60,912, being less than £1,000 below those of last year. The dividend, as already stated, is 4 per cent. The City of London Co. has £77,400 to dispose of, a decrease of £500, and the dividend remains at 8 per cent. The shares are 5s. lower on the week. Good expansion is shown on the power side of the company's business. Kensington and Knightsbridge has reduced its dividend from 7 per cent. to 6 per cent., although the year's income is only about £400 down as compared with 1917. South London has done well, its disposable balance of £21,000 being £300 better than last year's.

The Para Electric Railways & Lighting Co. shows a drop of nearly £20,000 in net revenue, to £141,000, but exchange came to the rescue, and the dividend on the ordinary shares is maintained at 7 per cent. for the year. The price is 5⅜. and the 6 per cent. preference 4¼.

Marconis are a better market on the re-establishment of wireless communication with Canada and the West Indies. The price has risen to 4¾, and brisker business than for some time past is apparent in the shares. Americans have rallied to 30s., Canadians to 16s., and Marconi Marines to 3¼ bid.

The cable group is steady, the usual demand for Eastern stocks and shares being the only feature. A reaction in Telegraph Constructions lowered the price £2. Some few shares came in on the big rise that had taken place, which induced some holders to sell prior to the re-arrangement of the capital. The British Insulated & Helsby Cables report, first since the doubling of the shares, shows a dividend of 12½ per cent., which is at the same rate as the 25 per cent. declared a year ago on the old amount of capital.

Calgary Power common shares have risen several dollars to 31. Various other American Utilities are advancing in price. The Mexican group has halted, exhibits rather a tendency to ease off, bullishness having subsided for the moment, pending next developments. Brazilian Tractions are better, and Rio de Janeiro Tramways bonds of both classes have improved.

Nobody has a good word or a spare hundred pounds for Home Railway stocks. Districts are lower at 25. A seller of Metropolitan Surplus Lands stock found no better bid than a point below the bottom price officially quoted. Underground Electric shares are duller. Amongst industrials, the weakness of armament and all the iron and steel shares is a feature, for the reasons already discussed above.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1916.	Dividend 1917.	Price March 11, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	9	10	7⅜	—	£6 16 7
Charing Cross Ordinary	6	4	3⅝	—	6 10 4
do. do. do. 4½ Pref.	4½	4½	3⅜	—	6 13 4
Chelsea	8	5	3¾	—	4 1 1
City of London	8	8	12½	— ¼	6 8 0
do. do. 8 per cen. Pref.	8	8	10⅛	—	5 18 6
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 6
Kensington Ordinary	6	7	5	—	5 16 8
London Electric	Nil	Nil	1⅛	— ⅛	Nil
do. do. 6 per cent. Pref.	4	6	3¾xd	—	6 13 4
Metropolitan	3	4	3⅝		7 8 0
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	8	9	7⅛	—	7 0 4
South London	5	6	8	—	6 13 4
South Metropolitan Pref.	7	7	20/6xd	—	6 16 7
Westminster Ordinary	7	9	6¾xd	—	6 13 4
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	—	8 1 10
do. Def.	1½	1½	21⅞	—	7 13 0
Chile Telephone	8	8	7½	—	6 6 8
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	+ ¼	*5 0 0
Eastern Tel. Ord.	8	8	161	+ ½	*4 19 6
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	24	22	32	—	6 17 6
Indo-European	13	13	68	—	6 12 0
Marconi	15	20	4¾	+ ¼	4 4 2
Oriental Telephone Ord.	10	10	2½	—	4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	6d.	1/3	1 11/16	— 1/16	*3 15 0
Western Telegraph	8	8	16⅞	+ ¼	*4 14 10
Home Rails.					
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan		1	28	— ½	4 9 3
do. District	Nil	Nil	25	— ½	Nil
Underground Electric Ordinary	Nil	Nil	3⅜	— ⅛	Nil
do. do. "A"	Nil	Nil	9/6	—6d.	Nil
do. do. Income	6	4	93	—	*5 7 6
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝xd	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	5½	3 1/16	— 3/16	—
do. do. 2nd Pref.	5½	—	3⅛	—	—
do. do. 5 Deb.	5	5	70½	—1	6 19 10
Brazil Tractions	—	—	55	+2	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	6	63½	—	7 17 8
do. do. Preferred	Nil	Nil	44	—	Nil
do. do. Deferred	Nil	Nil	42	—	Nil
do. do. Deb.	4¼	4¼	62	—	6 17 8
Mexico Trams 5 per cent. Bonds	Nil	Nil	64	—	Nil
do. 6 per cent. Bonds	Nil	Nil	53	—	Nil
Mexican Light Common	Nil	Nil	39	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	69	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	8⅞	—	8 17 6
British Aluminium Ord.	10	10	1⅞	—	5 6 8
British Insulated Ord.	20	20	2¼	—	4 9 0
British Westinghouse Pref.	7½	7½	2 7/16	—	5 3 0
Callenders	20	25	10⅛	—	5 19 1
do. 6½ Pref.	5	5	5¼	—	6 3 10
Castner-Kellner	22	20	8 5/16	—	6 1 8
Edison-Swan, "A"	—	—	19/-	—	—
do. do. 5 per cent. Deb.	4	4	74½	—	5 14 8
Electric Construction	7½	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6	10¼	—	6 6 10
do. Ord.	10	10	17½	—	*5 14 3
Henley	25	25	2 5/16	—	6 8 2
do. 4½ Pref.	4½	4½	4xd	—	6 12 8
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	10	—	6 3/16	— ⅛	*8 2 0
Telegraph Con.	20	20	54½	—2	*4 8 1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 12th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£78	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£43	..
a Copper Sulphate	"	£47	£3 dec.
a Potash, Chlorate	per lb.	1/9	..
a " Perchlorate	"	1/9	..
a Shellac	per cwt.	£12 10s.	£1 dec.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	"	£83	..
a " Lump	"	£25	..
a Soda, Chlorate	per lb.	11d.	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	11⅝d.	1d. dec.
c " Tubes (solid drawn)	"	1/2¾ to 1/3	..
c " Wire, basis	"	1/-	1d. dec.
c Copper Tubes (solid drawn)	"	1/4½	½d. dec.
g " Bars (best selected)	per ton	£118	£4 dec.
g " Sheet	"	£118	£4 dec.
g " Rod	"	£118	£4 dec.
d " (Electrolytic) Bars	"	£81	£9 dec.
d " " Sheets	"	£161	..
d " " Wire Rods	"	£91	£9 dec.
d " " H.C. Wire	per lb.	11½d.	1d. dec.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	2/4½	1d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e " " " medium	"	6/- to 10/-	..
e " " " large	"	12/6 to 25-/& up.	..
d Silicium Bronze Wire	per lb.	1/3½	½d. dec.
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	£224	..
n " Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Sphere Photometer.—In the course of the discussion on Mr. A. P. Trotter's paper on "Photometric Apparatus," at the meeting of the Illuminating Engineering Society on December 19th, Mr. J. W. T. Walsh referred to the use of an integrating photometer in the form of a cube at the National Physical Laboratory for the investigation of the candle-power of large carbon arcs. He said that in the case of a source of light of non-uniform distribution, an error of the order of 10 or 15 per cent. might result from the use of a cube instead of a sphere, but with care it was possible to obtain fairly accurate measurements With the aid of a large metal-filament lamp, with a shade of hemispherical shape behind it, which gave a polar curve almost identical with that of the ordinary carbon arc (except at the central point) it had been found possible to determine the total candle-power of the arc with a single measurement in a cubical photometer, and the cube was much more convenient in use than the sphere. Mr. C. C. Paterson said that at the N.P.L. it was believed that the errors of the sphere were quite as large as those likely to occur with a cube, and he would expect to get quite as accurate results from the latter. He did not believe the total error would exceed 2 or 3 per cent. Mr. L. Gaster pointed out that in the United States a hemisphere had been employed instead of a sphere; the method was said to prove more accurate than the use of a sphere, and had the advantage of free ventilation. Mr. Walsh further stated that the cube measured 2 m. inside.

Women War Workers.—The extent to which women replaced men in industry and commerce during the war, is disclosed in a White Paper issued on March 5th. After making necessary allowances, it is estimated that over a million and a half came forward to take the place of men. The position in April, 1918, is shown by the following figures :—

	No. employed, July, 1914.	Increase, April, 1918
Electricity, gas and water (municipal) ...	600	4,000
Tramways (municipal)	1,200	18,000
Tramways (company)	200	5,800
Other occupations	3,274,000	1,504,200
Total	3,276,000	1,532,000

COAL MINING NOTES.

Notes from the General Report of H.M. Chief Inspector of Mines.

Production.

From the recently-issued report of H.M. Chief Inspector of Mines for the year 1917 we learn that the total value of all minerals raised in the United Kingdom amounted to £223,963,986, an increase of £9,929,462 as compared with the year 1916. The total output of coal was 248,499,240 tons, and the value £207,786,894, showing a decrease in the output of no less than 7,876,126 tons and an increase in the value of £7,772,268 on the figures for 1916. The average price of coal was 16s. 8·68d. per ton in 1917, as compared with 15s. 7·24d. in 1916. These figures show the very great importance of the coal industry to this country; but it must be remembered that these values are more or less artificial, due to a great extent to the unpatriotic demands of the miners for high wages, when the nation was struggling for life in the midst of a great and terrible war, and not under ordinary competitive commercial conditions.

Increased values mean increased wages, and—this is the lamentable part—increased wages mean a reduced output under such conditions. Ordinarily, under a fair competitive system, this would, to some extent, remedy itself, as the high wages would attract labour; but, with all the best manhood of the kingdom in the British Army, there was no chance of this, and the nation was practically at the mercy of a few revolutionary malcontents.

It has, however, been a well-known law in the mining industry that as wages rise, output reduces, and to show the seriousness of this for the year 1917, not only was the output less by nearly 8,000,000 tons, but it was this much less in spite of the fact that there were 23,277 more persons employed in 1917 than in 1916. Altogether there were 2,814 coal mines at work, employing 811,510 males underground and 198,783 males and 11,047 females above ground. These figures are just now most interesting to the community in view of the threatened strike of the miners for a 30 per cent. increase of wages, and a reduction in the hours of work from eight to six. Much of the lost time is avoidable, and it would be most interesting to know what effect the granting of the "minimum" wage has had on the industry. Probably a fair estimate would not be less than 20 per cent. A 30 per cent. increase in wages and a reduction in hours from eight to six would result in an advance in the price of coal by at least 50 per cent., owing to the great reduction of output. It is useless for the miners' leaders to protest against facts such as these. They know perfectly well—the higher the wages, the more the lost time; the shorter the hours, the less the output; a minimum wage, less exertion. These are incontrovertible facts, which any colliery manager in the country will unhesitatingly confirm. Possibly some little improvement could be made in the use of machinery, but this requires capital; and with an old colliery, who is going to invest more capital in an undertaking which may prove unprofitable at any time, and more especially in times like these? In any case, the miners have never given any encouragement to the owners to introduce machinery, but on many occasions have been particularly hostile. Mr. Smillie has a bad case, and no one knows that fact better than himself; the miner is as well paid as, if not better than, the worker in any other industry, and we question if it is more dangerous than other occupations. The death rate from accidents in mines was 1·50 per 1,000 in 1917, which figure is also the average for the ten years 1908-17. The miners would have the public believe that accidents are caused by wilful neglect or inattention by the owners and management of the mines. On this point the Chief Inspector reports:—"The annual reports of the Inspectors of Mines regularly show that a great number of accidents are due simply and solely to carelessness, inattention, and want of thought. There is no doubt that a large reduction in the number of accidents would result if managers, officials, and workmen in and about mines were determined that avoidable accidents should be prevented, and would co-operate in taking steps necessary to prevent them." Unfortunately, many British workmen take little or no interest in their trade or work, and efficiency is the last thing they think of. Labour without the use of intelligence never produced anything beyond the bare necessities of life, and for the workman or labourer to expect to receive the proceeds of the intelligent worker's thought and exertions, is to rob the latter of his just due, and to put a premium on idleness.

The quantity of coal exported was 34,995,787 tons. Of this, France received over 17½ million tons, Italy over 4 million tons, Malta nearly 1¾ million tons, Egypt over 1½ million tons, Gibraltar nearly 1¼ million tons, Russia over 1 million tons, and Norway over 1 million tons. 3,504,722 tons were exported in the form of coke and manufactured fuel, and 10,227,952 tons were shipped for the use of British and foreign steamers engaged in foreign trade, making the total quantity of coal which left the country 48,728,461 tons, as against 55,001,113 tons in 1916.

The amount of coal remaining for home consumption was 199,770,779 tons, or 4·725 tons per head of the population. 40,981,757 tons were used in the manufacture of coke and briquettes, and 2,816,318 tons of coal, with 10,961,734 tons of coke (equal to 18,269,557 tons of coal) in the blast furnaces for the manufacture of pig-iron, as against 39,384,879 tons, and 19,780,690 tons respectively in the previous year.

The value of other minerals (at the mines or quarries) amounted to £16,177,092, the chief of which were iron ore, limestone, clay, shale, salt, oil shale, iqneous rocks, tin ore, sandstone, and slate. The values of the metals obtained by smelting from ores mined in the British Isles were as follows:—

Antimony (from lead ore)...	2	tons	£170
Copper	187	"	25,141
Iron	4,688,063	"	43,271,614
Lead	11,250	"	337,500
Silver	75,472	oz.	12,854
Tin	3,936	tons	935,407
Zinc	2,735	"	142,699
Total... ...			£44,725,385

Of tungsten ores, 205 tons 1 cwt., valued at £35,381, were obtained from mines and open workings in Cornwall, 32 tons, valued at £3,572, from mines in Cumberland, and 4 tons, valued at £789, from mines in Devon. The average percentage of metal contained in the dressed ore from Cornish mines was 62·75. This is nearly 150 tons less output than in the year 1916. It is to be hoped that this valuable mineral will increase rather than decrease in output.

The Kent coalfield produced 255,583 tons, being an increase of 46,960 over the year 1916, the value of which was £236,412.

Federation of German Technicians.—One of the results of the German revolution has been the formation of a Federation of Technicians, which recently held a Congress at Eisenach, when for the first time on record, technical men of all shades and classe assembled to further the objects of the Association. Among thos present were Herr Strecker, of the Imperial Post Office, and representatives of the Association of German Engineers, the Electrotechnical Society, the Chemical Association, and of the Society of Architects, railway technical officials, and foreman engineers, &c. The objects of the combination are to assist in the reconstruction of German industries, develop technical education, advise the Foreign Office in connection with the Peace conditions, participate in Parliamentary life (technical men are said to have increased 14-fold in the new Parliament), and to become members in connection with the work of local authorities.

WELDING AS A PROCESS IN SHIP CONSTRUCTION.

By COMMANDER S. V. GOODALL, R.N.

(*Abstract of paper read before the* AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, *February 19th*, 1919.)

DURING the war economy of time in the production of all that was needed to terminate hostilities successfully was of paramount importance. Economy in first cost and maintenance was relatively unimportant.

Now that hostilities have ceased, economy in first cost and maintenance becomes once again of primary importance, economy of time and labour being of value only in so far as it results in cheaper production. This is particularly true of shipbuilding. Every shipbuilder should now carefully review the various items of cost in the production of a ship, and while he may devote his energies to a reduction all round, he will, if he be wise, give greatest attention to a reduction in the cost of the most expensive of those items. Riveting is the most expensive item. It has been estimated that the labour cost of riveting is about 40 per cent. of the total labour cost of building the structure of a steel cargo carrier, while the labour cost of shopwork on structural material is about 15 to 20 per cent. During the past few years considerable attention has been given to improvements in shopwork, and it is unlikely that much economy can be effected in this direction. Can anything be done to lower the cost of riveting? The advocates of welding reply "Yes, by a wide substitution of welding for riveting." This is a claim that should not be lightly placed on one side, but carefully and critically examined by all shipbuilders.

Gas welding has been used in shipyards for many years, resulting in economy in the production of staple angles and similar smith's work. It has found a wide field in the construction of light fittings, being more particularly of value for thin work than for heavy plating.

It is very well known that electric welding has been of great value on repair work, particularly during the war. Ships that would otherwise have been laid up for weeks while new castings were obtained, old plates removed and replaced by new, &c., have been rapidly repaired and returned to service.

The Classification Societies have sanctioned the use of electric welding for a considerable amount of work of little importance so far as structural strength is concerned. The Welding Committee of the U.S. Emergency Fleet Corporation has found by actual experience that a labour saving of at least 60 per cent. results from the substitution of arc welding for riveting on these minor parts of a ship, and Mr. J. H. Anderton has estimated that a saving in time of 70 per cent. was effected at Hog Island.

Lloyd's Register of Shipping is prepared to classify an electrically-welded vessel, subject to the notations "Experimental" and "Electrically Welded," and provided the builders conform with certain rules. This decision was reached after an extensive and exhaustive series of trials. An electrically-welded ship is now under construction at Cammell Laird's, England, to be classified by Lloyd's, who have approved the employment of the Quasi-Arc Co.'s system in its construction. This is a small vessel about 150 ft. long, with plating generally $\frac{3}{8}$ in. to $\frac{1}{2}$ in. in thickness.

Electric welding work carried out by the British Admiralty has been described in a paper read by the author before the Engineers' Club of Philadelphia in July, 1918. Since that time valuable experience with this work on service has been obtained. The arc-welded barge has been satisfactory. The cost of material, electric current, and labour for this vessel was £301, as compared with £389 5s. for the cost of riveting, caulking, and drilling on a similar barge constructed at the same yard. The vessel was designed to be rivetless as a demonstration of arc welding; it was found that greater economy would result if certain parts, such as beams to frames, floor plates to angles, &c., were riveted.

As the plating of this barge is thin, and stresses to which it is subjected are not comparable to those which a large seagoing ship is called upon to withstand, greater interest is attached to experience with other British ships in which arc welding has been employed by the Admiralty, particularly to those where the work has been comparatively heavy. Failures of welded joints have been reported, although the number of such failures has not been large considering the amount of work that has been done, the lack of experience, the dearth of skilled operators, and the radical change in method. The Admiralty authorities, however, consider it wise, pending further experience, to defer the adoption of electric welding for those parts of the structure subjected to high complex stresses, unless the work can be so tested as to demonstrate exactly that such stresses can be safely carried.

Lap welding has been more satisfactory than butt welding, and the latter has been, for the present, discarded for all important work where the plating is $\frac{3}{8}$ in. or more in thickness. It is hoped that this situation will not last long, for it is in butt welding that the greatest gain from the use of this process may be expected, and lap joints necessitate a certain amount of overhead welding which is difficult and unreliable.

While the above briefly sums up the present position of electric welding as a process in shipbuilding, it may be fairly asked—if the Classification Societies permit the process on minor parts; if Lloyd's are prepared, subject to certain conditions, to classify an electrically-welded ship; if the British Admiralty has employed the process to a considerable extent; if the American railroads have used welding extensively on locomotives—why has not electric welding been adopted in American shipyards to a greater extent than it has been up to the present? The real reason, in the author's opinion, is that shipbuilders know that, at present, welds are lacking in uniformity, and it is not yet possible to tell when the welded joint is good or bad. Hence they hang back, and the author commends their wisdom.

How can this certainty that every joint will be efficient be ensured? While the electrical engineer and the metallurgist can assist the shipbuilder to solve this problem, there is much that he himself can do.

In the first place, he must realise the importance of employing only thoroughly skilled and experienced workmen, and he should call in the manufacturers of electric welding apparatus to assist him. The latter, for their own protection and the welfare of the industry on which they rely, should see to it that no ship should be allowed to be built with some of the thoroughly rotten work done by absolutely unskilled welders that the author has seen in the U.S.A. It is strongly urged that steps should be taken at once to establish welding as a skilled trade, and only certified men should be allowed to be employed. All the reports that have been seen on good and bad welds lay stress upon the fact that, in general, defects are mechanical, and not an inherent feature of the process. Skilled men working under an experienced foreman would know, for example, that clean surfaces were necessary for good work, they would quickly learn what types of joint were made with ease, in what portions of a ship welding was cheap, or where it was unreliable, and from their ranks should be drawn the draughtsmen who would design in detail the welded vessel of the future. The Electric Welding Committee of the U.S. Emergency Fleet Corporation has spent much time and thought on the attempt to discover a practicable non-destructive method of testing welds. While such a method of testing would be very valuable, it is the author's opinion that when only welders of proved skill are employed under experienced supervision, such tests will be no more necessary than a shear test on every rivet of a riveted ship; but so long as such welders are not available, the shipbuilder will look askance at a process that may be good generally, but may have weak spots of which he is ignorant.

Secondly, after he has trained a reliable staff of welders on work of minor importance, the shipbuilder must devote his attention to the best method of assembly of large parts, so that he may feel reasonably sure that every joint of the finished structure possesses the qualities which his welders can with certainty produce in test pieces. From the very outset it has been realised that this is a difficult problem which can be solved only by patient trial and experience. Present opinion at the British Admiralty is that the only satisfactory method is by the use of closing bolts as for riveted joints. In the case of the Richborough barge a certain amount of buckling resulted on the outboard edge of the garboard strakes after these plates had been welded to the keel plates, but this was removed when the bilge plates were put into position and bolted up. In the heavier work it may be that, buckling of plates being impossible, the internal stresses set up by the welding were the causes of the failures that occurred. It is understood that this method is being adopted at Cammell, Laird's, but, again, the plating of this vessel is not very heavy, and it is definitely known that this feature received most careful consideration from the very beginning. In the author's opinion this difficulty is by no means insuperable.

In the third place, it appears to be the fact that shipbuilding steel in Great Britain is more adapted to welding than shipbuilding steel in America, and the former is also more regular in its qualities. If shipbuilders are satisfied that such is the case, and are also convinced that electric welding has a great future in ship construction, they should take concerted action to ensure that steel producers supply the material best suited to their purpose.

A sound arc-welded joint is necessarily watertight, and once such a joint with known efficiency can be made with certainty, caulking is eliminated and the work of water-testing made easier. So far, the advantages anticipated in this direction have not been fully realised, but that they will be realised is only a matter of time, and it has already been fully demonstrated that welded joints, being stiffer, stand up better under test, and there is no breaking away of the caulk, such as is sometimes experienced with riveted connections under water pressure. Another advantage is a saving in steel due to the absence of rivet heads and the smaller width of laps and butt straps. The author at present is not a convert to the adoption of spot-welding for heavy ship work; there are many difficulties ahead of those shipbuilders who attempt this form of welding, and until these difficulties have been fairly and squarely met he hesitates to affirm that spot-welding will be found a valuable process in ship construction.

In conclusion, the best line of approach appears to be to build up a staff of thoroughly skilled welders, to gain experience by the adoption of welding on minor parts, to proceed cautiously in the extension of the process to more important members, not to expect a great saving in time and cost immediately, but to persevere, not necessarily towards the rivetless ship, but towards a vessel in which the employment of both processes of riveting and welding is so adjusted that more riveting or more welding could only be done at greater cost.

ELECTRICITY SUPPLY PROGRESS IN WAR TIME.

(*Concluded from p. 108.*)

KEIGHLEY.

As all the largest works and mills in this district have received a high-tension supply since 1910, when the three-phase system was first installed, the bulk of the development during the war has been with the existing consumers putting in more plant, and running longer hours. In 1915 a 5,000-KW. set was ordered, and was eventually put into commission in May, 1917. This enabled the rapidly increasing load to be met without serious risk of a prolonged stoppage. The principal developments affecting the electricity department (Mr. H. Webber, electrical engineer and tramways general manager) have been the installation of a national shell factory, and a very big lighting demand created by a war hospital of considerable size. A number of small works have been connected to the mains, and towards the end of 1917 another shell factory took its power supply from the department. The units sold have increased from 4,324,572 in March, 1914, to 8,510,566 in March, 1918, *i.e.*, nearly double the output. The maximum demand has increased from 2,325 KW. in March, 1914, to 3,703 KW. in March, 1918.

With regard to mains work, an extra-high-tension line has been erected to the new Morton Banks war hospital, and about two and a half miles of underground high-tension cable has been laid. A big increase in the hire of small motors and considerable development in textile mills has taken place. A supply to Oakworth is about to be commenced in order to drive a mill requiring about 600 KW.; this will involve the erection of just over two miles of overhead transmission line. The boiler capacity being on the small side with the existing draught, an induced-draught plant was installed and put to work about the beginning of November. This enabled the most inferior grades of fuel to be burned efficiently. A supply to the outlying districts is contemplated in the near future.

BURTON-UPON-TRENT.

On account of the large demand for power purposes in the borough (Mr. Thos. Hall, electrical engineer and tramways manager) it was found necessary to proceed with extensions last year, consequently a 3,000-KW. turbine has been installed, together with two 25,000-lb. Babcock boilers, coal handling plant, storage bunkers, and ash removal plant. A new switchboard has also been erected on the remote control system, electrically operated, and several miles of H.T. main have been laid to supply consumers in different parts of the borough.

SMETHWICK.

The following brief particulars of extensions of electrical plant relate to the activities of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. (Mr. G. T. H. Legge, chief engineer). The amount of plant capacity of the undertaking when war broke out was 12,475 KW., while the amount of plant installed during the war at the Dudley and Smethwick stations, which two stations operate in parallel, is 24,250 KW. An old 400-KW. D.C. set at Dudley was removed, making the total to date 36,325 KW.

With reference to plant installed during the war, at the Dudley power station a 2,000-KW. Brush turbo-alternator and new E.H.T. switchgear by the British Thomson-Houston Co., Ltd., was installed, while at the Smethwick power station the additions to the plant comprised the following: Two 8,000-KW. B.T.H. turbo-alternators, each fitted with Willans twin condensers, and a 6,250-KW. B.T.H.-Dick, Kerr turbo-alternator set fitted with a Brush condenser. Ten new boilers were installed during the war; of the Babcock and Wilcox boilers, two were rated at 17,000 lb. per hour and six at 21,000 lb. per hour, while the remaining two are Clarke Ohapman boilers, rated at 40,000 lb. per hour. Eight new Green's economisers were installed, and to deal with the cooling water, two Premier wooden natural-draught chimney cooling towers were erected, one of which is capable of dealing with 480,000 gallons and the other 334,000 gallons per hour. At Smethwick, coaling plant capable of dealing with 40 tons per hour was provided; this included bunkers of 3,000 tons capacity over the boilers, and new suction ash plant. The new E.H.T. switchboard is by the British Thomson-Houston Co., Ltd.

ELECTRIC WELDING.

The following are brief abstracts of three papers read before the Institution of Civil Engineers, on March 11th:—

"*Electric Welding Developments in Great Britain and the United States of America.*" By J. Caldwell and H. B. Sayers.

The retarded expansion of electric welding in the past is attributed mainly to the absence of clear understanding as to the essentials of the process and the lack of facilities to enable research investigation to be undertaken. Successful application is also dependent on the correct design and preparation of welded structures and the provision of sufficiently skilled operators. The three methods of electric welding are described, and their outstanding features are emphasised. With the resistance method the welding operation is rapid and efficient, besides being easily performed by unskilled labour, provided the machines are adjusted periodically. To enable repetition work to be undertaken at a higher rate of output, quick-releasing clamps and automatic switches are invariably fitted.

Special skill is required in manipulation with the carbon-arc process, by reason of the great heat generated at the arc, and welding by this means has therefore been largely confined to work of substantial size and thickness, although the authors point out that by observing certain necessary precautions, success has been achieved in applying the process to work of a general nature, particularly where speed is important.

Reference is made to the numerous stages of development through which the metal-arc process has passed since its inception, and particulars are submitted relating to the use of electrodes composed of covered and coated metal under various conditions of electric supply.

The second part of the paper deals with the general application of electric welding to various engineering and shipbuilding industries. Instances are cited of the efficiency and economy resulting from the use of electric welding in steam-railway practice, including relative data regarding repairs. The metal-electrode process is utilised almost entirely on this type of work, and with the recent improvements in this country of flux-covered electrodes, some of which are specially designed for welding high-tensile and alloy steels, the scope for electric welding plant in railway shops should be increased. The repair of cast-iron parts by the metal-electrode process is almost common practice in some locomotive repair-shops in America.

In munitions engineering works, resistance and metal-arc welding-processes have been employed to a large extent. Instances are given where the arc welding process is applied in aircraft work, and the authors advocate the adoption of the process for aeroplane construction to a much larger extent in the future.

Electric welding should benefit the automobile industry, especially in the easy assembly of steel bodies and in the repair of special steel parts with composite metal electrodes covered with suitable composition, by which means alloy and high-tensile steel can be successfully repaired and reinforced with metal having characteristics allied to those of the original material. Gear-wheels and gear-cases can be renovated, tanks and barrels manufactured, and caulking eliminated in riveted structures.

Two methods in the manufacture of tools are described, including the resistance welding of high-speed steel parts and the deposition of the cutting edges on mild-steel shanks with metal-arc welding.

In shipbuilding electric-arc welding has been proved practical as a substitute for forging, riveting, and caulking. Following the satisfactory conclusion of a series of tests, certain ship structures have been assembled either entirely or in part by this means, and examples are given where the process may be used to advantage in the construction of internal fittings and superstructures. As regards the possibility of joining ships' hulls by spot welding, information derived from recent experimental work indicates that spot welding of thick steel plates is capable of results equal in strength to riveting, with appreciable economy.

The remainder of the paper is devoted to a description of tests and experiments concerning the application of electric welding.

"*Experiments on the Application of Electric Welding to Large Structures.*" By W. S. Abell.

In this paper a full account is given of the comprehensive series of experiments recently carried out, on behalf of Lloyd's Register of Shipping, to determine the possibility of the application of electric-arc welding to ship-construction.

Information was sought regarding the physical properties of the welding and welded material, and its ability to withstand the alternating stresses to which vessels are subject.

The modulus of elasticity of the welded material was determined under several conditions, one series of observations being taken on test specimens, which were made as large as could be, with a view to approximating as closely as possible to conditions of actual service. It would appear that, in general, the extensions in way of the weld do not show any marked difference from those on the solid plate, the lines showing extensions in way of the weld lying among the others, without disclosing any distinctive features.

There is very little difference between the modulus of elasticity of the welded material and that of the solid plate.

Similar tests were also carried out on small test-pieces composed entirely of deposited metal, from which it appeared that the value of the modulus of elasticity of the material actually forming the weld was 11,700 tons per sq. in.

In the case of butt welds it was found that the tensile strength of the joints was 90 to 95 per cent. of that of the solid plate.

As the most common form of joint used in shipbuilding is the ordinary overlap, a complete series of tests was carried out on welded joints of this form. The tensile strength of the joint varied with the thickness of the plating, and was 65 to 85 per cent. of the strength of the solid plate in cases where a full fillet was fitted on both edges of the lap. The corresponding figures were practically the same in cases where a full fillet was fitted on one edge and a single run of weld on the other edge. In a comparative test the strength of a treble riveted lap joint with plates ½ in. in thickness was found to be between 65 and 70 per cent. of the solid plate.

The ultimate elongation of a welded specimen in this series of tests was found to be only 8 per cent. on a length of 8 in., as against 29 per cent. for the solid plate, while the contractions of area were 7 per cent. and 45 per cent. respectively.

Special attention was paid to the determination of the properties of welded material under alternating stresses of known value. Two types of apparatus were employed in these tests, in one of which the specimens were in the form of bars, while in the other flat plates were used.

The bars were tested in pairs, one welded and one plain, at varying stresses, and from curves showing the results may be inferred that the highest stress at which the welded bars are able to withstand a very large number of repetitions of alternating stress is about 6 tons per sq. in., the corresponding figure in the case of the unwelded bars being about 10 tons per sq. in.

In the second form of apparatus the specimens were arranged in sets of four, namely, plain plate, butt weld, riveted joint, and lap weld.

The curves showing the results of these tests would appear to indicate that the stress at which the specimens with butt weld are able to endure a large number of alternations is about 70 per cent. of the stress borne by the similar plain plate, the corresponding figure for the comparative endurance of lap welds and riveted laps being about 60 per cent.

The results of the bending tests show that the welds do not compare very favourably as regards bending with ordinary mild steel, the angle at which fracture occurred varying from 80 deg. with ¼ in. plates down to 20 deg. with 1 in. plates.

To ascertain the capability of welded material to resist the shear stress induced during crushing, specimens having the weld at an angle of 45 deg. to their axis, together with corresponding unwelded samples, were tested under compression. Both welded and plain specimens yielded by bending before crushing took place, but the welded specimens withstood the comprehensive load as satisfactorily as the others.

"*The Application of Electric Welding in Ship Construction and Repairs.*" By J. R. Smith.

Descriptions and illustrations are given of typical repairs that have been successfully carried out under the author's supervision, and for which considerable economy in money and time is claimed, inasmuch as the necessity for renewals was obviated.

The success of this system has encouraged the idea of substituting it for the present method of riveting, and in any case marked economy of material would result from eliminating rivets to a large extent, if not entirely.

In experiments carried out by the author all the tests applied were for cross-bending and tensile stress, whereas he is of opinion that fatigue tests should also be made and examined.

The author points out that the secret of success in electric-arc welding being largely in the hands of the operator, very careful inspection is essential to good results and to progress in this new method of construction.

NATIONAL ELECTRICITY SUPPLY IN THE MIDLANDS.

Some months ago, when the Government first decided upon the national super-stations, the possibilities of the Midlands, and particularly the Black Country, were fully inquired into with a view to the erection of one of those stations in that great centre of the coal and iron trades. In fact, several representatives of public authorities were actually called into conference. The great argument in favour of the Black Country was the fact that all the coal likely to be required for many years was near at hand, and that nearly all the mines were water-logged, and could only be worked with the assistance of the Mines Drainage Commission. On examination, however, it was found that it would be cheaper to take the station to the river Severn at Stourport, and carry the coal, than to raise the water in the Black Country, and so the former scheme came to be adopted. It is more than probable, however, that a sub-station will be erected at Tipton, and this phase of the matter was discussed last week at a conference of colliery owners and experts held for the purpose of considering how to save the mines of the district, in view of the fact that the operations of the Commission will come to an end in a few years at most. It was pointed out by different speakers that the water would shortly be a valuable asset to the district, in view of the electrical schemes under discussion. It is estimated that in the Tipton district alone fifty-two tons of water are raised to every ton of coal, so that there would apparently be no deficiency of water. Meanwhile local authorities have been conferring as to what steps should be taken with regard to the future supply of electricity in the North-West Midlands, in view of the fact that they successfully opposed the Bill of the Shropshire, Worcestershire, and Staffordshire Electric Power Co. A conference of local municipal authorities has passed the following resolution: "That this Conference agrees in principle to the setting up, as and when necessary, of a Joint Board for Electricity Supply for the area comprising the boroughs of Wolverhampton, Walsall, West Bromwich, Wednesbury, and the places now supplied by the Midland Electric Power Corporation, Ltd., together with the whole of the northern part of Staffordshire, particularly the borough of Stoke-on Trent and the county of Salop, including Shrewsbury, or for such other area as may be shown to be the most economic area for the supply of electricity in the North-West Midlands, such Board to consist of representatives of the present undertakers, and that the engineers be empowered to prepare a draft scheme giving particulars and costs for the best and most economic method of generating, transmitting, and distributing electrical energy to meet the future requirements of such area." The various authorities are being requested to sanction the retention by this Board of consulting engineers.

IMPORT TRADE OF PERU.

The following statement, showing the imports of electrical and allied goods into Peru during the year 1917, is extracted from the recently-issued trade statistics. The figures for 1916 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1916. £	1917. £	Inc. or dec. £	
Electrical apparatus.—				
From United States ...	1,500	5,000	+	3,500
Copper wire and cable.				
From United States ...	13,000	30,000	+	17,000
,, Other countries ...	1,000	62,000*	+	61,000
Total	14,000	92,000	+	78,000
* Credited to Chile.				
Incandescent lamps.—				
From United States ...	7,000	13,000	+	6,000
,, Great Britain ...	500	1,000	+	500
,, Other countries	1,500	1,000	–	500
Total	9,000	15,000	+	6,000
Pumps.—				
From United States ...	12,000	18,000	+	6,000
,, Great Britain ...	2,000	2,000		—
,, Other countries ...	1,000	1,000		—
Total	15,000	21,000	+	6,000
Boilers.—				
From Great Britain ...	10,000	6,000	–	4,000
,, United States ...	11,000	10,000	–	1,000
Total	21,000	16,000	–	5,000
Machinery (other than agricultural).—				
From Switzerland ...	2,000	6,000	+	4,000
,, United States ...	72,000	273,000	+	201,000
,, France	1,000	3,000	+	2,000
,, Great Britain ...	14,000	19,000	+	5,000
,, Other countries ...	2,000	2,000		—
Total	91,000	303,000	+	212,000
Spare parts for machinery.—				
From United States ...	41,000	119,000	+	78,000
,, Great Britain ...	15,000	13,000	-	2,000
,, Other countries ...	—	1,000	+	1,000
Total	56,000	133,000	+	77,000
Railway and tramway cars.—				
From Germany	27,000	47,000	+	20,000
,, United States ...	2,000	2,000		—
Total	29,000	49,000	+	20,000

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Simplex Heating and Cooling Fittings for Ships.

Messrs. Simplex Conduits, Ltd., Garrison Lane, Birmingham, have recently issued a new booklet (No. 684—1/19), entitled "Electric Lighting and Heating for Ships," which is fully illustrated, and shows many of the special designs which the firm has carried out on some of the important Atlantic passenger liners. There is a good range of designs of indication lanterns, a type of fitting in which the firm has always specialised. Also shown are a good number of lighting fittings suitable for ships, from the small cabin to the elaborate saloon. The illustrations are all from photographs of actual fittings supplied for their special purpose.

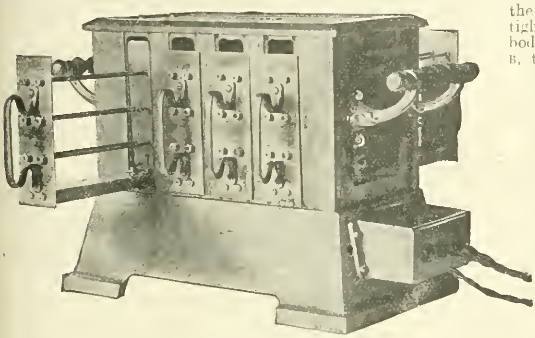
Fig. 1.—Multiple Electric Toaster.

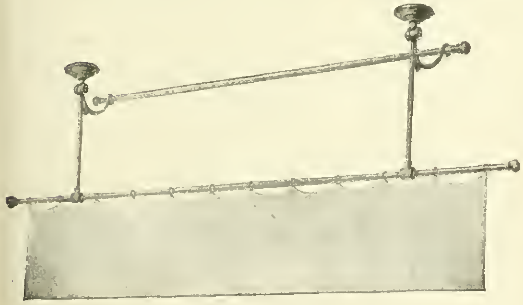
Fig. 2.—Simplex Punkah.

The "Plexsim" hot-bar fire is shown in a type specially designed for cabin use, while there are also designs of convector-type heaters of elaborate design for saloon use. The multiple electric toaster (fig. 1) is a business-like piece of apparatus, and must be exceedingly useful in a ship's galley. The last page is devoted to an illustration and description of the Simplex punkah (fig. 2), which makes use of electricity to replace the "Punkah Wallah." It is claimed that the solenoid and plunger arrangement (fig. 3) is a perfect imitation of the human pull: regular and rhythmic. It has the advantage of taking but little current, and as electricity neither sleeps nor neglects its duty, there should be a great future for the device in tropical countries.

An Electrically-Operated Gas Meter.

The Laclede Gas Light Co. in St. Louis, U.S.A., has recently installed a 750,000 cu. ft. per hour Thomas meter to measure the total gas manufactured in a station. The Thomas meter is different from all other forms of gas measuring devices, in that it records the cubic feet of gas per hour in the standard units of 30 in. of mercury and 60 deg. F., without any corrections for pressure and temperature. Further, it records this measure on a graphic chart which shows the amount and variation of the gas flow, and on an integrating instrument which shows the total gas during any given period. The measurement of the gas is accomplished by warming it 2 deg. with an electric heater as it flows through the meter, and measuring accurately the electric power required to do this. This quantity constitutes a measure of the rate of flow of gas in standard cubic feet regardless of the existing pressure, temperature, or volume of the gas. Current is regulated by two electrical thermometers. The equipment was furnished by the Cutler-Hammer Manufacturing Co., of Milwaukee.—*Journal of Electricity.*

The Swarren Conduit Coupling.

The accompanying illustrations show the construction of a new coupling for conduit, introduced by Messrs. Swarren, Ltd., of 52 & 54, Theobald's Road, W.C. 1, to dispense with the necessity of screwing the conduit and yet ensure watertightness and metallic continuity. In fig. 4 A is the main body of the coupling, showing the abutments against which B, the highly ductile metallic sealing members, are pressed by the nuts or tightening members C. The tightening of those nuts causes the said member to seal the joints between the inner surface of the body of the coupling shown at D, and the outer surface of the conduit shown at E.

This coupling has also been made with quite satisfactory results with the tightening member non-screwed, merely being a sliding fit within the main body of the coupling; in this case the nut is tightened by simply applying pressure to the outer faces of the tightening members by means of a pair of tongs or the like, the pressure being applied (in the case of ironclad fittings) to the face of the nut shown at G, and the internal surface of the ironclad box shown at H, in fig. 4. When joining two conduits, the tongs would be applied so as simultaneously to press upon the two opposite nuts shown at F and I in fig. 5. The makers have designed a simple tool to use in all these non-screwed cases, with which elbows and all other fittings can be conveniently tightened. Negotiations are in progress with leading manufacturers, who are now making a number of fittings, and Messrs. Swarren will be in a position at an early date to quote for this device in every size and form.

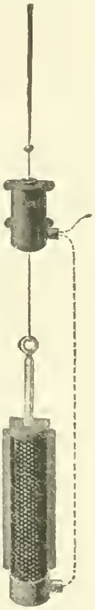
Fig. 3.—Solenoid and Plunger.

It will be seen that when this coupling is used there is no need to adjust the lengths of the conduits accurately, as when, for instance, a number of tubes are brought down to a fuse box; the variations in length are taken up in the couplings, thus saving a good deal of fiddling work, and ensuring a tidy finish. Moreover the wires can be threaded through the tubes in the first instance, as the couplings can be applied without rotating the tubes or taking them down for screwing.

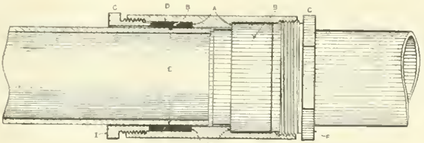

Fig. 4.—Section of Swarren Coupling.

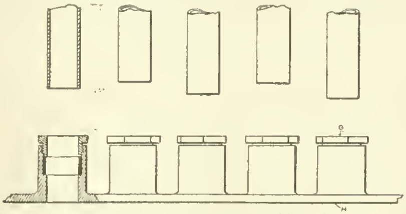

Fig. 5.—Conduits Entering Fuse-Box.

THE SUPPLY OF SINGLE-PHASE POWER FROM THREE-PHASE SYSTEMS.

Mr. H. S. Ellis, M.I.E.E., borough electrical engineer, South Shields, writes to point out that the brief report on page 250 of our last issue of his observations on Professor Miles Walker's paper was misleading. It might appear from our report that he had attempted to obtain single-phase current and three-phase current from the same machine at the same time, and that as a result the machine had had to be rewound. This is entirely wrong; he never attempted to do this, and, furthermore, when the machine referred to was rewound, the work was carried out with the sole object of making this particular machine exactly similar to the two three-phase machines more recently installed. Fortunately, when the original single-phase machine was supplied in 1912, it was supplied with a three-phase stator wound to give single-phase only, and there were a number of empty slots in this stator. Consequently it was only necessary to have these slots filled up and the windings arranged in an exactly similar manner to those of the other two three-phase machines. His three-phase alternators have worked on single-phase, or three-phase loads with entirely satisfactory results during the past four years. When running as a single-phase machine, one winding is left idle, one phase is earthed, and the other phase is connected to the inner of the high-tension, single- phase supply.

In the discussion on Prof. Miles Walker's paper, Mr. Ellis said he had been engaged upon the problem of obtaining a satisfactory supply of single-phase current from three-phase generators for general supply purposes, *i.e.*, lighting, heating, power, &c., in which case it was of the utmost importance to ensure a perfectly steady voltage. At South Shields they had, until about four years ago, two distinct systems, namely: single-phase (50 cycles) with transformer sub-station, where the bus-bar pressure of 2,100 volts was reduced to 220 and 110 volts; and a direct current system at 550 volts, which was used for traction and power purposes. In addition to the reciprocating plant there was installed a turbo-generator (1,500 r.p.m.) consisting of a 1,500-kw. turbine, a 1,000-kw., d.c. generator, and a 1,000-kw., single-phase alternator in tandem. In 1914, owing to the increasing demands for current for power purposes, he considered the question of installing a second set such as that just described, but after careful consideration, he decided that the future requirements of the area called for a supply of three-phase current. Consequently a 2,000-kw. turbine (3,000 r.p.m.) coupled to two 1,500-kw. alternators (2,100 volts) in tandem was installed together with rotary converters. The alternators were specially designed to be capable of generating 1,500 kw., three-phase, or 1,200 kw., single- phase. The set was therefore suitable for supplying three entirely separate systems, *i.e.*, three-phase, single-phase, and (through the rotaries) direct current.

The 1,000-kw. alternator (1,500 r.p.m.) had recently been rewound, and made exactly similar to the two alternators just described, and the capacity of the turbine had been increased by 500 kw. by adding new nozzle blocks and a new first diaphragm. All the alternators could be run in parallel either as three-phase or single-phase machines.

There were now three distinct sets of bus-bars in the station, consequently three types of generators had to be kept going. He was aiming at having one system of generation only in the future, namely, three-phase, but as it would take some time to accomplish this, he now proposed to install "Scott-connected" transformers, so that he would be able in future to do away with the single-phase generators, and obtain all the single-phase current required from the three-phase bus-bars. Then by installing more rotary converters he would be able to do away with the direct-current generators, and so, ultimately, to obtain the whole supply from three-phase plant.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

3,649. "Electric control and safety device for headlights." A. B. Ashworth. February 14th.

3,650. "Cooling enclosed electric motors, &c." D. Penman. February 14th.

3,654. "Automatic excitation regulator for electric machines." J. T. Irwin & A. Rushton. February 14th.

3,664. "Sparking plugs." W. W. Simpson. February 14th.

3,665. "Dynamo-electric generators." V. Crabb. February 14th.

3,676. "Electrical storage cells." H. C. Smith and Van Raden & Co. February 14th.

3,680. "Electrical bell." M. Rose. February 14th.

3,683. "High-voltage windings embedded in grooves or slots." Akt. Ges. Brown, Boveri et Cie. February 14th. (Switzerland, May 24th, 1918.)

3,684. "Electric heating elements." R. K. Hearn. February 14th.

3,692. "Electromagnetic step-by-step signalling and synchronous rotation." C. L. Walker. February 14th.

3,693. "Electric furnaces." W. E. Moore. February 14th.

3,701. "Electric locomotives." G. Pestarini. February 14th. (Italy, February 14th, 1918.)

3,702. "Devices for controlling flow of electrons." E. Berry & Marconi's Wireless Telegraph Co. February 14th.

3,711. "Lamp telephone relays." M. Latour. February 14th. (France, February 14th, 1918.)

3,712. "High-frequency generators." E. Girardeau. February 14th. (France, February 14th, 1918.)

3,724. "Apparatus for controlling supply of electric energy." M. Anninger. February 14th.

3,725. "Friction-drive mechanism for electric generators." L. Rosengart. February 14th. (France, December 21st, 1918.)

3,753. "Devices for indicating position of electric switches, gas fittings, &c." J. E. Arnold. February 15th.

3,761. "Attachment to trolley of overhead electric trams, &c., for facilitating replacement of trolley on the wire." T. Forsyth. February 15th.

3,780. "Sparking plugs." D. Anderson. February 15th.

3,788. "Mounting sparking plugs in position on engines." H. E. Brodrick & J. F. Joyce. February 15th.

3,789. "Operating electric switches from a distance." A. H. Francks, and Telephos Domestic & Street Lighting Co. February 15th.

3,794. "Electric reading lamp attachable to cuver of a book." G. H. Marsh. February 15th.

3,808. "Sparking plugs." V. Bonde. February 15th.

3,828. "Dowel for attaching electric-bell covers, box lids, &s." A. E. B. Lloyd & F. E. Wallis. February 17th.

3,835. "Methods of using three-electrode ionic tubes." L. B. Turner. February 17th.

3,841. "Device to protect controller and motors on electrically-propelled vehicles." G. C. Adams. February 17th.

3,860. "Process for manufacture of zinc cylinders for primary batteries." S. O. Cowper-Coles. February 17th.

3,883. "Electric and gas ovens, stoves, &c." H. H. Berry. February 17th.

3,887. "Electric switches." M. F. Callecaris. February 17th.

3,888. "Automatic indicator of failing current." Synchronome Co. February 17th.

3,931. "Sparking plugs." W. G. Ikin. February 17th.

3,942. "Sparking plugs." H. Taylor. February 18th.

3,956. "Magnetic and galvanic buttons." A. H. Simpson. February 18th.

3,966. "Sound reproducers for gramophones and telephones." R. A. Dibdin, G. H. Glover & Resonance, Ltd. February 18th.

3,977. "Electrical cut-outs or circuit-breakers." W. H. Illingworth. February 18th.

3,990. "Automatic cut-in and cut-out switches." Fuller Accumulator Co. and A. P. Welch. February 18th.

3,993. "Automatic telephones." A. E. Jones. February 18th.

4,029. "Thermo-electric apparatus." W. H. Wilson. February 18th.

4,057. "Couplings for armoured or protective cables and electric conductors." V. C. H. Gibson. February 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

34. Sparking plugs. W. G. Kent & F. Martin. January 2nd, 1918. (122,865.)

1,865. Device for stopping a motor or giving a warning when an obstruction occurs between its armature and magnets. P. Rutherford & J. Robb. February 1st, 1918. (122,876.)

1,903. Electromagnetic clutches without frictional contact. D. C. Henry. February 1st, 1918. (122,880.)

1,988. Electrical switchgear. A. Reyrolle & Co., R. M. Longman and H. W. Clothier. February 4th, 1918. (122,885.)

2,085. Adjustable electric reactance coils for split-conductor systems. J. L. Thompson. February 5th, 1918. (122,893.)

2,349. Electric lamps of the kind which are carried by a handle which projects therefrom. Elandem Co. & A. H. Williams. February 9th, 1918. (122,914.)

2,664. Electric motor-control systems. British Thomson-Houston Co. and J. J. Ash. February 14th, 1918. (122,926.)

3,014. Mine and like electric bells. J. B. Eder & British Agencies, Ltd. February 20th, 1918. (122,931.)

3,330. Automatic apparatus for shaking snow from electric conductors. V. Cicari. April 30th, 1917. (115,417.)

6,918. Electric starters for internal-combustion engines. A. H. Midgley, and C. A. Vandervell & Co. April 24th, 1918. (122,973.)

10,309. Rontgen-ray and like apparatus. G. G. Campion. June 22nd, 1918. (122,780.)

10,099. Telegraph systems. Automatic Telephone Manufacturing Co., H. H. Harrison & S. R. Smith. June 19th, 1918 (121,914.)

10,466. Electric contact breakers or interrupters. G. F. Cooke. June 25th, 1918. (122,580.)

11,043. Electrical fuses. R. A. R. Bolton. July 5th, 1918. (122,360.)

12,306. Non-accumulatic electric signalling indicator for colliery shafts and the like. H. Brown & J. H. Evans. July 29th, 1918. (122,136.)

12,367. Electric time transmitters or master clocks. J. J. Liverton. July 30th, 1918. (122,592.)

12,839. Distributors for use in ignition magnetos. A. Anzani. August 7th, 1917. (120,714.)

12,949. Automatic telephone systems. Automatic Telephone Manufacturing Co. September 19th, 1917. (119,449.)

12,959. Dynamo-electric machines. J. H. St. H. Mawdsley. August 9th, 1918. (122,141.)

13,988. Lampholders of the Edison type. A. Piazzi. August 28th, 1917. (118,637.)

14,154. Controlling switches of combined ammeters and voltmeters used in connection with dynamo-lighting and battery-charging systems of motor vehicles and the like. W. Holt & B. Brooks. August 31st, 1918. (122,797.)

14,148. Electric lampholders. August 31st, 1918. W. L. Bodman. (122,000.)

14,372. Means for improving the conductivity at the joints of electrodes for electric furnaces. C. W. Kayser & D. W. MacDonald. September 4th, 1918. (123,017.)

15,124. Energy meters for alternating electric current. Fabrique des Longines Francillon & Co. September 17th, 1917. (119,657.)

15,250. Welding joints. British Thomson-Houston Co. (General Electric Co., U.S.A.) September 19th, 1918. (122,604.)

15,587. Electrodes or plates for electric accumulators of the alkaline type. W. N. Stewart September 25th, 1918. (122,380.)

15,869. Electric welding apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) September 30th, 1918. (122,606.)

16,269. Electric regulating resistances. E. A. E. Tornblom. October 8th, 1917. (119,872.)

17,222. Electric coupling. E. Pagnon. October 22nd, 1918. (123,032.)

17,641. Motor power plant. British Westinghouse Electric & Manufacturing Co. November 21st, 1917. (120,889.)

20,794. Electrical phase-converting systems. British Westinghouse Electric & Manufacturing Co. December 13th, 1917. (121,487.)

20,069. Sparking plugs. A. E. Lamkin. December 4th, 1918. (122,617.)

21,592. Sparking plug for explosion engines. E. Ruillet & R. Hureau. December 26th, 1917. (121,953.)

THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4. LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: AGEEKAY, CENT., LONDON." Code. A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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NEW YORK: D. Van Nostrand, 25, Park Place
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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

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PLAIN SPEAKING.

WE commend to the attention of all our readers the straightforward speech of Mr. W. M. Crowe, chairman and managing director of the British L. M. Ericsson Manufacturing Co., Ltd., reported in our City pages to-day. We still hold the opinion that little is lost by discussing the subject of industrial relations in a conciliatory spirit, but sometimes it does no harm if we substitute for smooth and persuasive utterance a plain statement of facts. We may confuse the seriousness of a situation by a mass of words—may lose the substance in grasping at the shadow—may legislate for better conditions in the present and create a legacy of want for days to come. Let us, then, get down to the facts. Mr. Crowe, as representing an industrial company which desires to take advantage of the unparalleled world-trade opportunities of the moment, is faced with a series of menacing conditions which are blocking the path of British enterprise, while competitors in other lands are not so seriously handicapped. He has summarised this series of difficulties in a way that should carry conviction. As we have again and again pointed out during the war, the stricken nations of Europe and the empty outer countries of the world must have supplies of manufactured electrical products. British prestige stands high to-day, and sentiment is in our favour, but our capacity to supply their needs and the price at which we can sell our product are matters of supreme concern to the client whose necessities are clamant. He *must* have the goods from somebody. He prefers to come to England for them if he can get them, but have them he must, and that without delay, and if we cannot meet his requirements, sentiment will be subordinated to necessity, and he will get them where he can. We have a greatly-increased works and plant capacity; have, or shall have, as more and more men come home to find work, plenty of labour; many of our manufacturers are ready to show a greater spirit of venture and enterprise than ever in the past; the raw-material situation may be getting easier shortly; but there are clouds on the horizon far bigger than a man's hand, presaging a veritable deluge of difficulty which is inducing capital to take cover rather than expend itself in the open in efforts which will secure business and provide work. Experienced men and economic students know all too well that unemployment has always been an inevitable consequence of want of confidence. In normal times a financial upheaval in one country has spread its nervous influence from land to land; there has been unemployment and a period of distress; then, after a few years, a renewal of confidence has been manifested in a fitful and venturesome sort of way in several places at once; there has been a gradual recovery, and at last we have been well on the way to revival, rising on a trade curve to a boom. It is perfectly true that the present are not normal times, and that there are new factors in the situation—such as a crying need for manufactures which demands to be satisfied. The great question for us to-day is whether the industrial interests of Britain are going to be sacrificed because our present difficulties and discussions prevent us seizing the opportunity to meet those demands. How can a manufacturer quote firm and competitive prices or undertake to give quick deliveries when there is so much doubt overhanging all his operations? What will the taxation on industry be? What will labour cost—When will it become stable? What will be the effect of shorter hours—will there or will there not be, in a given case, increased efficiency and more economical production? What will be the profit permissible on industrial capital? Will some compulsorily imposed system of profit-sharing have to be taken into account when giving estimates? Or will additional industrial capital be found wanting because a bigger yield can be secured in less disturbed directions? What will be the international policy regarding imports and exports of manufactured goods? What will the safeguarding of key industries amount to? If the British workman takes a larger measure of leisure and pleasure and a larger wage without giving increased work, and the decrease in effort cannot be fully made up for by new methods and new machinery, where shall we be placed competitively? We are aware that any fool can ask questions, but manufacturers and others who are in a dilemma because of a series of questions which are a very babel about their ears just now, are no fools. They see that unless the present period of uncertainty can be cut short, Labour and the nation may awaken when it is too late to the fact that we have been playing into the hands of other peoples who, perfectly legitimately, are out to do business while we are engaged in discussing how burdensome a halter we can possibly carry round the neck of British industry.

To suggest that Mr. Crowe's speech should be widely circulated in labour circles might be to invite attacks on capital and its propaganda. Yet the speech is a plain statement of fact, and however ingeniously Labour may put it through the sieve, it cannot dispose of the truth that it contains—namely, that uncertainty haunts the path of the manufacturer, and prevents him engaging in a progressive Peace-time industrial activity.

We are in for a neck-and-neck race with foreign competitors. We may foolishly impose a handicap upon ourselves which will put us out of the running for the prize of world trade supremacy. The sooner we see the danger that lies that way, and settle our differences as permanently as may be, the better it will be for the entire nation. Better conditions for all can only be secured, under the present system, by ensuring the stability of industry by enabling it to be profitably conducted. It is possible for the State to stifle industry by imposing throttling taxation. It is possible for Labour to render it unattractive by repeating unreasonable demands. It is possible for Capital to perpetuate discord and cripple itself by withholding from Labour a fair share of the profits that it earns. The State needs, and must have, revenues—it stands to gain them by allowing industry the maximum of freedom for display of enterprise and the policy of development. Labour demands the right to live in better circumstances—sure of work and sure of good wages; it cannot obtain its desires permanently if it continues its prevailing policy of demanding more than competitive industry can afford. Capital may, and should, do what it can by profit division along some such lines as are indicated by Mr. Crowe and by the chairmen of some other electrical and industrial undertakings, to give those who earn its dividends a commensurate interest in those profits.

A Board of Imperial Communications.

It was announced in our columns last week that the Government had decided to appoint a Board, under the presidency of Lord Milner, to control Imperial communications. Readers of the ELECTRICAL REVIEW will remember that in our recent notice of Mr. Charles Bright's book, "Telegraphy, Aeronautics and War," we pointed out that the book was practically an argument for a Board of Imperial Communications to be charged with the systematic development of cable and wireless telegraphy throughout the Empire. The proposed composition of the Board and its precise functions have not yet been announced. Undoubtedly there is great scope for a Board composed of practical men, and endowed with adequate powers in the most important field of Imperial electrical communications. The war and the restrictions arising from it have played havoc with rapid communication, and there is nearly five years of arrested development to make up. It is to be hoped that the Government will appoint practical men from the electrical profession to this Board. Besides Mr. Bright, whose name is known to the public through his writings, there are other telegraph engineers, doubtless unknown to the politicians, whose life work has been Imperial telegraphy.

The Reliability of Large Turbines.

That the total cost of power generation will be materially affected by the choice of sizes of generating sets, is generally admitted. A question that will probably remain unanswered to the satisfaction of all for some time to come, is: has the remarkable growth of steam turbo-generating plant in recent years been natural, or has it suffered temporarily from over-stimulation, which is destined to result in a relapse?

In any electricity supply system, the size of the individual generating set should bear some clear relation to the total load, and to its fluctuations throughout the day. On the one hand, it does not pay to put too many eggs in one basket; on the other, there is a material disadvantage in an unnecessary multiplicity of sets. The fundamental consideration is that there should be enough reserve plant in a system to ensure that no contingency reasonably to be expected can seriously interfere with the output, so far as the generating stations are concerned.

Some interesting information relative to the reliability of large turbines was given in a recent article in the *Electrical World*. In so far as conditions affected by the design of plants are concerned, it is appreciated that in sizes up to at least 30,000 KW. rating, higher efficiency at the same cost per kilowatt is obtainable purely by reason of the larger size, and still higher efficiency for a slight increase in cost per kilowatt, and it has been demonstrated that as high a degree of reliability is obtainable in the larger units as in the smaller ones.

It is given as the opinion of the engineer of the turbine department of an American manufacturing company that large units are commercially practicable up to limits not yet reached. He maintains that increase of size need not impair reliability, while it may improve efficiency. To demonstrate that any difficulties experienced can be corrected after proper analysis of the trouble, he refers to installations of large sets furnished by his company.

Up to the present time that company has built 14 large units, ranging in capacity from 30,000 KW. to 70,000 KW. Of these, 11 have been shipped, 10 are in service, and 7 have been in service for one to five years. Of the 30,000-KW. sets in service, all of which are of the pure reaction type, one is a tandem-compound machine, direct-coupled to a single generator; two are of the single-cylinder and three of the double-cylinder type. Two cross-compound sets are rated at 40,000 KW. and 45,000 KW. respectively, whilst the largest unit, of 70,000-KW. capacity, is a three-cylinder cross-compound machine.

Whilst the records of these units do not all show 100 per cent. perfection, they do show that in not one instance has there been any evidence of inherent or basic defects in design or difficulties in construction or operation. Some troubles have been experienced, but these have all been of minor character, due to avoidable defects in details such as are experienced with new designs of any size or sort. It is significant that with one exception (the high-pressure rotor of the 40,000-KW. set was returned to the shops for checking for truth and reblading) no important part of any of these sets has ever been returned to the works for any reason. Whilst most of them have not been subjected to any accurate steam-consumption tests, definite reductions in station coal-consumption rates were effected by their installation.

This performance should speak for itself, and, in conjunction with the report of a Sub-Committee of the "Union of Electrical Syndicates," which has, according to the *Revue Générale de l'Electricité*, reported on the means for restricting accidents to turbo-generators, should throw light on this most important problem, and afford valuable guidance in the developments which are about to take place in this country.

The Divisional Engineers.

The official statement, reproduced on another page, recording the formation, misapplication, and dissolution of the Divisional Engineers of the Royal Naval Division is a melancholy story—a record of splendid abilities and patriotic ardour wasted and frittered away, at a time when the nation's need for such qualities was imperative and insatiable. It is, unfortunately, only one of many examples of official inability to appreciate the value of the technical knowledge and experience of professional engineers, which were freely offered to the nation, accepted, and treated as of no account. Just as a blockhead might use a razor to pull up tacks, so ignorance condemned these men, whose speciality was brains, to manual labour which would have been better done by navvies. Even when, owing to improper use and the lack of adequate organisation, the remnants of the unit had to be absorbed in the Royal Engineers, their seniority was washed out, and they were regarded as recruits—after two years' arduous service!—and they were still employed on unskilled work. That was not because there was a surplus of technical men—quite the contrary; it is notorious that many commissions were granted to men who had no claim to the possession of engineering qualifications, and who, consequently, were dependent on their subordinates for guidance and instruction in the performance of their duties. The whole affair reveals a degree of ignorance regarding the meaning of the term "engineer" which is simply appalling, and the imperative necessity for engineers to assert themselves and to secure due recognition, not only in the public eye, but also before the law, is obvious. We hesitate to accept the theory which has often been pressed upon us, that those who were entrusted with the duty of appraising men in terms of their ability, took care that expert engineers should not be given commissions if it could be avoided, lest their own shortcomings should be revealed by the superior abilities of their subordinates—but if this theory is discredited, the only alternative is to ascribe the ghastly mistakes that were made to blank ignorance. It is quite inconceivable that any competent and impartial engineer officer, charged with the choice of men to fill responsible engineering posts, could possibly pass over duly accredited engineers in favour of non-technical men—it is incredible. We trust that employers engaged in reorganising or extending their works will give special heed to the claim justly advanced on behalf of these ex-members of the Divisional Engineers—that they ought to have the first chance.

The Transport Bill.

The speech delivered by Sir Eric Geddes in the House of Commons, on Monday last, in recommending the Transport Bill to the members for second reading, confirmed the intention of the Government to proceed at once with the electrification of our main-line railways, but contained no suggestion that the Government was willing to remove the National Electricity Supply Scheme from the control of the new Ministry. That there exists no country where the railway conditions offer a more attractive field for electrification than this, we have maintained before, and we see no reason to modify our views; nowhere else in the world will be found such dense traffic, such a network of railways, such a demand for expediting the handling of trains and increasing the carrying capacity of the system, as here. But what are the arguments in favour of putting the supply of electricity under the control of the Railway Minister? Sir Eric claims that when the railways are electrified, fully 20 per cent. of the electricity of the country can be used for traction; but 50 per cent. will be used for industrial purposes—and if the biggest consumer is entitled to have control of the supply, it will not be the railway interests that will establish the best claim to that privilege. He went on to argue that it was in the interests of the railways to develop the resources and industries of the districts which they served, and that it would obviously be to their interests to develop the industrial use of electricity, just as in the past certain railways have assisted in the development of agriculture and poultry farming in order to augment the traffic on their lines—but Sir Eric did not add that those railways had felt it necessary to that end to keep hens. It will not do. The arguments in favour of his scheme of annexation are as thin as they are fallacious. He points to the prosperity of the North-Eastern counties as proof of the advantages of co-operation between the railway company and the electricity supply authorities—*co-operation*, be it noted, *not combination*. We are amazed that such feeble reasons should be seriously put forward to justify a course which not only offers no genuine advantages, but is bitterly opposed by the public bodies concerned (except those which stand to profit by it—namely, the railway companies), and we can hardly believe that this extraordinary proposal will find acceptance at the hands of Parliament.

I.E.E. Proceedings.

The activities of the Institution show no signs of slackening; this week no fewer than four meetings are taking place in London alone, three of which are open to all the members, and the February issue of the *Journal* contains several pages of "Institution Notes," showing that various important movements are in progress. Amongst the latter are included the organisation of sectional meetings for the reading and discussion of papers on Wireless Telegraphy, and the formation of a Society of Radiographers, while the labours of the electrical standardising committees of the British Engineering Standards Association, which consist mainly of members of the Institution, are as valuable to the industry as they must be exacting to the personnel. The week was marked by the inauguration of the "informal meetings" on Monday last, and we are pleased to record that the new departure was successful from the start; the hall was well filled, and evidently the accommodation will prove inadequate in the future. The paper, by Mr. Pooley, was thoughtful and suggestive, and the discussion was both well maintained and interesting—in some respects exceptionally so, though, in compliance with the principle which is to rule these proceedings, we forbear to enter into details.

We may, however, venture to offer the managing Committee a few suggestions, based not only upon our own observations, but also upon remarks that were volunteered to us by other members who were present, with a view to promoting the efficiency of the meetings and enhancing their popularity. In the first place, the hour of opening is rather late; we suggest that it be altered to 6.30 p.m. Again, the adjournment for refreshments in the middle of the meeting is of doubtful advantage; it interrupts the proceedings and introduces delay, without compensating benefits, and if the present practice of the Institution's ordinary meetings were followed, the refreshments being "on" from 6 to 6.30, we believe the change would be welcomed. Lastly, as the main object of the meetings is discussion, the opening paper should be confined to half-an-hour at the outside, leaving one, or one and-a-half hours, for debate before closing at 8 or 8.30. We believe that if these points were put to the vote by the chairman at the next meeting, the verdict would be strongly in their favour.

COMMISSIONING ALTERNATORS.

By C. W. MARSHALL.

When new alternators are being put into commission, it is the general practice to leave all the preparations in the hands of a representative of the makers. The procedure followed by different firms varies greatly in detail, but the broad outlines may be gathered from the following notes, which deal with the electrical part of the problem :—

Drying-out.—After erection, the first stage of preparation for service is the drying-out of the stator and rotor windings. Most British firms dry-out by circulating low-pressure current through the windings. The condition of the insulation is determined from time to time by measuring the insulation resistance, and as a safeguard against excessive local temperatures, thermometers are placed in contact with the coils. Continental firms do not generally dry-out by the above method, as they contend that the heating is initially almost solely confined to the copper. This tends to cause self-stressing in the windings, and may injure the insulation. To avoid this, they dry-out by running the alternator first unexcited, then with gradually-increasing excitation until the desired insulation resistance is attained.

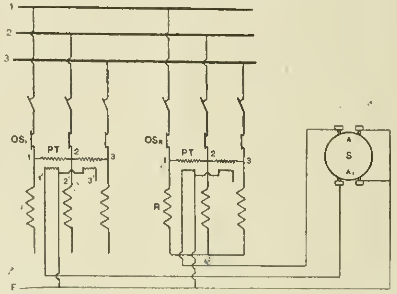
Manufacturers are not yet unanimous as to the value of the insulation resistance at which the drying-out may be said to be complete. The British Engineering Standards Association gives some general rules which may be taken as a guide on this matter, but care should be taken to consult the makers of any machine which is being put into service if any responsibility is to lie with them. The most important point cited by the above Association (Report 72, 1917) is that the insulation resistance in megohms shall be not less than—

Rated pressure (volts) ÷ (1,000 + rated output (K.V.A.).)

For a 6,600-volt, 6,000-K.V.A. machine this formula gives 0·9 megohm, and there is a special note regarding the dangers of trying to obtain high values, as the insulation may be permanently damaged in the process. This point is now generally accepted, but at least one important firm insists on 40 megohms as a minimum. The writer's experience of machines of this make tends to confirm the views of the Standards Association, as samples of insulating material taken from damaged machines which had been subjected to rigorous drying out were found to be extremely brittle and defective mechanically.

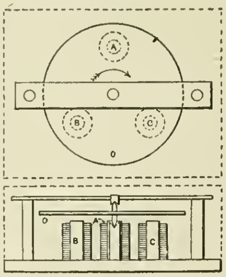
Pressure Tests.—The rules given by the Standards Association for pressure testing are fairly definite, and should be followed as closely as possible. The R.M.S. value of the test pressure (applied to the stator windings) should be twice the rated pressure + 1,000 volts. This pressure should be applied gradually, and then maintained for one minute. Any frequency between 25 and 100 cycles/sec. may be employed. The insulation between phases and to frame (earth) may be completely tested by two tests, phases 1 and 2 to 3 and earth, then phases 2 and 3 to 1 and earth. Subsidiary pressure tests are carried out on the rotor and the exciter. In these cases the test pressure should be ten times the rated excitation pressure, with minimum and maximum values of 1,500 and 3,500 volts. Two points of practical importance not mentioned in Report 72 are the K.V.A. capacity of the testing transformer, and the use of spark-gaps to prevent the application of excessive pressure to the machine undergoing test. Regarding the former point, it may be mentioned that the Admiralty specifications give 5 K.V.A. as the minimum size of pressure-testing transformer to be used on their apparatus. The reason for using a large testing transformer is that many machines take a considerable charging current, which may give rise to peaky potential wave form. Hence the R.M.S. value of the test pressure recorded by an ordinary voltmeter may give a very inadequate idea of the maximum stress to which the insulation is subjected. The capacity of the stator winding of a 6,000-K.V.A., 6,600-volt, three-phase, 1,500-R.P.M. alternator stator winding is about ·5 microfarad. The charging current for such machines at the standard test pressure (14,200 volts) would be about 2 amperes at 50 cycles/sec. The K.V.A. load on the test transformer, if all three phases were tested simultaneously to earth, would be 30 K.V.A.

British manufacturers disagree as to whether spark gaps should be employed or not. Several firms will not allow a gap to be used at all, as they fear the possibility of surges arising in the event of the gap coming into action and setting up an arc in a resonant circuit. On the other hand, one large company insists on a needle gap being coupled up in parallel with the circuit under test. The writer inclines to the opinion that a spark gap should only be used if the testing transformer is capable of subjecting the machine under test to a pressure greatly in excess of the required testing voltage.



I, incoming alternator; R, running alternator; PT, potential transformer; S, synchroscope; OS, oil switch.

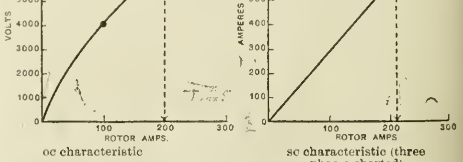
FIG. 1.—CONNECTIONS FOR SYNCHRONISING TEST.



A, B, C, bobbins with iron cores, with windings star connected; D, disk (copper or iron).

FIG. 2.—PHASE ROTATION METER.

Verification of Paralleling Instruments.—As it is necessary to open up the alternator neutral point connections for pressure testing, it is convenient to verify the synchronising gear immediately after this test. The method of doing this is to switch the new machine on to the live bars with its neutral point open, and so excite both coils of the synchroscope from one source. Under these conditions the synchroscope pointer should come to its normal paralleling position. Fig. 1 shows the principal connections in this test.



OC characteristic

SC characteristic (three phases shorted).

Resistance of stator windings = 0·022 ohm.

FIG. 3.—VERIFICATION OF CHARACTERISTICS.

The only error likely to occur in these connections is a cross on the leads from the potential transformer secondary of the incoming machine. This would be indicated at once by the synchroscope reading 180 electrical degrees out of phase (A′). Should the pointer indicate 120° from A, the potential supply to the synchroscope has been taken from the wrong phase, but this mistake is not likely to occur with anything approaching intelligent supervision. The ratios and polarities of all potential transformers for the new machine should be verified at this stage. No mention is made of paralleling devices, such as voltmeters or lamps, as these are assumed to be obsolete; the application of the method outlined above to any of these is, however, quite obvious.

Phase Sequence.—The only other point which requires verification before the machine is put in parallel with existing plant, is its phase sequence. This can be done, in some instances, by running an existing motor by means of the new machine, and noting whether its direction of rotation is normal or reversed. It may, however, happen that this method cannot be adopted, and a phase-rotation meter must be employed in conjunction with the alternator potential transformers. The procedure in this case is to connect the phase-rotation meter to 1′, 2′, 3′ (fig. 1), and note the direction of rotation of its disk (*a*) when the potential transformers of Machine I are supplied from the bus-bars, as in fig. 1, and (*b*) when supplied by Machine I itself. In this case, OS_1 is, of course, open, and the neutral point of the machine is connected up. If the direction of rotation is the same in both cases, the alternator may be paralleled in safety. It may be noted that a phase-rotation meter is only a small three-phase induction motor working with about 0·1 ampere. One form of this instrument is shown in fig. 2.

In the event of the direction of the rotation of the new machine being reversed, it is necessary to reverse any two of its outgoing leads. Such an error should not arise, as it is easy to predetermine the phase sequence of an alternator from a winding diagram or the machine itself.

The alternator is now ready for going on load, but it is well worth while to make the following auxiliary tests before starting it off on its regular work:—

(*a*) Verify the open- and short-circuit characteristics.

(*b*) Test the operating current of the protective gear under artificial fault conditions, and the degree of balance obtained under normal working conditions.

The foregoing tests are summarised in the following table, and are illustrated by an example taken from practice:—

No. 6 Alternator, "A" Station.

(6,600 volts, 1,500 r.p.m., 25 ~, 6,000 k.v.a.)

Programme and results of tests, &c., before going on load:—

(*a*) *Drying Out.*—Method, direct current passed through stator phases connected in series. Current maintained at 250 amperes for 20 hours.

Initial insulation resistance < 50,000 ohms, stator.
< ,, ,, rotor.
Final ,, ,, 10 megohms, stator.
1 ,, rotor.

(*b*) *Pressure Test.*

Circuit.	Test pressure.	Capacity current.	Time of application.	Remarks.
Stator phases, 1, 2 and 3 to frame (*e*)	14,000 v.	0·36 a.	1 min.	Very heavy "static" discharge from windings during test.
1 and 2 to 3 and earth	,,	0·24 a.	,,	—
2 and 3 to 1 and earth	,,	0·24 a.	,,	—
Rotor winding to frame	500 v., D.C.	—	,,	No facilities for making more rigorous test.

(*c*) *Synchroscope Connections.*—The alternator was switched on to the bus-bars with its neutral point open. The synchroscope read 180° from correct position. This was corrected by reversing the leads from the synchronising transformer.

(*d*) *Phase Rotation.*—The same direction of rotation was obtained on an induction motor when run by existing plant and then by the new alternator.

(*e*) *Subsidiary Tests.* — (i) Open- and short-circuit characteristics were verified, and are reproduced in fig. 3.

(ii) Verification of Protective Gear. (Merz - Price circulating-current system, with high-impedance relays.)

(*a*) Fault conditions (short between phases).

Relay operated when fault current reached 60 amperes, *i.e.*, approximately 10 per cent. of full load.

(*b*) Balance.

With normal full-load current in the alternator (600 A.) the current in the relay circuits was less than 1 milliampere. When the relays were short-circuited to reduce the resistance in the circuit, the current rose to 3 milliamperes.

The machine was then paralleled on to the bus-bars and gradually loaded, until at the end of two hours it had reached its normal full-load capacity.

ELECTRICAL DEVELOPMENT IN CATALONIA.

[FROM OUR SPECIAL CORRESPONDENT IN SPAIN.]

Catalonia is the Lancashire of Spain, and its capital—Barcelona—has the characteristics of Liverpool, Manchester, and Birmingham combined. Industrially, it is the most developed Province in Spain, and is, therefore, the leader in the Regionalist or Home Rule movement, which is now distracting the politics of the country. For the same reason, it is the centre of Trade Unionism and syndicalist activities. There is also a strong Republican party. All these elements, working singly and in combination, have made Catalonia the danger spot of Spain, and it is probable that if the Province had undergone the severe inconveniences and privations suffered in other parts of the country (due chiefly to the lack of coal), the history of the whole of the Peninsula during the past four years would have been very different. At the present time it looks as if the good Catalans have almost lost patience. They have gone on strike as a protest against high prices and against Government by the effete and old-fashioned rest of Spain.

The reason why the prevailing lack of coal has not been so acutely felt in Catalonia is that this Province is very rich in water power, and some very large hydro-electric plants have now been in operation for some years. The following table gives some idea of the existing installations and the possible development:—

Water Power in Catalonia.

Owned by—	H.P. installed.	H.P. in construction.	H.P. in reserve.	Total H.P.
Riegos y Fuerzas del Ebrao	96,500	60,000	185,000	341,500
Energia Electrica de Cataluna	42,000	20,000	145,000	207,000
Cataluna de Gas y Electricidad ...	12,000	24,000	200,000	236,000
Sociedad Productora de Fuerzas Motrices ...	—	24,000	40,000	64,000
Other ownerships ...	—	—	256,460	256,460
Totals	150,500	128,000	826,460	1,104,960

Thus, 13·5 per cent. of the total power available is already installed, and 11·5 per cent. is still under construction, leaving 75 per cent. not yet touched.

The Riegos y Fuerzas del Ebro, together with its sister company, the Barcelona Traction Light and Power Co., has its registered office in Toronto, Canada, and was founded by the late Dr. Pearson. The capital of the two undertakings is $35,000,000. Energy is transmitted at 110,000 volts over a distance of 183 km. from some of the outlying power stations. The Energia Electrica de Cataluna was founded in 1911 by Emilio Riu, financed by French and Swiss capitalists to the extent of 50,000,000 fr. The "Canadiense" and the "Cataluna" have a working agreement in the industrial zone of Barcelona and Mataro, and lend mutual aid when required.

All the great enterprises were busy making extensions when the European War broke out. The "Canadiense," for example, was preparing to devote 75,000 H.P. to chemical purposes, including 25,000 H.P. for the production of nitrates. The war stopped these developments, and, up to the present, the cessation of hostilities has had very little effect in the direction of stimulating the development of industry, either in Catalonia or in the rest of Spain. On the contrary, it appears that there are troublous times ahead for the whole of the Peninsula. When things have settled down again an influx of American capital may be expected—the deep interest taken in the United States in the proposed new trans-Spanish railway and in the proposals to develop the port of Vigo is indicative of this. Also, it is not absolutely absurd to imagine that Catalonia may one day find herself a province of republican and democratic France. In either case, Great Britain is likely to be left out in the cold.

NATIONALISATION v. PRIVATE ENTERPRISE.

By GEO. H. HOOLE.

It is, unfortunately, true that what the daily Press says to-day is accepted by the nation to-morrow; and it is also a fact that the greatest difficulty is experienced in forcing the English people to think for themselves and not only of themselves.

"Nationalisation" is developing into a parrot cry; and unless some definite facts for and against nationalisation are brought to the notice of the people, there is a real danger that there will be nationalisation—in the ordinary acceptance of the word—of many industries within the next few years.

It is essential, first of all, to ascertain what are the causes giving rise to the insistent call for nationalisation. The root causes are:—

1. *The people's desire to be protected against exploitation.*

2. *Their natural demand—the result of years of drudgery—to be, at least in a minor way, their own masters and not workers for dividends.*

3. *The opinion held by the working people—i.e., by the masses—that nationalisation will result in a more equal distribution of wealth, an opinion fostered by the propaganda of a section whose enthusiasm exceeds its discretion.*

4. *The people's need of State protection which would ensure security of employment, better wages, and improved conditions.*

The demands are due to a semi-conscious desire to return to the early days when the earth belonged to the people who conquered it.

At the present time the people are experiencing the intoxication of power—a power gained in consequence of the policy adopted during the war, the policy of the Government rightfully recognising that it is the "common" people who comprise the majority of the nation, and conquest rests with the majority.

Right only conquers because ultimately the majority is on her side; up to the time when America entered the war, might was horribly victorious.

Now, in a democratic country, the conquerors are the majority—*i.e.*, the "masses"—and unless the people's "might" is guided by right motives, and the people are made fully cognisant of what will be the result of their actions, there is the grave danger of "might" being victorious to the detriment of what is "right" to themselves and to the nation as a whole.

The four root causes enumerated are legitimate growths, and must be recognised and taken fully into account.

Each one is genuine, and each root has to be removed out of the national consciousness of the people before national security, in the broadest understanding of the word, is reached. The people are demanding that the removal be carried out by adopting nationalisation, believing that that proposal is the only effective method. By nationalisation they mean the *full* control by the State of industry—*i.e.*, that the State buy out the present owners, and take over the buildings, plant, and staff, and work the concerns for the benefit of the people.

It is suicidal to ignore these root causes, for by so doing the growth will become vigorous, and require more labour to uproot at a later date. The wiser course to follow is to cultivate the growth so that it will take an orderly direction leading to industrial peace.

To take each of the four causes enumerated:—

1. *The People's Desire to be Protected against Exploitation.*—Nationalisation would certainly remove the cause of this grievance—*i.e.*, the profiteer; but it would not bring about the reduction in prices which the masses would ordinarily expect. On examination it will be found that:—

The excess price of the article over actual cost of production would not be in direct proportion to the cost of the "protection" sought by the people, but much in advance of that cost consequent upon the necessity of employing a much larger *unproductive* staff to deal with industry under Government administration. I say "necessity" advisedly, as this "unproductive" staff is a real necessity in any Government Department responsible for its doings to any Party Government.

2. *The Worker's Desire to be his Own Master.*—There never was a greater fallacy than to imagine that employment under the Government gives a man greater freedom.

It must be recognised that foremen and controllers, directors—call them what you will—are necessary in all concerns, and the bigger the concern, the greater number there are above the ordinary workmen. By nationalisation, automatically the whole of an industry becomes equivalent to one firm controlling the industry, with the important difference that were one firm to control the industry, the number of persons in positions of authority would be much less than the number under nationalisation, and that fact is due to—

1. Responsibility to the country, necessitating, as nearly as is practicable, a thief-proof and fool-proof system.

2. The necessary consultation with other Government Departments, to ensure uniformity of general policy.

3. The setting up of separate departments, which in industry under private ownership are controlled, along with other departments, but which under nationalisation would become too large to be dealt with in that manner.

4. The compilation of statistics required for the information of the House of Commons—the representative body of the people, and the actual controllers of the industry.

1 and 4. *More Equal Distribution of Wealth and Better Conditions.*—By nationalisation of industries there would certainly be better wages and better conditions, but those advantages could be obtained more economically, and to a far greater extent, by the proper organisation of private industry than by nationalisation. If in industries there were—

1. A fair and reasonable limitation of profits, the limit for each industry to be fixed by the State, after conference with the masters and men.

2. A working understanding between the heads of industry and the body of the industry.

3. A fuller and more genuine recognition of the fact that each is a unit of the whole, and that unless all work together for the good of the industry, and of the nation, disaster to both must result.

Nationalisation is in direct opposition to the natural desire of the people, and is the outcome of an unnatural outlook upon life.

If the policy of nationalisation, as it is understood to-day, were adopted, it would cut out competition; healthy, legitimate competition between one body of men, *i.e.*, Capitalists and Labour, working under proper conditions and for legitimate remuneration, and another such body of men.

Take away competition, and you take the heart out of life; you shut down enthusiasm and damp ambition.

It is English to desire to beat the other man, to wish to be the winner, and this spirit is evident in the whole of an Englishman's life.

Further, under nationalisation the most remunerative posts would be given to those who had passed difficult examinations, for which only college trained men could hope to enter, and the rise of anyone without college training would then be impossible, a most un-English state of affairs. The system would make more evident the "class" difficulty, a difficulty which at the present time is nearer solution than it has ever been in the history of the world.

In private industry, initiative, discretion, ambition, and pluck—each one an English characteristic—are essentials, but in nationalisation caution and safety must take precedence, the responsibility being to the country!

Any industry to be successful—and a successful nation is a combine of successful industries—must take account of *all* the people employed in that industry. Those with initiative, energy, enthusiasm, must in the natural course of events rise to positions where their special qualities will further the advancement of the industry; again, those with manipulative abilities must occupy their responsible posts in the industry. In other words, *in private enterprise each man, to a great extent, finds the level he is most suited for, whilst under nationalisation the level is made for him.* In private enterprise there is every avenue open to the working man who has energy, enthusiasm, and initiative; whilst under nationalisation, there is practically only one accessible path, and that one is so long, so narrow, so hedged in and so horribly uninteresting that it is almost impossible for such a man ever to reach the end of it, or to pass from it to a broader and pleasanter highway, where he has room to expand and display his abilities.

As a nation we have a high position to maintain—the position of leader to the whole civilised world, the *rôle* of exponent of the "might" of "right." To maintain that position, each Englishman must give of his best; but nationalisation takes away most of the admirable characteristics attributed to Englishmen. Let us live in the open. Let us be free. There is room for all. Let the people have their proper share of the profits and in the management of industry, and their grievances will disappear; refuse them that share, and there is no power which will prevent them breaking down the barriers which prevent them from expansion.

They have seen beyond the broad fields of a fuller life, and, having seen, desire. The power to grant that desire is with those already in the broader fields of life.

THE "DEX" OIL COOLER.

The important part that efficient cooling of the large quantities of oil employed plays in modern power-station installations has compelled much careful consideration to be given to the problem by the engineers responsible for such installations. In this connection, the following particulars of the "Dex" oil cooler (Harrison's patent), which is being manufactured by Messrs. W. H. De Ritter & Co., Ltd., of London, will be of interest.

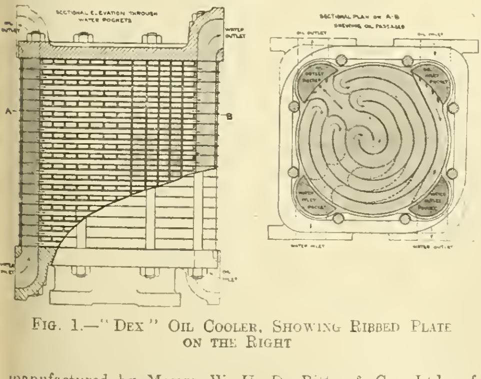


Fig. 1.—"Dex" Oil Cooler, Showing Ribbed Plate on the Right

The construction, as seen from fig. 1, consists of bolting up between strong end covers a series of die-cast plates arranged alternately with rolled metal plates. The cast plates are provided with ribs and flanges on both sides, so that when bolted up a series of passages are formed between the plates through which the oil and water are circulated. The four holes in the corners of the plates form pockets running the whole depth of the plates, and terminating in the oil and water connections on the end covers. The oil and water enter the cooler by their respective connections on the bottom cover, pass to their respective pockets, and, through slots cut in the flanges surrounding the latter, are delivered to the passages between the plates. After circulating through alternate passages in opposite directions the two liquids are delivered in turn to their respective outlet pockets and connections on the top cover.

The passages are rectangular and shallow, thus exposing a large cooling surface to the fluids passing through. A further point is that there are no dead spaces where either fluid can remain stationary, thus preventing the transfer of heat, or where air can collect; any air bubbles which might be formed would be driven forward by the positive flow of the fluids and carried away.

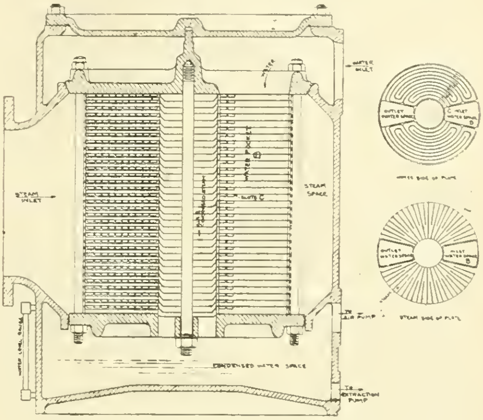


Fig. 2.—"Dex" Condenser.

The only possible leakage of one fluid into the other is at the pockets; the length of joint here exposed is, however, very short. Any other leakage would be visible. The ribbed plates are die cast and then ground on both faces. It is claimed that when this work is carefully carried out in the proper manner perfect joints are the result, and that the effect of any expansion of the plates, due to warming up when in operation, would be to increase the pressure on the joints. Normally the oil and water passages are in parallel, but by introducing baffles in the pockets the parallel may be changed to the series system of working, with two, three, or more flows, thus increasing the cooling area.

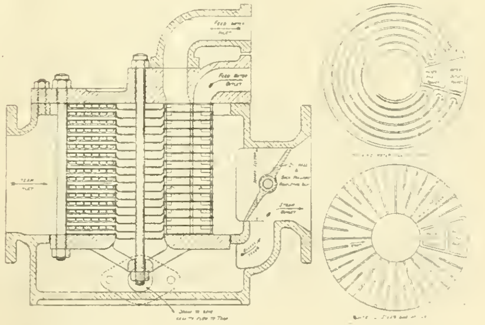


Fig. 3.—"Dex" Exhaust Feed-water Heater.

The passages for the fluids give a high heat transmission efficiency without undue friction, and from tests carried out by the manufacturers it was found that a transmission factor of 270 B.TH.U. per 1 deg. F. per sq. ft. was obtained for a drop of 15 lb. pressure between the inlet and outlet connections. Moreover, it appeared that this transmission factor varied in direct proportion to the velocity of the oil, and that the velocity was nearly proportional to the pressure.

It is claimed that the space occupied by this cooler is only 10 per cent. of that required by a tubular oil cooler of equal capacity, and a further advantage is that additional surface can be obtained by simply increasing the number of plates, requiring only bolts of increased length. For large installations a number of standard units would be built up in multiple, this arrangement having the advantage that the whole battery need not be shut down at any time, it being practicable to cut out one unit at a time for cleaning or repair purposes.

The "Dex" principle of heat transmission is adaptable to various other uses in which it is desired to transmit heat between fluids, either for heating or cooling, such as air coolers, feed-water heaters, condensers, &c. The latter have been tested on a small scale and show a very high efficiency. It will be noted (fig. 2) that in the condenser the plates are assembled between two headers forming an independent unit which is dropped into its seat in the casing. It is therefore a very simple matter to drop in a spare set of clean plates while the set taken out is being attended to at leisure.

The condensers would be built up in multiple in a similar manner to that arranged for the larger oil coolers. The outer casing would, however, embrace all the units, and the steam and water connections would be made on the casing so that no pipe joints would require to be broken when removing a set of plates.

The exhaust feed-water heater (fig. 3) requires no explanation, except to point out that the bolting is much heavier than that of the oil cooler or condenser, to withstand the higher pressure.

L. AND W. MOTORS AND GENERATORS.

The field of application for light-weight, portable and semi-portable, self-contained electric generating sets is very wide. Recently we had brought to our notice, at Willesden, during a visit to the works of Messrs. Arthur Lyon and Wrench, Ltd., some such sets, the electrical parts of which appear to be designed on efficient and somewhat novel lines. The inspection of the works, which are of modern construction, spacious, well lighted and heated throughout, afforded considerable interest; the comforts of the employés are looked after by the provision of a well-equipped canteen, to the quality of the meals served in which we can personally testify.

Besides the generating sets referred to, the firm also manufactures apparatus for the projection of light, such as searchlights, signalling lamps, &c., considerable numbers of which have been supplied to the Forces. During the war the firm has been actively engaged upon the production of munitions of war, and at present it is in course of changing over from war- to peace-time production.

The L. & W. petrol-electric sets are made in a range of sizes with outputs of from 0.5 kw. upwards, the 2.5-kw. set complete weighing about 155 lb. The semi-portable set consists of a two-cylinder vertical type engine, coupled to a 4-kw. dynamo, the set being entirely self-contained and weighing about 6 cwt. complete. For portability, detachable carrying-poles are supplied, and the equipment can also be fitted on trucks, which latter can be propelled by the engine through a special clutch. The set consists of a well-balanced, horizontally-opposed, 2-cylinder, 4-cycle, petrol engine, direct coupled to a 4-pole, special light-weight dynamo fitted with a cooling fan, which draws a stream of air through the dynamo, and then circulates it round and over the cylinders of the engine with such cooling effect that, it is claimed, the engine will run continuously on full-load ratings. The materials are of high quality, while all moving parts are fitted throughout with roller and ball bearings, and with automatic lubrication.

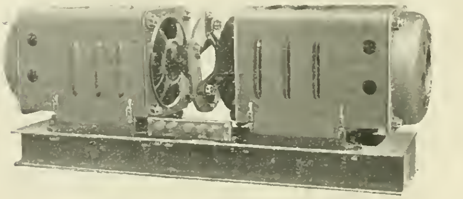


Fig. 1.—Motor-Generator Set.

Referring to our illustrations, fig. 1 shows a motor-generator set comprising a L. & W. motor and dynamo of the protected type, mounted and coupled by a flexible coupling. Fig. 2 illustrates a drip-proof motor, while fig. 3 gives an idea of the motor without the enclosure, and showing method of frame construction, as well as the detachable brushgear as a self-contained unit.

These machines are specially designed to save weight by scientific proportioning of materials, and are exceptionally small in size. The workmanship is of a high standard, all parts being made to limit gauges and viewed between successive manufacturing operations. The frames of these machines are of light and rigid construction, being built up of steel rods attached to cast end brackets. The field magnets are of laminated construction; they are built up of stampings so arranged that there are no mechanical joints whatever in the magnetic circuit, and practically the whole of the stampings provide a path for useful flux. Former-wound coils are employed in the armature with mica insulation to Admiralty requirements.

The brushgear is of patented construction, and arranged to be withdrawn, by unscrewing four simple screws, complete with the rocker arm, as a self contained unit, without disturbing the connections or end brackets. By the suitable design of the field magnets, perfect commutation, it is claimed, is ensured at all loads without interpoles.

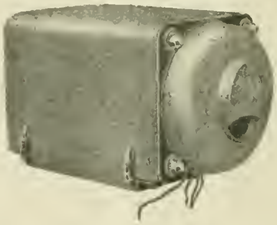


Fig. 2.- Drip-proof Motor.

Ball bearing are standardised on all machines, while a ventilating system provides for the circulation of air through the commutator and armature, and extending through ducts in the poles and yoke of the machine. If necessary compound windings can be arranged for falling, level, or rising characteristics as required. Sliding base plates are standardised for each size of machine, and starters are provided from stock suitable for standard motors.

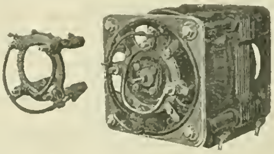


Fig. 3.—Motor Without Enclosure, showing Detachable Brushgear.

We are indebted to Mr. Arthur Lyon for permission to publish the above particulars, and to the departmental managers for affording facilities to obtain the same.

ELECTRICITY SUPPLY IN SOUTH YORKSHIRE

The economic possibilities of a comprehensive scheme which would, by means of one inter-connected system, supply Sheffield together with the whole South Yorkshire Coalfield and the North Lincolnshire Ironfield—an area covering roughly 1,200 square miles—with electricity, are reviewed in a report prepared by Sir John Snell and Mr. C. H. Merz. The report points out that the present position of electricity supply in the area is not satisfactory; the average size of plant in use is too small to allow of really economical generation, while the growth during the last five years has been very large. At present the total maximum demand is about 250,000 kw., and it is estimated that the total load will eventually grow to a figure of not less than 680,000 kw., and probably 750,000 kw., which latter figure is equivalent to a generating-plant capacity of over 1,000,000 h.p.

In Sheffield the load has grown in four years about 380 per cent., and the city electrical engineer estimates that the present load will be nearly trebled five years hence.

The waste energy available in the district, from coke ovens, exhaust steam and blastfurnace gas, is an important item of which full advantage could be taken were a central generating station established, for it is estimated that from this source a continuous output of 60,000 kw. would result during the first year of operation.

The question of a site for the suggested central power plant appears at first to be a very complex problem, but a site on the Trent, either at Keadby Bridge or Gainsborough, is the right policy at which to aim. There are five possible sites on the Don, viz., Neepseud, Blackburn Meadows, Rotherham, Thrybergh, and Sprotborough, of which the first three have already been appropriated by Sheffield and Rotherham.

Estimates show that a great economy of coal and in the cost of energy to the consumer would be attained from the concentration of all main generation in plant situated on the Trent, as against a chain of stations on the Don, though the cost of transmission is necessarily higher in the former case. The condensing water facilities on the Don are strictly limited in the summer months, and stations of the size required can only be worked with the aid of large batteries of cooling towers.

It is suggested, therefore, that arrangements should be made to write off as soon as possible sufficient of the capital sunk in the three stations, Neepsend, Blackburn Meadows, and Rotherham, to allow of their being treated as auxiliary or stand-by stations.

The main generating plant on the Trent would be all coal fired, and what is particularly important from the Sheffield point of view, a saving of some 350,000 tons of coal annually could have been brought about in 1923 by this policy, had it not been necessary to keep the Don stations working on normal load.

Thus generation—other than generation from waste heat—should be effected mainly by large plant situated on the large tidal rivers, and generation from coal-fired stations situated in the denser areas where water is deficient should eventually be reduced to a minimum.

The report shows that by adopting this system of generation, electrical energy could be supplied at minimum prices, while at the same time providing a reasonable and sound return on the capital expenditure involved.

A three-phase E.H.T. primary transmission system operated at 50 cycles per second, at a pressure of not less than 33,000 volts, should be laid down on standard lines over the area (though these need not be standardised for all time) to supply distribution networks operated at a standard pressure of 10,000 to 11,000 volts, which would be laid out and so designed that they could eventually be linked up into one general system.

To meet the estimated load in 1923, new capital of from £11,000,000 to £12,000,000 will be required. With coal at 15s. to 16s. a ton, the report estimates that high-tension A.C. energy at 11,000 volts could be delivered remuneratively to consumers at an average cost of 0.394d. per unit.

The area should certainly not be reduced, and advantages would be gained by extending it. It is of prime importance that this district should adopt such a general policy and lay-out of plant as will eventually secure the lowest fuel cost.

The practicability of the policy recommended depends upon all parties concerned agreeing to proceed as rapidly as possible with the scheme, as delay would mean that some other method would have to be taken to deal with immediate increase of load.

THE DIVISIONAL ENGINEERS OF THE ROYAL NAVAL DIVISION.

The Royal Naval Division was composed originally of the men who came forward from motives of patriotism and enthusiasm. In September, 1914, the Army recruiting machinery had completely broken down, the formation of special battalions was discouraged, the Royal Engineers, the Royal Engineers (Territorial) Electrical Engineers, and other regiments were declared to be "full" with waiting lists of several hundreds. The creation of the Divisional Engineers of the Royal Naval Division opened a door for technical men, and it appeared at that time that their experience in all kinds of engineering would be appreciated and utilised. It is true that if there had been less enthusiasm, and if they had waited, most of these men would have done better for themselves.

Arrangements were at once made by the Institution of Electrical Engineers, assisted by the Institutions of Civil and of Mechanical Engineers, to recruit this unit, and the body of men sent to camp in a few days was remarkable no less for its technical ability than for its eagerness to enlist. As soon as they sailed for the Mediterranean the parent institutions necessarily lost touch with them.

A committee of the Institution of Electrical Engineers has been appointed to make inquiries about the subsequent history of the Divisional Engineers, and has found that during the Gallipoli campaign the section was employed in such work as digging wells and building a jetty; it dwindled owing to casualties, transfers, and promotions, and as there was no precedent for the Royal Naval Division, and its Divisional Engineers, there was no organisation to carry on the original formation, and no source from which similar men could be drawn. The unit had become so small by January, 1917, that no other course was possible but to absorb it into the Royal Engineers.

One of the terms of the enlistment was that the Divisional Engineers would have the same standing as Royal Engineers. There was therefore no serious hardship in the absorption, except as it affected seniority, &c., though owing to the *esprit de corps* which had quickly developed, it was greatly to be regretted. Seniority was lost owing to the change; the men were regarded as having joined the Army at the date of transfer to the R.E.'s, their previous services of more than two years being ignored. Seniority was restored for the officers, but possibly this has not been considered with regard to further promotion.

The employment of skilled men on unskilled work has been very common during the war, not only in the Army but in civilian official work. Every man in the unit enlisted as a sapper. The officers as well as the men were employed on unskilled work. It is true that the original contract under which they joined for three years or for the duration of the war, whichever were the shorter, was broken, and the conditions under which the men joined were not retained. But this was done under an Act which applied to men in all regiments.

That their engineering experience was but little appreciated by the military authorities is a matter beyond any control or influence that the engineering institutions could exercise. The value of that experience and the enthusiasm of those who offered themselves is known to nobody better than to those members of the institutions who took part in the recruiting; and nobody can more deeply regret the waste of this fine unit than those who are proud to have been permitted to form it.

The Institution of Electrical Engineers has records of the following who enlisted in the R.N.D.:—

Officers	60
N.C.O.'s	19
Sappers	24
Killed	9
Discharged	11
	123

The total number of members of the Institution of Electrical Engineers who have joined the services is about 2,000. Circulars have been sent out by the Electrical Appointments Board to every known case, and about 600 replies have been received.

The early date of voluntary enlistment, and consequently their long service, to say nothing of the disappointments which have been experienced, should weigh with the institutions and their members in endeavouring to find appointments for men who joined as divisional engineers of the Royal Naval Division.

CORRESPONDENCE.

Letters received by us after **5 P.M. ON TUESDAY** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The New Ministry and Electricity Supply.

Following the first shock of surprise at the inexplicable inclusion of electricity supply administration as a department of the duties of the new Ministry of Ways and Communications, all efforts to realise the significance of this proposal have only served to expose its inexpediency and to consolidate opposition from all quarters.

The only possible connection with "ways and communications" is that electricity will come into greater use as the motive power on railways. But if the Minister for Railways should logically control the general supply of electricity, merely because he will some day be a large consumer, then he should at once control the coal mines of the country as being for steam locomotive purposes by far the greatest single consumer of fuel. Electricity is, in any case, only a means of transmitting the energy obtained from burning coal.

But so far from its being nationally advantageous that a Government department, as a large consumer, should have supreme power over either the supply of electricity or coal, it appears, on the contrary, that such a development might be positively dangerous to the whole prosperity of the country.

In the aggregate the greater consumption of fuel or electricity must always be in the factory and the household. The whole factory system of Great Britain is based on the supply of cheap and abundant fuel, and latterly there has been a very rapid increase in the proportion of works taking energy from the public electricity mains rather than burning coal themselves. All who have studied the economics of electricity supply will agree as to the advantage, from the point of view of diversity of load and wholesale generation, that wherever possible factories and railways should both buy their electricity from a common source. But the longer this principle is examined the clearer it becomes that neither should have exclusive powers of control. The factories represent the major interest, nothing less, indeed, than the whole industrial efficiency of the country being involved in their case; but all arguments against their selling electricity to the railways are just as strong against their buying from the railways.

The municipal authorities, to whom local prosperity is naturally all-important, cannot admit that a national railway minister would have a more careful regard than themselves for the needs of their industrial ratepayers in this respect.

It is the more strange that this ill-considered proposal should be sprung on Parliament seeing that, after prolonged investigation by a specially appointed and thoroughly representative committee, the national policy in respect of electricity supply has been the subject of a comprehensive report which, it was understood, would be reflected in early legislation.

What that report amounts to in brief is that district boards should control the wholesale generation of electricity, that supply authorities and industrial and railway consumers should have representation on such boards, and that local distribution in detail should be undisturbed, although it will be given, undoubtedly, great stimulus by the provision of these so-called "super power stations." The national and local interests were to be watched by a body of electricity commissioners, which would see fair play as between different classes of consumers, and otherwise harmonise the organisation of supply and transmission.

Broadly those recommendations secured general approval, and represent what is the present demand not only of municipal and company supply authorities, but of industrial consumers as well. The introduction of the Bill embodying these proposals is therefore demanded. If it be claimed that the electricity commissioners must be attached to some Ministry or other for Parliamentary purposes, then there is every reason why the Board of Trade, now reforming itself into a Ministry of Commerce, should be that Ministry, and there is every reason why one as yet unformed, and likely to be for an indefinite period more or less chaotic, should not.

L. L. Robinson, M.Inst.C.E.

Electricity Department, Hackney,
March 12th, 1919.

New Housing Schemes.

With regard to the tariff to be adopted for the supply of electricity for the medium-sized houses of the industrial districts, I am considering the adoption of a two-rate meter, to operate on one scale when passing the lighting load, say 100 watts, and to operate on another scale when passing more than 800 watts. The units on the lighting scale will be charged for at the lighting rate, and on the other scale at the heating and cooking rate.

Considerable opposition to the rateable-value system is experienced. The writer is informed that the above system has been tried at some places, and he would very much like to have opinions on the method.

W. A. Turnbull.

Electricity Works, Aylesbury, *March 17th*, 1919.

The Resettlement of Officers.

"Fed Up's" letter on the resettlement of officers struck a sympathetic chord in my breast. In spite of service in Gallipoli and France, I was unable to obtain a commission as I was "categorically unfit." In civil life, a professional electrical engineer, with a university degree, I was allocated the respective Army "trades" of linesman, instrument repairer, and electrician. Mine was by no means an exceptional case. I have seen many men of good technical education and experience cleaning down wagons, doing stable-boy's work, or even worse, doing technical jobs under the supervision of officers or N.C.O.'s with neither ability nor knowledge of the subject. As instances of the deplorable ignorance of those in authority, let me mention the sergeant who, in all seriousness, suggested that a broken battery container should be repaired with "two or three layers of stamp-edging"; and the N.C.O. instructor who lectured on magneto-generators, and drew a field (?) winding round the magnet yoke!

The root of the trouble is the lack of adequate representation of the engineering profession. The doctor, the dentist, the "vet." is recognised by the Army as a responsible worker, and is given commissioned rank. A stableman or groom will nearly always become an N.C.O.; but the engineer receives no recognition of his profession, unless he possesses "fine personal appearance, plenty of swank and bluff," when he stands somewhat less chance of a commission than a man of these attributes in the infantry.

It is up to engineers, then, to get their profession taken at its worth and given proper recognition, and it is to be hoped that in future commanding officers of technical units will be engineers as well as soldiers, and will consider technical ability a greater qualification than a martial appearance on the parade ground.

Ex-Sapper, R.E.

London, *March 15th*, 1919.

Judging from the tone of "Fed-up's" letter in your recent issue, I imagine him to be one of those awful people who considered it beneath their dignity to take a commission in H.M. Army, for the simple reason that there were some (doubtless a very small proportion) obviously unqualified men who obtained commissions. I'm sure that in the opinion of many of us there has been scarcely anybody more unpatriotic during the war than the man who, feeling convinced in his own mind that he was quite well qualified to hold a commission, and was not prevented from applying on purely personal grounds, did not come forward when there was a shortage of officers. However, from a consideration of the manner in which "Fed-up" writes, one is almost obliged to think that the number of "unqualified ones" would only have been slightly swollen had he honoured the War Office by accepting a commission.

One who is proud to have held a Commission.

March 15th, 1919.

Electrified Seed.

I am sorry to see the note signed "Charles Mercier," dated March 10th, because it is not worthy of the learned author of "New Logic," and I trust it may not be too late to prevent the lending of his great name to what he might quite rightly term "a farce," if only he could be made to realise the importance of taking into account the ravages of birds, worms, ants and corn-root lice, beetles, molds, and what our American friends call "robber-plants"—against all of which *chemical* treatment alone affords so much protection that electricity doesn't count!

You, Sir, are a better judge than Dr. Mercier now is of whether or not I am in earnest; and I beg that you will allow me to press for answers to the questions which have been asked by me in all seriousness. What I fear is that, when the whole of the facts are calmly and carefully considered, we shall find no evidence which will stand cross-examination.

Wide Awake.

March 15th, 1919.

The Association of Officers and Staff Members of Electricity (Power and Supply) Companies of Great Britain (A.O.E.C.).

I have read the letter of Mr. C. Vernier, which appears in your issue of the 14th inst.

It seems clear from the opinions expressed at the initial meeting of the A.O.E.C., held at Caxton Hall on January 30th, that there are a large number of staff officers who do not agree with Mr. Vernier's views. The A.O.E.C. was formed with the object of protecting the interests of its members in connection with the absorption or amalgamation of the companies, and it appeals to a very large number of men (both technical and commercial) who do not belong to the other associations mentioned—probably, also, to many of those who do—as constituting a strong representative body for its specific purpose.

It would appear, therefore, that such an association as the A.O.E.C. is most essential for the protection of the interests of all concerned.

O. L. Peard.

London, S.E., *March 18th*, 1919.

The Electrically-Propelled Battleship "New Mexico."

Much interest has been recently taken in the news which was published in the daily papers, to the effect that the new American electrically propelled battleship had broken down whilst escorting President Wilson across the Atlantic to the United States from France. It is true that a breakdown did occur; it was caused by one of the two steam turbine prime-movers stripping (the port side one), but the *New Mexico* was never in any danger through this trouble, which is common to all steam turbines. She was able to proceed with her starboard turbo-generator at work at a speed of 15 knots, and this in extremely heavy weather, so much so that the accompanying destroyers also had to slow down and fall out of the escort. No apprehension for the *New Mexico's* safety was ever entertained by American naval officers.

The statement that the electrical machinery had given trouble is absolutely without foundation; no trouble has been experienced, and the greatest enthusiasm is still maintained. The fact that the *New Mexico* was able to proceed with all four propellers running at the speed of 15 knots is evidence of the great elasticity and efficiency of the lay-out of plant, and the accident can be looked on as a test which has come out most successfully, compared with the havoc which would probably have been the result of half the turbine machinery going wrong in the case of an ordinary steam-turbine propelled vessel.

William P. Durtnall, M.I.Mar.E., M.I.Loco.E.

London, S.W., *March 15th*, 1919.

Three-Phase Distribution.

I am anxious to get hold of an authoritative report recommending that three-phase distribution be used throughout without conversion to D.C. This appears to be implied in various reports, and I believe it was actually recommended in the Merz Report on the London supply some years ago. I have, however, not been able to lay my hands on any report regarding it. If you could put me in the way of getting such report I should be much obliged.

C. Turnbull.

Electricity Works, North Shields, *March 17th*, 1919.

The Channel Tunnel.—Mr. Bonar Law, answering questions in the House, last week, with regard to the Channel Tunnel, said that before any action was taken consideration would be given to the comparative cost, the time in which it could be started working, and the value to industry and commerce of a train ferry, or several train ferries, across the Channel, as against a single Channel Tunnel. The sanction of Parliament would be required before the country was committed to carrying out a tunnel scheme.

LEGAL.

Ansett v. Siemens Bros & Co., Ltd.

In the King's Bench Division, on March 12th, Mr Justice Rowlatt heard an action in which a lad named C. S. Ansett of North Woolwich, claimed from defendants, of Woolwich, damages for personal injuries sustained by him while engaged at their works.

Counsel for the plaintiff explained that the lad had been in the employ of the defendants for some time, first as a drum-boy, and later in working a spinning machine, his duty being to look after the machine used in the manufacture of trench cable for telephone service in the trenches, for which he received 35s. a week. The cable consisted of three or four strands of wire, which, after passing through a collector, had to be taped; after that they passed over a wheel and round the drum. At about 4.30 on the afternoon of March 11th of last year, while plaintiff was engaged in his usual work, the tape broke. He mended it, but after having done so it slipped off the wheel. In order to replace it he put his foot on a girder; the latter being greasy, he slipped, and his foot was caught by a cogwheel and severely injured. He was taken to the Seamen's Hospital at Greenwich, where he remained for 12 weeks, and since then he had been unable to follow any regular employment. The allegation against the defendants was that they had neglected to keep a dangerous piece of machinery properly fenced and protected in accordance with the requirements of the Factory Act.

The defendants denied that the machine was dangerous, or that there had been any negligence on their part in not fencing it, as the factory inspector did not regard the suggested protection as necessary. They were, they said, under no statutory obligation, and the accident, they contended, was consequent upon a breach of duty on the part of the lad.

His Lordship, after hearing the evidence on both sides, said there was no doubt as to the boy having suffered injury, and the only point in the case was whether there had been neglect to fence in a dangerous piece of machinery as required by the Factories Act. The evidence was that the particular part of the machinery was not dangerous, and that there had been no negligence on the part of the defendants in regard to it. The fact that the boy was injured did not prove that the machine was dangerous, as injury might at any time be caused by the carelessness of a worker. Although he was sorry for the boy, he was bound to come to the conclusion that he had failed in his action, and would have to content himself with what he could get under the Workmen's Compensation Act. Judgment would, therefore, be entered for the defendants.

On the application of plaintiff's counsel, his Lordship fixed the payment by the defendants to the plaintiff under the Workmen's Compensation Act at £55, and said that plaintiff would have to suffer a set-off of £10 towards the costs of the action, in which he had failed.

Meagher & Hayes v. Cork Electric Tramways and Lighting Co., Ltd.

Mr. Justice Powell, in the High Court of Ireland, granted an order for discovery on behalf of the plaintiffs, Messrs. Meagher & Hayes, in an action against the Cork Electric Tramway & Lighting Co. for £110 alleged to have been charged for electric power in excess of the rate of charge to others in the same area The case is listed for trial at the Cork Assizes.

BUSINESS NOTES.

German Prices Advancing.—The Sales Office of the United Manufacturers of Insulated Electric Wires has increased the prices of material of K.Y.Z wires, as catalogued, by 15 to 35 per cent. All German fittings factories have decided upon fixed prices to last provisionally five years. The price of cast-iron fittings is to be increased at once by 15 per cent., says a German paper published on February 14th.

Water-Power Plant Production at Stoke-on-Trent.—Messrs. Boving & Co., Ltd., are known in engineering circles as specialists in water-power plant, turbine pumps, and wood-pulp machinery. Until a couple of years ago they factored out their work to various shops in the country practically leasing some smaller firms, or, in some cases, letting larger firms build machinery for them to their drawings. They also used to import water turbines and pulp machinery from Sweden. During the war, however, they acquired an engineering works at Stoke-on-Trent, and these have now been remodelled; further large extensions are contemplated, with a view to efficient manufacture of their specialities. Messrs. Boving will be able to handle the largest water turbines, and just at present they are actually putting through three turbines of 3,000 H.P. and two of 8,000 H.P., which are very soon to be followed by units of 16,000 H.P. Besides these a number of smaller turbines are also going through. The number of workmen employed is at present about 300, but it is expected that before long there will be about 600 men employed. The most labour-saving and accurate heavy machine tools are to be introduced and a rigid control will effect quick deliveries.

Export Free List.—In the Consolidated Free List of Exports in force from March 15th the following appear :—

Adding and calculating machines, electrodes, gauge-glasses glassware; hardware for builders, if of iron or steel; iron and steel manufactures, except manufactures of high-speed steel; and except articles prohibited by name on List A or B (subject, however, in the case of machinery to the definition given under that heading); lighting fixtures, if of iron or steel machinery of all kinds and parts (except textile machinery and machinery wholly or mainly made of copper or brass): marble (raw and manufactured).

Export Restrictions Removed.—A further list of Export Restrictions which have now been removed is published in the *London Gazette* of March 14th.

German Copper Works' Troubles.—At a meeting of the administrative and executive officials, one of the directors, Herr Kurrer, made a notable statement as to the present condition of the Mansfeldsche Kupferschieferbauende Gewerkschaft. The expenditure of the works from October 1st, 1918, to January 20th 1919, amounted to Mk. 47 millions, against which must be put a sale of Mk. 20 millions only. It must be observed in this connection that the sale fell from more than Mk. 11 millions in October to Mk. 2½ millions in December. The circumstance is significant that American copper can be delivered at a price, roughly, of Mk. 350 per 100 kg., while the prime cost of the Mansfeld copper is in the region of Mk. 700. The State has not, so far, granted the support which was asked of it. Employers of labour, really coversant with the conditions, admitted that socialisation of works which were being run almost at a loss would only accelerate the impending disaster. Nevertheless, the directors of the mine professed willingness to entertain proposals for the amelioration of the state of things, since they thought it their duty to keep in employment the 80,000 men who still depended directly on mining for their livelihood. No socialisation would abolish the necessity of working harder than ever in order to tide over the crisis, and it was regrettable that labour would not face bare facts. As things stood at present, a catastrophe was inevitable.—*D.A.Z.*, February 7th.

Real Welfare Work.—The visitor to the Welfare Department at Messrs. W. T. Henley's Telegraph Works at North Woolwich is impressed by the fact that the department takes no narrow view of its objects or its possibilities. It is recognised that something more than faultless feeding arrangements are necessary in order to get a willing and contented staff. While, therefore, the canteen appointments leave nothing to be desired, provision is also made for mental fare. At half-time, during the dinner hour, various lecturers on social and political subjects are introduced weekly. A piano is available if diversion of a lighter kind is desired. On Tuesday, 11th inst., Mr. H. Savage, the chief electrician to the company's works, gave, by request, a lantern-illustrated lecturette on "Some Interesting Facts About Submarine Cables." He was introduced by the chairman of the company, Mr. George Sutton, who announced the immediate shortening of the hours of labour in the works (an announcement that was greeted with applause), and appealed to the workpeople, in their own interests, to keep up the output of work. Mr. Savage, who was assured of his popularity by his reception, began with a statement of the reasons why copper was used, and, after showing by means of a projected ammeter its conductivity in respect of other metals, he went on to instance the work of Dr. Matthiessen, who, in spite of the physical disadvantages of paralysis from infancy, gave us Matthiessen's standard, which had been the cable-maker's guide for 50 years or more. The teredo was then shown on the screen, and its depredations illustrated. The importance of care in brass taping as a preventative of damage by submarine borers was visibly brought home to those engaged in that operation. The lecturer then went on to show and describe operations of tanking, conveyance, and laying of submarine cable, with charts of the positions of some of the more important. One striking chart showed an American-owned cable made at Silvertown crossing on the bed of the Pacific one made at Greenwich, so that in the Antipodes, Silvertown and Greenwich met in the result of their work. The universal expression of opinion, as the hooter called all hands back to labour, was that the time was all too short in which to convey the proffered instruction, which was very acceptable. Anything which gives the employé a new and intimate interest in the product of the work of his hands is welfare work of a valuable kind. Much can unquestionably be done to relieve the drabness and monotony of humdrum occupation if we only lay ourselves out for it.

The B.E.A. Directory.—The British Engineers' Association (Inc.), 32, Victoria Street, London, S.W., has issued a new edition (1918-19) of its Official Directory of Members. The contents are rendered in English and Spanish. A general introduction explains the objects and position of the Association, and after a brief message to readers in Spain and South America, and some particulars of metric and British weights and measures, there is an alphabetical section of members' names, postal and telegraphic addresses, and the telegraphic codes used by them. Another section indicates, in tabular form, members' arrangements for representation overseas, while many pages are devoted to a classified list of manufactures.

Permits for Establishing New Businesses.—Those who have sent us inquiries in regard to this matter should take note that the Order made by the Minister of National Service relating to the granting of licences for opening new businesses, or branches of existing businesses, will in future be administered by the Ministry of Labour, and forms of application are obtainable at all Employment Exchanges.

Recent Trade-Marks Applications.—Appended is a summary of the recent applications for British trade-marks in connection with the electrical industries:—

Olipel. Nos. 387,231, 387,232, 387,233 and 386,724.—All goods in Classes 6, 8, 10 and 11. Oliver-Pell Electric and Manufacturing Co., Ltd., Granville House, Arundel Street, London W.C. December 11th, 1918, and January 2nd, 1919.

A.G. Co. (letters combined with design), No. 381,632.—Electrical apparatus included in Class 8. Edward A. Graham, trading as Alfred Graham & Co., St. Andrew's Works, Crofton Park, S.E. August 3rd, 1918.

Compex. No. 387,349.—Electric accumulators included in Class 8. Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester. January 7th, 1919.

Cumex. No. 387,351.—Electrical accumulators included in Class 8. Chloride Electrical Storage Co., Ltd., Clifton Junction, Manchester. January 7th, 1919.

Elastride. Nos. 387,691 and 387,728.—All goods in Classes 38 and 40. St. Helens Cable and Rubber Co., Ltd., Bank Quay, Warrington. January 18th and 21st, 1919.

Megohmax. No. 387,397. Class 50.—Electrical insulating material. John Moores & Co., Brougham Street Works, Salford, Manchester. January 8th, 1919.

Megohmior. No. 387,398. Class 50.—Electrical insulating material. John Moores & Co., Brougham Street Works, Salford, Manchester. January 8th, 1919.

Government Financial Assistance for U.S. Export Trade.—Certain provisions contained in the Victory Short-Term Notes Bill, which came before the House of Representatives during the last week in February, should be brought to the notice of the British Government. The Chancellor of the Exchequer, and the Treasury in particular, should at this moment, when they are considering their relation to British industrial affairs and preparing financial policy which may be fraught with enormous consequences, take note that U.S. export trade is to be assisted by means of loans. According to the *Electrical World*, one section of the Bill authorises the War Finance Corporation to make loans to exporters and to banks, bankers and trust companies, until one year after the termination of the war, to assist in the exportation of domestic products. Because of exchange conditions, thereby necessitating some of the foreign Governments putting restrictions upon American exports to them, as it is claimed, it is believed that this provision will materially help U.S. industries in their production during the transition period, and to maintain their export business. Other particulars regarding the plan are explained in the report as follows:—

"This section authorises the War Finance Corporation to make advances for periods not exceeding five years direct to any exporter engaged in the export business in the United States, if, in the opinion of the board of directors of the corporation, he is unable to obtain funds upon reasonable terms through banking channels.

"Any such advance shall be made only for the purpose of assisting in the exportation of such products, and shall be limited in amount to not more than the contract price therefor, including insurance and carrying or transportation charges to the foreign point of destination, if, and to the extent that, such insurance and carrying or transportation charges are payable in the United States by such exporter to domestic insurers and carriers. The rate of interest charged on any such advance shall not be less than 1 per cent. per annum in excess of the rate of discount for 90-day commercial paper prevaling at the time of such advance at the Federal Reserve Bank of the district in which the borrower is located.

"This section also authorises the corporation to make advances for not to exceed five years to any bank, banker or trust company in the United States, which, after this section takes effect, makes an advance to any exporter for the purpose of assisting in the exportation of domestic products. Such advances are to be limited to not exceeding the amount remaining unpaid of the advances made by the bank, banker or trust company to the exporter for the purpose of exporting domestic products.

"The corporation cannot have outstanding under this section, and unpaid at any one time, advances in excess of $1,000,000,000."

The corporation at the time of making any advance must require adequate security.

Concert.—On the evening of March 13th a successful concert was held in the canteen at Messrs. Fuller's Works, Grove Road, Chadwell Heath. It was organised by the Fuller Works Social Welfare Committee in aid of St. Dunstan's Hostel, for which it is hoped £30 will have been raised. Mr. D. A. Palmer presided. The canteen was suitably decorated with flags and lanterns, and arrangements for stage, curtains and lighting, were carried out by Mr. Brigden, assisted by members of the Committee. The canteen was crowded, indeed the audience was larger than the most optimistic had anticipated, and many of the audience had to stand throughout the performance. The programme included the sketch "Motoring" (by kind permission of Mr. Harry Tate) presented by Mr. Tom Campbell, assisted by members of the British Lighting and Ignition Co.'s Revue Company. At half-time Mr. Donald Palmer, director of the Fuller Co., thanked the artistes, the canteen manager (Mr. Rhodes), and Mr. Brigden. Mr. Palmer apologised for the absence of Mr. Fuller, and gave a short description of the work and objects of St. Dunstan's.

Trade with Russia.—A limited number of business men who wish to proceed to Constantinople or South Russia may now do so. Application should, in the first instance, be made to the Russian Section, Department of Overseas Trade, Sunderland House, Curzon Street, Mayfair, W. 1.

U.S. Electrical Developments.—The *Board of Trade Journal* says:—"There is a suggestion for a combine between the General Electric Co., the Western Electric Co., and the Allis-Chalmers Manufacturing Co., but no practical steps have yet been taken in the matter. It is also stated that some of the lesser firms contemplate a combine for the exportation of their electrical machinery and appliances, but there is no definite confirmation of this report."

United States Copper Position.—The announcement that the famous Calumet and Hecla Co. has deferred payment of its dividend "because of the unsettled condition of the copper industry" is a fresh reminder that that industry in the United States—and, indeed, throughout the world—is still in the throes of transition. Last week the big porphyry companies—the Chino, the Nevada Consolidated, the Ray Consolidated, and the Utah—announced "cuts" in their quarterly distributions. Practically all the United States copper producers have now joined a new Export Association formed under the Webb Act. A more important recent development, however, has been the decision of the United States Government to allow its large holding of copper to be liquidated at market prices over as long a period as 15 months. Before the war the world's record annual production of copper was about 1,000,000 tons, whereas during the height of hostilities it grew to over 1,400,000 tons. Of this enormous total it is believed that at least three-quarters was being absorbed by the Allied Governments for munitions, &c. Obviously it must take time before ordinary trade demand can be re-attracted in such volume as to absorb the copious supplies of the metal now available, even allowing for the drastic slowing-down of production which is claimed to have been already effected this year.—*Financial Times*.

German Electrical Activity.—A special correspondent of the *Times*, in Berlin, says:—"Large German factories are overwhelmed with German orders. The electrical industry, for example, I was told, 'has orders for six days for every one day's work that can be turned out.' The same is true in various other factories of completed and especially non-perishable goods of high intrinsic value."

The Big American Electrical Export Scheme.—Further particulars are given in the *Electrical World* of the International General Electric Co. (Inc.), which has been organised under New York laws with a capitalisation of $20,000,000, divided into $10,000,000 of 7 per cent. cumulative preferred, and a like amount of common stock. The stock is paid in, and is all held by General Electric interests. All of the foreign interests and export business of the General Electric Co. will be under the charge of this company. The directors are C. A. Coffin, A. W. Burchard, E. W. Rice, Jun., Owen D. Young, J. R. Lovejoy, G. F. Morrison, Gordon Abbott, Sidney Z. Mitchell, George P. Gardner, Charles Neave and Gerard Swope. Gerard Swope is president of the new company and Charles Neave chairman of the board. M. A. Oudin is vice-president of the company.

Electrical Wages in Manchester District.—According to the *Manchester Guardian*, a meeting of members of the Electrical Trades Union of the Manchester district was held at the Milton Hall on Sunday to hear the report of the representatives who attended the meeting with the employers on March 6th, at which an arrangement was come to by which the principle of a minimum wage was agreed upon on the basis of a pre-war wage of 35s. per week, equivalent now to a wage of 68s. 6d. At the close of a long discussion the meeting accepted the report, and stated that had the terms offered not been satisfactory there would have been a cessation of work to enforce them.

The Importance of British Export Trade.—Sir Arthur Steel-Maitland, M.P., Director of the Overseas Trade Department, gave an address on Monday to members of the Leeds Luncheon Club on the future organisation of the Consular Service. He said it was of vital necessity to us that our foreign trade should be re-established and extended, and it was quite clear that if we did not manufacture for other countries there would be nothing for us to do but starve.

Competition in foreign trade was going to be much keener than ever before. He had proofs of it, and could lay them before anyone who wished to discuss them with him. Some people declared that the Government should steer clear of trade and not touch it at all. Others even went so far as to imagine that the Government should do their commercial travelling for them. The position really was that the Government could survey the whole field and collect information. They had no axe of their own to grind, and had no thought of dictating to business men. They wanted to co-operate with them. There was an immense field in front of them, and it was important for the Government and business men of all trades to work together.—*Morning Post*.

New Lamp Works.—The Highways Committee of the Bedfordshire County Council has considered an application from the Osram-Robertson Lamp Co., Ltd., for permission to construct a level crossing on the Leagrave Marsh and Luton Main Road, in the parish of Limbury. It appears that the company propose to acquire land adjoining this road for the purpose of erecting large works employing many thousands of hands, and they require a level crossing in order to connect their works with the line of the Midland Railway. The Committee reported in favour of sanctioning the level crossing.

Non-Ferrous Metal Industry Act.—The *London Gazette* for March 18th contains a further list of licences granted under this Act.

Catalogues.—Brittain's Electric Motor Co., 110, Cannon Street, London, E.C. 4.—Twenty-page finely illustrated catalogue of Brittain electric motors, containing a complete specification of single and polyphase motors, both squirrel-cage and slip-ring types, followed by tabulated sizes for motors ranging from 25 to 100 periods. The single-phase machines listed range from ¼ to 90 H.P., and the polyphase from ¼ to 145 H.P. In the preparation of the catalogue and of the price lists that accompany it the firm have specially kept in mind the convenience of the buyer. The various machines have been grouped into a number of sizes of frame, each marked with a distinguishing letter. A buyer can ascertain the size letter of the machine he wants, and with this in his mind he turns to the separate price lists, which are distinguished by a different coloured paper. The price table gives the size letter, price, code-word, the size and price of pulley, and so forth. The motors are built to the standard British specification. The company is translating the lists into several languages, and invites inquiries for copies.

The Midland Electric Manufacturing Co., Barford Street, Birmingham.—Folder in the form of a large show sheet, showing half-tone illustrations, particulars and prices of the M.E.M. ironclad switch and fuse gear—Paragon, Gem, Glasgow, Kantark, and Memco designs.

Messrs. J. & W. B. Smith, Ltd., 15-23, Farringdon Road, London, E.C. 1.—Twenty-page price list (No. 132), of a variety of electrical accessories—lampholders, switches, fuseboards, cut-outs, wires, brackets, bell accessories, and so on.

Liquidations.—Osram Robertson Lamp Works, Ltd.—Winding up voluntarily. Liquidator, Mr. J. Fraser, 31, Copthall Avenue, London, E.C. Meeting of creditors March 24th. Particulars of debts, &c., must be sent to the liquidator on or before that date.

British Continental Electricity Co., Ltd.—A meeting of members will be held at 21, Finsbury Pavement, London, E.C., on April 24th, to hear an account of the winding up from the liquidator, Mr. C. E. Barker.

Fraser & Chalmers, Ltd.—Particulars of claims to the liquidator, Mr. W. McDermott, Moorgate House, Finsbury Pavement, E.C., by April 30th.

Book Notices.—*Arithmetic for Engineers.*—By C. B. Clapham, B.Sc. London: Chapman & Hall, Ltd. Price 7s. 6d. net. Second Edition. Pp. xi + 465; figs. 167.—This is one of the "D.P." Technical Series, and lives up to its title; it covers simple algebra, mensuration, logs, graphs, and the slide rule, and employs an abundance of practical examples, while all that is not "directly useful" is omitted. As we reviewed the first edition very fully in 1916, it will suffice to add that apparently the only change in the present issue is the addition of an appendix on verniers and micrometers, which are very clearly explained with the aid of many illustrations of sample settings. The book, as a whole, is thoroughly practical, and as it commences with quite elementary ideas, it is highly suitable for the use of apprentices, as well as for engineering students in general.

The Journal of the Röntgen Society, No. 56, Vol. XIV, July, 1918, has just been issued, with apologies for the delay in publication; it contains the Silvanus P. Thompson Memorial Lecture, by Prof. Sir Ernest Rutherford, F.R.S., technical articles, and the balance-sheet of the Society. No. 57 (October, 1918) has also been received, containing the annual report of the Council and a report of the proceedings at the annual general meeting held on June 4th, 1918. The membership then stood at 315. The new rules of the Society and a list of members to December 1st, 1918, are published in this issue.

Practical Electrician's Pocket-Book for 1919. Pp. lxxv + 480; illus. Edited by H. T. Crewe. London: S. Rentell & Co., Ltd. Price 2s. 6d. net.—With this issue the Pocket-Book attains its majority; but it has been handicapped by the stringency in the paper supply, and though it is very fat and prosperous-looking, it has not been so largely increased in size as the Editor had hoped. New chapters on electrical pyrometers and the oscillograph have been added, that on electric vehicles has been rewritten, and other sections have been revised and extended, whilst improvements have been effected in other ways. Excellent before, it is still better now, and will meet with a cordial welcome.

"Mechanical World Year-Book, 1919." Pp. 272; 80 figs. Manchester: Emmott & Co., Ltd. Price 2s. net.

"Can we Compete?" By G. E. Mappin. Pp. 159. London: Skeffington & Son, Ltd. Price 4s. 6d. net.

"Induction Coils." By G. E. Bonney. Revised by A. H. Allen. Pp. x + 198; 80 figs. London: Sir Isaac Pitman and Sons, Ltd. Price 6s. net.

Beama Revista Trimestral Ilustrada de Ingenieria. March, 1919. London: B.E.A.M.A.

Heat Treatment Bulletin No. 8, issued by Automatic and Electric Furnaces, Ltd., describes the methods of holding a number of small articles for simultaneous treatment in the furnace.

"*Journal* of the Institution of Municipal Engineers." Vol. VII. No. 25. February, 1919. London: The Institution. Price 1s.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 2. February, 1919. New York: The Institute.

Trade Announcements.—Mr. Schattner, who was the original founder of the Electrical Apparatus Co., Ltd., and has held the office of chairman since its formation 12 years ago, resigned the chairmanship on March 1st, owing to indifferent health, aggravated by the severe strain of managing a manufacturing business for four years under war conditions with a depleted staff. Mr. Schattner will retain his seat on the board, to act in an advisory capacity. He will also join the board of several other electrical companies, after a period of recuperation during which he will visit France, Italy, and the Balkans, partly in the interests of the Electrical Apparatus Co., Ltd. On February 28th Mr. Schattner was entertained by his colleagues on the board at a dinner at the Savoy Hotel, on which occasion they presented him with a gold watch, and on March 11th he was the guest of honour at a dinner arranged by the staff, at the Holborn Restaurant. He was presented with an illuminated address. During the 12 years of Mr. Schattner's chairmanship, there has been rapid and steady growth of the company's business. There will be no change in the constitution of the board. Mr. R. H. Barbour, M.A., has been elected chairman; and Major R. Amberton, who has been absent on military service since the outbreak of war, is taking over the commercial organisation, and the complete board is constituted as follows:—Mr. R. H. Barbour, M.A. (chairman); Major Amberton (commercial organisation); Mr. G. R. Moore (administrative); Mr. H. R. C. Partridge (works superintendence); Mr. E. Schattner (advisory); Capt. E. A. Godson, M.C. (financial); Mr. H. Taylor, A.S.A.A. (secretary).

Mr. W. J. Lattimer, having been demobilised, has resumed business as an electrical engineer and contractor, at 203, Lower Addiscombe Road, Croydon.

In order to meet the increasing demand for Wild-Barfield electric hardening furnaces, new premises have been secured for works, and the works address of Automatic and Electric Furnaces, Ltd., is now 281-283, Gray's Inn Road, W.C. 1.

The Concordia Electric Wire Co., Ltd., state that business delays are occurring owing to customers addressing them at *Queen* Victoria Street, instead of 155, *Victoria* Street, S.W. 1.

Mr. Albert Morgan is now demobilised, and is trading as an electrical and mechanical engineer, at 138, Gower Street, London, W.C. 1. He wishes to receive manufacturers' catalogues and latest prices.

The Electrical Apparatus Co., Ltd., have removed their Scottish branch office in Glasgow from Hope Street to 74, York Street. Temporary telephone number, "Central 3467." Their branch manager, Mr. J. Ferguson, regrets any inconvenience caused to customers during the removal.

Lieut. George Preece, R.E., has been released from the Army, and has been appointed Yorkshire representative of Messrs. James Howden & Co., Ltd., Glasgow, and of Messrs. Mavor & Coulson, Ltd., Glasgow. His offices are at Telegraph Chambers, Market Street, Bradford.

Bankruptcy Proceedings.—William T. Smith, electrical and mechanical engineer, Victoria Street, and 60, Hampden Street, Bolton, Lancs. Although the creditors of the above debtor had agreed to the adjournment of his case for three months, the Official Receiver pressed for an order at Bolton, on March 12th. The Registrar, Mr. C. H. Hulton, was not at first inclined to grant any further adjournment, pointing out that several adjournments had already been granted to see if Smith could dispose of a war patent. Nothing had come of that, and now an adjournment was asked for to see if he could dispose of pre-war patents. On the debtor stating that he could complete negotiations for those patents inside one month, and then pay 20s in the £, the Registrar granted an adjournment for one month.

LIGHTING AND POWER NOTES.

Arbroath.—Street Lighting.—The Arbroath E.L. and P. Co. has asked the T.C. whether the electric lighting of the streets is to be continued.

Ashton-under-Lyne. - Proposed Extensions. — The T.C. has approached the Hurst U.D.C. with a view to supplying electricity within its area.

Aughton.—Extension of Time.—The Ormskirk Gas and Electricity Co. has decided to apply to the B. of T. for an extension of the time for the laying of electricity mains to Aughton.

Australia.—Victoria.—Alkali Manufacture. — The Melbourne *Leader* states that Messrs. Brunner, Mond & Co. intend erecting a large factory for the manufacture of alkali in Victoria, and a representative of the company is negotiating with the State Government on the matter.

National Electricity Supply.—During a discussion on the Electricity Commissioners' Bill in the Legislative Assembly, the Minister of Railways stated that the Morwell brown-coal field would be the best and cheapest site for the production of electricity, although the possibilities of water power would be ascertained. It would be the duty of the Commissioners to secure co-ordination of all State or other electricity undertakings, and secure the adoption of standardisation of plant, voltage and distribution. The Premier stated that the measure would not exclude the utilisation of water power.

Sydney.—Water Power. The Local Government Association has brought before the Minister of Works a scheme for the utilisation of the water power at Barren Jack; the cost is estimated at £300,000, and it is stated that the scheme would provide sufficient energy to supply the whole of Sydney.

Depreciation of Plant.—For the purpose of calculating the amount to be paid annually to the depreciation account, the Sydney (N.S.W.) Council has adopted the following schedule, which is to be revised periodically, in connection with its electricity undertaking:—Buildings, underground and overhead mains, and house services, 50 years; machinery, apparatus, &c., 20 years; motors, 17 years; conveyors, hoppers, and meters, 12 years; land, infinity.

Bandon.—E.L. Scheme.—The T.C. has appointed a Committee to consider proposals for the electric lighting of the town, put forward by the Clonakilty E.L. Co. and Mr. Joseph Brandon, a local mill-owner.

Bootle.—Year's Working.—During the past year the income of the Corporation electricity undertaking increased by £2,674, whilst loan charges increased by £4,407 and working expenses by £10,983; there was a deficit of £8,552.

Bradford.—L.G.B. Inquiry.—Colonel Ekin, of the L.G.B., held an inquiry, on the 11th inst., into the application of the Corporation to borrow £295,125 for extensions at the Valley Road and Bolton Road electricity works, and £74,000 for transformers and mains. Mr. T. Roles, the borough electrical engineer, stated that up to two years ago the undertaking was the most economical in Yorkshire, as far as coal consumption was concerned, with an average of 2·49 lb. per unit. The output increased from 24,418,282 units in 1912-13 to 55,539,998 in 1917-18, and he anticipated that this rate of increase would continue. Since the restrictions regarding the small power and lighting consumers had been withdrawn, there had been an abnormal rush of applications for supply, and at present 332 applications, for a total of 4,800 kw., were in hand. In view of the present conditions and the proposed linking-up schemes, it was difficult to state the proportion of "spares." The undertaking was already linked-up with the Yorkshire E.P. Co., and he anticipated that, apart from any Government scheme, Bradford would link-up with Leeds and elsewhere. They were paying an average of 21s. to 22s. per ton for coal; in 1912, coal cost ·142d. per lb., whereas in 1918 it was ·313d. Details of the proposed extensions are as follows:—Turbo-generator, with auxiliaries, £118,249; three boilers, fans, pipes, chimneys, &c., £85,510; four forced-draught cooling towers and foundations, £17,600; extension to suction ash plant, £5,500; three rotary converters and mains, £61,556; cable ducts, £6,050; portable coal elevator, £660.

Continental. — Austria. — A Committee for the standardisation of frequency and voltage in Vienna has published its recommendations, which refer to lighting and power transmission, but excepting traction, as a draft for discussion, says *Elektrotechnik und Maschinenbau.* The frequency of 50 cycles per second, and the following voltages are recommended:—D.C., 110, 220, 420 volts; A.C., 220, 380, 3,000, 5,000, 10,000, 15,000, 20.000, 35.000, 50.000, 75.000, 100,000 volts.

Darlington.—Price Increase.—The Electricity Committee has recommended that, from the end of March, the charges for electricity for power and lighting be increased by one-sixteenth of a penny per unit, and that the charges for all D.C. supplies be advanced by a further 5 per cent.

East Anglia.—National Electricity Supply.—The municipal electrical engineers, town clerks, and chairmen of Electricity Committees of Norwich, Yarmouth, and Lowestoft are to hold a Conference regarding the Government proposals for the establishment of a national electricity supply. There is in East Anglian municipal circles widespread opposition to the proposal to place the control of electricity supply under the Minister of Ways and Communications.

Grimsby. — Proposed Extensions. — Plans for the extension of the municipal electricity undertaking, estimated to cost £100,000, will be considered at next month's meeting of the T.C.

Hardingstone.—Mains Extensions.—The U.D.C. has granted permission for the Northampton E.L. & P. Co. to erect overhead mains within its area.

Hastings.—Proposed Loan.—The T.C. has applied for a loan of £5,000 for electricity services.

Hatfield.—Mains Extensions.—The R.D.C. is to consider the question of granting the N. Metropolitan E.L. Co. permission to lay mains within its area.

Hebburn-on-Tyne.—Street Lighting.—The U.D.C. has decided to apply to the L.G.B. for sanction to borrow £5,850 for the provision of 606 new lamp-posts, this being the amount which the Council agreed to pay towards the scheme of the Northern Counties E.S. Co. for public lighting.

Holywood (Co. Down).—Proposed Increased Lighting.—The U.D.C. has appointed a Sub-Committee to consider the question of increasing the lighting of the town by the utilisation of water-power.

Huddersfield.—L.G.B. Inquiry.—On March 13th, Colonel T. C. Ekin, of the L.G.B., held an inquiry into the application of the T.C. for a loan of £90,000 for extensions in connection with the electricity undertaking. The proposed new plant included a 6,000-kw. alternator (estimated cost, £42 000), boilers (£26,000), cooling towers, switchboards, mains, transformers, and extensions to the coal bunkers and conveyors. The town clerk stated that the sewerage department and manufacturers required an additional 4,000 kw., and the tramway department, which desired to scrap its power station and obtain energy from the electricity department, required 1,000 kw.; the National Shell Factory required 800 kw., and numerous applications had been received from small consumers. It was hoped eventually to scrap the out-of-date single-phase plant, and the total plant would ultimately be capable of an output of 15,000 kw., with a maximum demand of 8,700 kw. Between 1912 and 1917 the undertaking contributed £12,750 to the relief of the rates, but during 1918 there was a loss of £8,000. Before the war they had bought coal at 7s. 6d. per ton; it was now 28s. per ton, whilst the percentage of ash had risen from 15 to 40. The Inspector said he would recommend the application, which was unopposed.

Leeds.—Price Increase.—The recent increases in the charges for electricity (referred to in our last issue) are estimated to produce an average of 4·6d. per unit for private lighting, 1·2d. for power, and 1·5d. for lighting and rateable-value supplies.

Letterkenny (Co. Donegal).—E.L. Scheme.—The U.D.C. has adopted an electric lighting scheme for the town.

London.—Public Lighting Rates.—The B. of T. states that no useful purpose would be served by an inquiry into the rates charged for the supply of public lighting by public undertakings as compared with private undertakings, and as to the standardising of lighting particularly in London and Greater London.

Development Scheme.—The South-Western Divisional Committee of London Electricity Undertakings urges immediate steps to secure the development and inter-connection of existing stations and the provision of a site for a bulk-supply station. It points out that unless local authorities are in a position to prove that they are organised to deal with any necessary extensions they will most likely be very seriously prejudiced by the suggested fresh Government legislation.

Fulham.—Price Increase.—The B.C. has increased its charges for electricity from 6d. to 7d. per unit.

Hammersmith.—Proposed Linking-Up.—Owing to the delay in the proposed Hammersmith-Battersea-Fulham scheme for the linking-up of electricity supply, the B.C. has invited the Battersea and Fulham Councils to appoint deputations to confer with the Hammersmith B.C. on the question, with a view to settling any differences at an early date.

Stoke Newington.—Mains Extensions.—The E.L. Committee has recommended that the electricity mains be extended to Millard Road, at a cost of £102.

Malvern.—Proposed Extensions.—The U.D.C. has decided to canvass West Malvern as to the advisability of extending electricity mains to that district. The cost is estimated at £4,000.

Matlock.—E.L. Scheme.—The U.D.C. has decided against the scheme of a Glasgow firm to supply the town with electricity, and has expressed the opinion that the matter should be taken up by the Council itself.

Paisley.—Proposed Extensions.—The T.C. has decided to seek permission to borrow £59,500, for extensions in connection with the electricity undertaking. The scheme includes a substation in West Croft Street, E.H.T. mains, transformers, two boilers, &c., which will be required in order to supply the Paisley District Tramways Co. and large power consumers in the district.

Rochdale.—Developments.—Mr. F. H. Rudd, borough electrical engineer, gave an address last week on the growth of the local electricity works. The supply was commenced in 1900, and in the first year the supply was 90,000 units for lighting and 2,276 for power. In 1914 the output was 6½ million units, but in 1917 it had increased to 16 millions. In future, power stations would have to be erected on a much larger scale, as the demands would be so great as to almost dwarf the present loads. The Corporation would not be justified in incurring any expenditure on the power station other than was absolutely necessary, as any alterations would be outgrown in a short time. It had been practically decided to meet the immediate extra demands for power in Rochdale by taking a bulk supply from the Lancashire E.P. Co., whose generating station was at Radcliffe, eight miles distant. Overhead mains would be constructed along almost the whole of the route, at a pressure of 10,000 volts.

South Africa.—Strike.—According to the daily Press, the power-station hands and tramway men have struck, and the town of Pretoria is without electricity. Other public services are disorganised, and it is said that there is grave unrest among miners and artisans of all classes, which may at any moment lead to a serious situation.

South Molten.—E.L. Scheme.—The T.C. has decided to consult an electrical engineer as to the practicability of harnessing the river Mole for the generation of electricity.

Stoke-on-Trent.—Church Lighting.—The Council has agreed that the price of electricity supplied to places of worship shall be at the same rate as that supplied to kinemas.

Tiverton.—E.L. Scheme.—The T.C. has referred to the Lighting Committee a proposal to secure an E.L. installation for the town.

TRAMWAY AND RAILWAY NOTES.

Allerton (Yorks.).—Proposed Extensions.—The P.C. has asked the Yorkshire (W.R.) Electric Tramways Co. to extend its service from Castleford to Allerton-Bywater.

Ashton-under-Lyne.—Proposed Loan.—The Tramways Committee has decided to apply to the L.G.B. for sanction to borrow £4,150 for increased shed accommodation required by the taking over of part of the system of the Oldham, Ashton and Hyde Co.

Bo'ness.—Electric Vehicle.—The T.C. has purchased an electric vehicle, at a cost of £1,005, for the collection of refuse.

Burton-on-Trent.—Proposed Loan.—The T.C. is to apply for a loan of £3,400, for tramway depôt extensions, overhead equipment, and rails.

Continental.—Spain.—Strike.—The situation at Barcelona is becoming worse than ever. Martial law was proclaimed last week, which step was taken after new strikes by the tramwaymen and other transport workers. Strikers who were called up for military service, and who resisted their officers, have been imprisoned. All public services are running under military organisation.

About 90 tramcars, operated by soldiers, were run on Sunday last, but were boycotted by the workmen. A meeting between the company and the strikers, with a view to arriving at an understanding, ended in complete failure.

Edinburgh.—Tramway Electrification.—After inspecting the tramway systems in London and Bournemouth, a deputation of the Tramway Committee has come to the conclusion that the conduit system for Princes Street is "well worth consideration."

The Tramway Committee has agreed upon the provision of fifty top covers for existing cars.

Mr. Pitcher, the manager, is to make arrangements regarding an administrative staff, and to advertise for a traffic superintendent at a salary of £450 per annum.

Egypt.—Following on the arrest and deportation of certain agitators, several demonstrations took place at Cairo, last week, when shops and tramway cars were attacked, and in consequence the tramway services ceased running on Tuesday, last week.

Great Yarmouth.—Year's Working.—A deficit on the tramway undertaking of £3,500 is to be covered from the rates.

London.—Tramcar Fire.—A fully-laden L.C.C. tramcar took fire on Wednesday, last week, in the Peckham Road, Camberwell. No passengers were hurt.

Derailments.—Much inconvenience was caused to City workers on Thursday, last week, by three tramcar mishaps. In the Walworth Road, where the track is under repair, a car left the metals and got into a hole at the side. It was by the merest chance that the car did not turn completely over. Traffic was held up, and at one time there was nearly a mile of waiting cars. The service in New Cross Road was also held up, owing to the fouling of a car's plough; while at Deptford, too, tramway traffic was suspended owing to a car leaving the track because of an obstruction in the central conduit rail. It took a considerable time to clear the line.

Tramway Season Tickets.—Notice of motion has been given that it be referred to the L.C.C. Highways Committee to consider the question of issuing monthly and quarterly season tickets on the Council's tramway service.

Post Office Tube.—A White Paper, issued last week, shows that out of £1,000,000 sanctioned for the construction of the Post Office tube railway in London, £714,466 was expended up to March 31st, 1918. Tunnelling alone cost £561,917 up to that date.

New Zealand.—Auckland.—Negotiations are in progress between the Auckland Electric Tramways Co., Ltd., and the City Council, with a view to the acquisition of the undertaking by the municipality.

Northampton.—Breakdown.—Owing to a breakdown at the generating station, on March 8th, the tramway service was disorganised during the week-end.

Morley.—L.G.B. Inquiry.—An inquiry was held last week into the application of the T.C. for a prov. order to extend the railless trolley system from Leeds to Ardsley, *viâ* Morley, a total length of 7 miles.

Musselburgh.—Fare Revision.—The Musselburgh and District Electric Light and Traction Co. has received B. of T. sanction to increase its tramway fares by 50 per cent., with a minimum of 1d. for workmen's fares.

United States.—Strikes.—The tramway strikes at Newark and New Jersey have practically stopped passenger traffic; service men have refused to work the systems.

TELEGRAPH AND TELEPHONE NOTES.

Buenos Aires.—The employés of the telephone companies have gone on strike.

India.—An auxiliary wireless service has been established by means of the existing Government stations to augment the cable service to India.

Isle of Man.—Pending the repair of the submarine telegraph cable between the Isle of Man and England, the public telegraphic service is now being conducted by wireless at the usual Inland rates. The Admiralty installation at Douglas is being used, the English station being situated at Heysham.—*The Times.*

Marconi Co. and the War.—The Postmaster-General, in reply to a question in the House last week, stated that the Government had made considerable payments on account of the services rendered by the Marconi Co. during the war at stations in this country, and proposed a basis of settlement to the company in May last, which was not accepted. The services had now practically ceased, and the question of making a further offer to cover the period up to the date of cessation was under consideration.

The amount of damages for the cancellation by the Government of the contract for the proposed Imperial wireless chain was remitted by the High Court to an arbitrator. The company has formulated a claim, but a date has not yet been fixed for the hearing.—*The Times.*

Poland.—The Minister of Posts and Telegraphs, in view of certain defects in the construction of the network of wireless stations erected by the occupying powers, intends to build a new network. The cost of constructing the central station is estimated at Mk. 250,000, and the smaller ones at Mk. 30,000.—*Nowa Reforma.*

Priority Abolished.—On Tuesday the Postmaster-General abolished Government priority telephone calls. Priority in future will be allowed only to Cabinet Ministers and certain heads of departments at the War Office, and then only by the use of a code word. At the same time, an Order severely limits Government Department priority rights on cables. Government and non-Government messages will in future be sent at all cable stations during alternate half-hours. If Government cables are still excessive, priority rights will be abolished entirely.

Spain.—At the opening of the new commercial wireless service between Great Britain and Spain on March 13th, messages of congratulation were exchanged between the King of Spain and Senatore G. Marconi.

Telephone Breakdowns.—In answer to a question in the House of Commons last week, the Postmaster-General stated that complaints had been received concerning the telephone service at Manchester. Approximately 15,000 subscribers' lines were broken by the snowstorms in that area on January 4th, in addition to a large number of main telephone and telegraph lines. About 11,000 subscribers' lines had already been repaired.

Trans-Atlantic Wireless Telephony.—It is announced by the Marconi Co. that it has succeeded in establishing wireless telephonic communication between Ireland and Canada.

United States.—The Navy Department has released the high-power stations of the Marconi Co. at Belmar, N.J., and at Chatham, Mass.

The Court of Errors, the Court of last resort in the State of New Jersey, on January 7th affirmed the judgment against the Marconi Co., awarding royalties of $300,000 to the International Radio Telegraph Co., of New York.

Wireless in the Air Service.—Major-General Seely, Under-Secretary for Air, in introducing the air estimates for the ensuing year, in the House last week, speaking of the aerodromes which will be required in this country for civil aviation, said that they would be fitted, amongst other signalling systems, with telephone and telegraph stations, with directional wireless enabling machines to be directed from the ground, and, he was glad to say, with wireless telephones, in which only in the last few days they had achieved a result which they had been trying to secure for years. Until a few days ago it was possible for one aeroplane to communicate with another, but not to receive the answer. They now had a wireless telephone with which they could both send and receive on the same instrument.

According to the *Daily Mail*, a squadron of British aeroplanes passing over the City on Friday afternoon kept up communication by means of wireless telephony. In this system the receiver of an ordinary wireless telegraph set can be adjusted, it is said, to receive the spoken message, as well as the Morse code, from a telephone transmitter. The perfection of the wireless telephone has been the result of very extensive work at the R.A.F. experimental station at Biggin Hill, following original research work by the R.F.C. at Woolwich. As far back as March, 1918, British machines were being controlled by telephonic orders, and to-day, it is claimed, conversations can be held with machines over 150 miles from the control station, and trailing aerials are no longer necessary. Conversation can be held without talking through the lips at all, thus the pilot's message is not drowned by the roar of the engine. An appliance has been invented which is placed round the pilot's throat, so that when he speaks the movements of the throat are transmitted as words.

Wireless Operators.—No amicable settlement having been come to between the Marconi Co. and the Shipping Federation and the Association of Wireless Telegraphists as to the payment of the bonus which was arranged to be paid to the operators in October last, the Wireless Telegraphists' Association gave notice to the Ministries of Shipping and Labour that action was to be taken on Monday by the operators. The Association contends that the operators are entitled to the special war risk bonus of £3 a month which was granted to the mercantile marine in October, 1918. *Birmingham Post.*

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Australia.—SYDNEY.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

April 28th. Municipal Council. Power transformers. Electrical Engineer, Town Hall, Sydney.

May 15th. Department of the Treasury, Brisbane. H.T. switchboard, storage battery and motor-generator set for the Electric Power House, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Bedford.—Corporation Electricity Department. Geared turbine to drive an existing alternator. (See this issue.)

Grimsby.—April 10th. Corporation Electricity Department. One 3,000-KW. steam turbine, 6000/6600-volt, 3-phase alternator, condenser, pumps, &c. : two water-tube boilers, stokers, superheaters, fans, steel chimney, &c. : cooling tower, &c. (See this issue.)

Ipswich. — Corporation Electric Supply Department. Pipework in connection with the new steam turbine. (March 14th.)

Liverpool.—March 25th. West Derby Union. Electric supplies from April 1st to June 30th. Mr. H. P. Cleaver, Union Clerk, Union Offices, Brougham Terrace, Liverpool.

London.—March 27th. West Ham Union. B. of G. Six months' supply of electrical fittings. Mr. T. Smith, Clerk to the Guardians, Union Road, Leytonstone, E.11.

OFFICE OF WORKS.—One 300-KW. Belliss generating set, or two 150-KW. Belliss generating sets. (See March 14th.)

Manchester. — March 25th. Corporation Tramways. Copper and bronze trolley wire. Specification, &c., from Mr. J. M. McElroy, General Manager.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Bradford.—Electricity Committee :—

Two oil switches for 1,500-KW. rotary converters.—British Westinghouse Co., Ltd.
Spare battery for electric tipping wagon.—Chloride Electrical Storage Co., Ltd.
Two Tray coal conveyors.—Goodall, Clayton & Co., Ltd.
One 30-ton electrically-driven travelling crane. Thos. Broadbent & Sons, Ltd.

Tramways Department :—

Copper rail bonds, £363.—B. I. & Helsby Cables, Ltd.
Five miles of round copper trolley wire, £572.—Thos. Bolton & Sons, Ltd.

Winchester.—T.C. House service meters for a year. Messrs. Chamberlain & Hookham.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, March 21st. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Jigs, Tools, and Special Machines with their Relation to the Production of Standardised Parts," by Mr. H. C. Armitage.

Electro-Harmonic Society. — Friday, March 21st. At 7.45 p.m. At the Holborn Restaurant (Venetian Chamber). Smoking Concert.

Institution of Electrical Engineers.—Friday, March 21st. At 1, Wimpole Street, W. 1. At 8 p.m. Joint meeting with the Royal Society of Medicine (Electrical Section). Papers on "Some Notes on Electrical Methods of Measuring Body Temperatures," and "Some Notes on the Electro-Cardiograph," by Mr. R. S. Whipple.

Thursday, March 27th. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Paper on "The Co-ordination of Research in Works and Laboratories," by Mr. J. S. Highfield.

(**North-Eastern Centre**).—Monday, March 24th. At the Mining Institute, Newcastle. At 6.45 p.m. Paper on "The Determination of the Efficiency of the Turbo-Alternator," by Dr. S. F. Barclay and Dr. S. P. Smith.

(**North-Western Centre.**)—Tuesday, March 25th. At the Engineers' Club, Manchester. At 7 p.m. Popular lecture on "The Atom of Electricity," by Sir Ernest Rutherford, F.R.S.

(**South-Midland Centre**).—Wednesday, March 26th. At the University, Edmund Street, Birmingham. At 7 p.m. Paper on "Condensers," by Mr. R. J. Kaula.

(**Students' Section**).—Tuesday, March 28th. At 7 p.m. At the City and Guilds (Engineering) College, South Kensington. Lecture on "The Organisation of Technical Engineers," by Dr. J. F. Crowley.

Junior Institution of Engineers.—Friday, March 21st. At 7.30 p.m. At 39, Victoria Street, S.W. Social evening.

Royal Institution of Great Britain. — Saturday, March 22nd. At Albemarle Street, W. At 3 p.m. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Electrical Power Engineers' Association (Glasgow Section).—Saturday, March 22nd. At the Trades House Restaurant, Glasgow. Dinner.

Manchester Association of Engineers.—Saturday, March 22nd. At the Grand Hotel. At 6.30 p.m. Annual meeting. Paper on "Development of Reinforced Concrete," by Mr. B. Taylor.

Royal Society of Arts.—Monday, March 24th. At 4.30 p.m. At John Street, Adelphi, W.C. Cantor lecture on "Fuel Economy," by Prof. W. A. Bone, F.R.S. (Lecture III.)

Wednesday, March 26th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "British Engineering and Hydro-Electric Development (the Training of Engineers)," by Prof. A. H. Gibson.

Institution of Civil Engineers.—Tuesday, March 25th. At 5.30 p.m. At Gt. George Street, S.W. Further discussion on papers on "Electric Welding."

Industrial Reconstruction Council.—Tuesday, March 25th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Place of the Merchant in British Industry," to be opened by the Hon. F. M. B. Fisher.

Physical Society of London.—Friday, March 28th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Discussion on "Metrology in the Industries," to be introduced by Sir R. T. Glazebrook, F.R.S.

NOTES.

Electro-Harmonic Society.—The last smoking concert of the season will be held at the Holborn Restaurant in the Venetian Chamber to-night (Friday), commencing at 7.15 p.m. Mr. F. A. B. Lord, C.C., will be in the chair. Artistes :—Mr. Gale Gardner, tenor ; Mr. Walter P. Scott, bass ; "The Three Freds" Mr. Fred Gregory, baritone ; Mr. Fred Gibson, humorist ; Mr. Fred Wildon, Phonofiddleoddities ; Mr. Fred Curtis, comedian ; Mr. Warwick Pryce, musical sketch at the piano ; and Mr. Bernard Flanders, A.R.A.M., solo pianoforte and accompanist.

Copper Prices.—Messrs. James & Shakespeare report March 19th, copper bars (best selected), sheets and rods, £114.

Wiremen in the Navy.—The Admiralty has sanctioned the establishment as from June 10th, 1918, of the following rates of pay :—

	s.	d.	
Wireman, 2nd class	2	8	a day.
Do. over three years...	2	11	,,
Wireman, 1st class	3	3	,,
Do. over three years as such ...	3	6	,,

Time served in the obsolete rating of armourer's crew (wireman) is allowed to count as service as wireman 2nd class.

Scientific Management.—The following series of lectures has been arranged by the Industrial Reconstruction Council to take place at the Institute of Journalists, 2 and 4, Tudor Street, E.C. 4. There will be a different speaker at each lecture, which begins at 5.30 p.m., and is followed by a discussion. No tickets are necessary :—

April 1st.—"The Determination of Standards in Scientific Management."
,, 15th.—"The Planning Department in Scientific Management."
,, 29th.—"Incentives to Efficiency in Scientific Management."
May 13th.—"Costing in Relation to Scientific Management."
,, 27th.—"The Relation of Welfare Work to Scientific Management."
June 10th.—"The Benefit to the Workman of Scientific Management."

National Electricity Supply.—According to the *Daily Dispatch*, Mr. Waddington, Captain C. Ainsworth, Mr. Marshall Stevens, Captain Barnett, and Mr. Lewis Haslam, form a sub-committee which has been appointed by the Commercial Committee of the House to watch national electricity questions at Westminster.

Appointments Vacant.—Station superintendent (£226), for the Rawtenstall Corporation Electricity Works : lecturer in electrical engineering (£300, rising to £350), for the University of Bristol Merchant Venturers' Technical College. See our advertisement pages to-day.

Rebuilding a 25,000-KW. Parsons Generator.—A number of years ago the Commonwealth Edison Co. installed in its Fisk Street station a Parsons turbine driving a 25,000-KW. generator. The turbine had considerable margin of overload capacity, and it was decided to reconstruct the generator to make this a 30,000-KW. machine. The process has been carried out satisfactorily.

Engineering Developments in Occupied Territory.—The Manchester *Daily Dispatch* hears "that the Government are about to send a mission—consisting of representatives of the electrical and engineering concerns, and also the machine tools and textile industry—to the occupied territories of Germany and Austria to investigate the developments of engineering during the war. The mission is under the direction of the Ministry of Munitions."

The Transport Bill.—The transport system of this country is in a state of chaos, and quite incapable of meeting the demands which are going to be made on it, Sir Eric Geddes told the House on Monday, in explanation of the far-reaching powers which he is seeking under the Ministry of Ways and Communications Bill. The importance of the transport problem was urged in forceful terms, and Sir Eric said he was not exaggerating when he stated that, with the exception of the municipal tramways, this country's transport systems were to-day financially in a semi-paralysed state. They were in that state either because they were not very prosperous before the war or because they had had the shadow of nationalisation overhanging them, and their development had been retarded through capital expenditure not being undertaken. Further, apart from their financial position, they were physically ill-equipped to meet the great strain upon them, and they ought to be put back on a paying basis. In the past private interest made for development; to-day it made for colossal waste. On the subject of electricity, Sir Eric denied that as a transport authority the industrial requirements of a district would be disregarded. Transportation was not merely carrying something from A to B; it was the greatest power that they had for bringing prosperity to the community, and for developing the districts served by it. In everything that made for the prosperity of the district itself, it was in the interests of the transportation agency to push it, and the suggestion that such an agency, with electricity of all things, would desire to penalise the manufacturer could only be put forward by one who did not understand really what they were after. It was estimated conservatively, that when they got through the electrification of the main lines, which should be done and done promptly—and it would be undertaken if the Bill became law—fully 20 per cent. of the electricity of the country could be used for traction. There was no estimate of the actual cost, but from their experience of actual experiment, it was a very remunerative proposition. The advantage of electrification was not only in the reduction of the price of energy, but also in the extra traffic that could be worked over the line, so that there was a still further advantage in developing industrially the district that was electrified. As the lines of railways were the most direct, the safest, and the easiest routes for the H.T. transmission lines, and it was in every way in the interests of the railway and transportation agency to get electricity spread out into the industrial areas, it was really a fallacy to suppose that it would be against the interests of the railways and the Ministry as a whole to develop the industrial use of electricity. The difference between co-operative use and co-operative production of electricity was enormous, and there was no district in this country where electricity was better organised to-day than along the North-East Coast. There the Electric Power Co. had worked hand-in-hand with the North-Eastern Railway. There they had a joint organisation—he was instrumental in setting it up—for attracting industry to and developing industry in the district. They jointly arranged for placing the power stations near the coal mines, and developing the economic use of waste heaps. That was not against the interests of the railway, because it developed the prosperity of the district, and it was in that spirit only that they looked at the question.

British Engineering Standards Association.—It is announced in the *Journal* of the Institution of Electrical Engineers that the Sub-committee on Electrical Accessories (Mr. C. H. Wordingham, chairman) has completed the preparation of the following specifications:—

Electricity meters (B.S. Report No. 37/19).
Ordinary duty cut-outs (B.S. Report No. 88/19).
Motor starters (B.S. Report No. 82/19).

A number of other specifications for electrical apparatus are on the point of completion. Owing to the wide range covered, the Sectional Electrical Committee has set up additional sub-committees to deal with electricity meters (Mr. C. C. Paterson, chairman), electrical instruments (Mr. E. B. Vignoles), electric control gear (Mr. C. H. Wordingham), and heating and cooking apparatus (Mr. S. T. Allen).

The Association has had in hand the preparation of specifications for aircraft material, and a Sub-committee on Electrical Parts (Mr. C. C. Paterson, chairman) has dealt with electrical apparatus; eight specifications have been issued, and will probably come up for revision in due course by the electrical section of the Association.

Fatality.—An inquest was held last Friday, at Ripon, into the cause of death of Ernest Pogson (30), chief engineer at the electric power station, North Camp, who was killed on the previous night. The medical evidence showed that artificial respiration and other measures were tried for some time, but without success, and that death was due to heart failure, the result of electric shock. The technical evidence showed that deceased was working at the power station behind the cubicles. He put his left hand inside the No. 2 cubicle to trace the wire; his right hand was resting on the iron framework. He had no rubber gloves on, but had one foot on the rubber mat. Previous to putting his hand into the cubicle he had tested the terminals, and said there was no current. He then had the gloves on. All the cubicles had been shut down except No. 2, and the engine driving the dynamo was running light, and was not supposed to be generating current. J. T. Shepherd, who was working with him, suggested shutting down the engine altogether, but deceased said it was all right. Deceased could not have done what he intended to do with the gloves on. The only reason why the engine should not have been stopped was that it would have delayed the supply of electricity. Second Lieut. A. Redfern, district electrical and mechanical engineer, Northern Command, Darlington, said that upon examination after the accident he found that all high-tension switches on the board that controlled all the high-tension apparatus were in the off position, and the locking pins were all in position, and all generators were shut down. But the switches which were out did not control the cable which made a solid connection between one terminal on the switch board and the generator. This terminal could not be made dead unless the engine was standing or running at a very slow speed. After the accident witness placed himself in the same position as the deceased was said to be in, and he found his forearm rested on a bent wire and his wrist touched the terminal of the cable connected direct to the generator, which would be a live cable to a greater or lesser degree according to the speed of the engine. On examination of the body witness found on the left wrist six or eight lines about a quarter of an inch long exactly corresponding with the screw thread of the terminal.

From 12,000 to 116,000 KW.—The Ashley Street plant of the Union Electric Light and Power Co., St. Louis, Mo., was originally laid out to house only three 3,000-KW. and two 1,500-KW. cross-compound vertical Corliss units, aggregating 12,000 KW. Upon completion of work now in progress there will be installed between the same four walls three 20,000-KW. horizontal, four 12,000-KW. vertical, and two 4,000-KW. horizontal turbines, or a total capacity of 116,000 KW.—*Electrical World.*

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Thursday last week Mr. G. L. Addenbrooke delivered the third and last of his lectures on dielectrics. Dealing with tests on mineral oils, he showed that the phenomena were generally similar to those observed in the case of blotting paper; the curve of losses was much flatter, but the apparent watts curve bent over at a low frequency and became practically proportional to the frequency. On drying the oil, the power input became directly proportional to the frequency, the losses being negligible; the true dielectric constant thus obtained was about half that given in the usual tables. The various actions observed could now be isolated from one another over the whole range of frequency.

In the case of glass, as in others, the capacity increased with frequency; at low frequencies the dielectric coefficient was higher than at high frequencies, and the coefficient decreased with the temperature, becoming constant at very low temperatures. In the case of celluloid the moisture could be dried out, but in the case of glass the material that caused the change in the coefficient remained in it. Much work remained to be done on the effects of temperature variation. The change of capacity with temperature of dried celluloid was small, but when the celluloid was not dried there were considerable changes with both frequency and temperature, and the temperature coefficient at zero frequency was much greater than at 200 cycles/sec. Celluloid was a typical subject for experiment. He had made a special glass cupboard in which experiments could be carried on whilst the humidity of the air was under control, and thus the changes of moisture content in the celluloid could be actually weighed; the results of these tests showed no trace of any "mass" action apart from the effects due to the moisture.

The D.C. and A.C. losses, as well as the changes in capacity, increased with the proportion of moisture present, and the A.C. losses were practically a measure of the moisture, a fact which would be of use in cable manufacture, as the moisture present could be determined at every stage by electrical observations. Cable breakdowns were due to moisture, not as a rule due to defects in the materials used.

It was difficult to apply similar tests to oil, but a method had been proposed by which the moisture content of oil could be determined.

The temperature effects, which were very large, might be accounted for by the vapour tension of water, which varied largely at similar temperatures.

He believed that he had obtained a new series of dielectric constants, free from the effects of the losses, which were included in the values given in tables at present. These true constants showed a definite relationship with the densities and atomic weights of the elements.

In conclusion, Mr. Addenbrooke outlined a theory of capacity effects based on the electron hypothesis, and gave reasons for supposing that the moisture in a dielectric was diffused throughout its substance.

On Monday last the first of the "informal meetings" of the Institution took place, at the rooms of the Chartered Institute of Patent Agents. The proceedings were opened by Mr. C. H. Wordingham, Pres.I.E.E., who took the chair at the commencement, and briefly explained the objects which the Council had in view in arranging for the meetings to be held; he pointed out that while they were intended specially to serve the interests of the junior members, they were, nevertheless, meetings of the Institution, and should be conducted in accordance with its traditions. Mr. F. Pooley then read a paper on questions relating to Trade Unionism, though, he said, it dealt rather with the relations between Capital and Labour. Reviewing the history of the subject. he remarked that in the early days many employers treated their workers badly; strikes took place only under great provocation, and entailed great suffering. Nowadays the workers had combined and had discovered their strength—they had strike funds. and were shielded by the law, which had been loaded in their favour by politicians who were now reaping the fruits of their class legislation and the preaching of class hatred. The unrest of the present day, in his opinion. was largely due to nervous war strain on the part of both employers and workers: there was also a persistent lack of confidence between them. and the shop-steward system of control introduced additional difficulties. Production was essential to the restoration of prosperity, and the greatest need of the time was an effective propsganda. explaining to the workers the evils of restriction of output, the elements of economics, and the necessity for co-operation. He placed great reliance on the prominent labour leaders, and suggested that they should be granted statutory authority to deal with labour questions, while provision should be made for attaching Trade Union funds in order to compel adherence to agreements. Strikes should be made illegal unless every other resource had been exhausted.

Mr. Wordingham complimented Mr. Pooley on his able address, and after an interval for refreshments an interesting discussion followed, to which Messrs. Rankin (chairman), Paul, Law, Dickinson, and Oswald contributed: the proceedings closed at 9.40 p.m.

It was announced that on the afternoons of the days on which future informal meetings would be held, visits to works would take place, the first being to the Osram Lamp Works. Those desirous of taking part in the visits should communicate with the Secretary as soon as possible.

In the current issue of the *Journal* particulars are given of the arrangements which have been made by the Council for the administration of the Paul Scholarship for post-graduate work on the development of ways and means for electrical measurements, based on the gift of £500 by Mr. R. W. Paul. A Committee has been appointed to make the awards.

The Council has appointed Mr. W. Elsdon Dew to be the Local Hon. Secretary and Treasurer of the Institution for the Transvaal, in place of the late Mr. J. Hubert Davies.

A Committee has been appointed to arrange for sectional meetings for the reading and discussion of papers on Wireless Telegraphy. The members of the Committee, in addition to the President. are Major E. A. Barker. Mr. C. Bright, Dr. W. H. Eccles, Prof. G. W. O. Howe. Mr. W. Judd, Prof. E. W. Marchant, Major J. Erskine-Murray. Capt. H. R. Sankey. Mr. J. Sayers, Major T. V Smith, Mr. A. A. Campbell-Swinton, Mr. J. E. Taylor, and representatives of the Admiralty. Air Ministry, and War Office.

A preliminary Committee is engaged in drawing up a draft Memorandum and Articles of Association for a proposed Society of Radiographers, to ensure that only adequately trained radiographers are employed in electromedical work, and to promote the science and practice of Radiography. The Committee comprises Mr. C. H. Wordingham, Mr. J. S. Highfield, Mr. A. A. Campbell-Swinton, and Dr. R. M. Walmsley, nominated by the Institution; Dr. R. Knox, Dr. C. R. C. Lyster, Dr. S. Melville. and Dr. F. Hernaman-Johnson, nominated by the British Association of Radiologists and Physiotherapists; and the following radiographers:—Messrs. F. E. Doran, G. F. Westlake, H. Henry, and W. Turner.

The twelfth list of the Roll of Honour of the Institution appears in the *Journal* for February.

Diesel Engine Users' Association.—Further additions to the membership of the Association were announced at the meeting held this month. Notice was given that at an early meeting a paper was to be read by Mr. Geoffrey Porter on the subject of engine wear, the discussion of which should prove to be useful and instructive. Owing to his serious illness, Mr. C. T. Bullough was prevented from stating his experience in connection with his system of electrically heating tar-oil fuel. An interesting announcement was the formation of a French Association of Manufacturers and Users of Internal Combustion Engines, and the suggestion that the two Associations should co-operate in promoting the interests of users and manufacturers of heavy-oil engines. The subject of the allowance for depreciation in connection with income-tax assessment purposes for Diesel and semi-Diesel engines is again receiving the attention of the Committee. A discussion took place on the definitions of Diesel and semi-Diesel engines respectively. Draft definitions were submitted, with suggestions and proposed modifications.

Chief Technical Assistants' Association.—The annual general meeting of the above Association was held on the 8th inst. The retiring chairman, Mr. H. F. J. Thompson (Battersea), reviewing the work of the past year, referred to the kindly assistance of Mr. C. H. Wordingham, C.B.E., President I.E.E., in bringing the C.T.A.A. and the E.P.E.A. together, with the result that the members of the former decided to join the latter for protective purposes. An eminent engineer—one who always had the welfare of the assistants at heart—had told him that it would be in the interests of all concerned, if these sectional organisations would band together and form one large protective association, but it must be done quickly. Mr. Thompson hoped that all engineers. of whatever rank, would follow that advice. and join the E.P.E.A. He regretted he had not permission to publish the name of the engineer referred to. because, if he could, he was sure that it would result in the enrolment of a number of engineers who, for some reason not quite understandable, were holding aloof, to the detriment of themselves and others. The main object of the C.T.A.A. was to hold debates on subjects directly connected with electricity supply, and some very useful papers had been read and discussed during the past year.

The new chairman, Mr. J. H. Parker (vice-president E P.E.A.), referred to the good work done by Mr. Thompson in advising the members to join the E.P.E.A. In the near future, he said, many occasions would arise in which unity would be essential to safeguard their interests, and therefore he trusted that all electricity supply engineers would get together at once and, if the E P.E.A. did not come up to their ideals, endeavour to make it so. He also mentioned the good work done by Mr. MacAlister as hon. secretary, since the formation of the C.T.A.A. some six years ago; he was sorry to hear he was relinquishing that office, but he had a good successor in Mr. Thompson, who, together with Mr. MacAlister, was responsible for the formation of the C.T.A.A. The following officers were elected for the ensuing year: Chairman, Mr. J. H. Parker (Croydon): vice-chairman, Mr. A. P. MacAlister (Islington); hon. secretary, Mr. H. F. J. Thompson (Battersea); executive committee, Mr. J. T. Baron (St. Pancras), Mr. W. Young (Stepney). Mr. E. R. Ingram (Poplar).

The Institution of Automobile Engineers.—The ninth meeting of the session will be held on Wednesday, April 2nd, at the Royal Society of Arts, at 8 p.m., when Mr. Carl Opperman will read a paper on "Electric Vehicles." Cards of invitation to the meeting may be obtained by those interested in the subject on application to the Secretary of the Institution of Automobile Engineers, 28, Victoria Street, London, S.W. 1. A further meeting will also be held at the Chamber of Commerce Hall, New Street, Birmingham, on the following day, viz., Thursday, April 3rd, at 7.30 p.m., when Capt. G. Smith-Clarke will read a paper entitled "Some Notes on Petrol Flowmeters and the Calibration of Carburettor Jets." Cards of invitation to this meeting may also be obtained as above.

High-Speed Steel.—At a meeting of the Allen West Engineering Society, held at the Brighton Technical College, a lecture was delivered by Mr. T. Shawcross, manager of the Crucible Steel Department of Messrs. Armstrong, Whitworth & Co., Ltd., on the present-day development and practical application of high-speed steel. There was an attendance of about 250. Mr. Shawcross described, with the aid of lantern slides and exhibits, exactly how high-speed tool steel had been developed to its present pitch of perfection: how it was made, and how it should be used. The feature of the lecture was the introduction for the first time to British engineers of a new hardening process for high-speed tool steel. This new treatment aroused the greatest interest, and will be of the first importance to British engineering shops.

Electric Welding.—The possibilities of electric welding as a commercial proposition were dealt with by Mr. H. W. Wolton in an address to the members of the Birmingham and District Electric Club, on March 8th. The system of electric welding he pointed out, might be divided into arc welding and resistance welding. The amount of work accomplished by the former in factories during the period of hostilities covered a very wide field The bodies of the majority of the submarine mines had been welded together by this means, and it had also enabled damaged warships to be repaired very quickly. The majority of steel tire and rims for the Army transport departments were electrically welded during the war. One firm supplied approximately two million rims of various sections for the Allied Armies, the whole of which were welded by the resistance method.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Southampton Electricity Committee has received the resignation o Mr. H. L. Mills, for many years deputy electrical engineer Mr. Mills has served throughout the war in the Navy, and has decided to remain afloat.

Mr. Benjamin Hall, assistant borough electrical enginee and tramways manager at Keighley, has been appointe rolling stock superintendent and works manager and enginee to the Wigan Corporation Tramway Department, at £250 a year, rising to £300.

Mr. S. L. Pearce, chief engineer and manager of the Manchester Corporation electricity works, received the orde of the C.B.E. from the King at Buckingham Palace, las week.

Mr. George Webster, general manager, Rochdale Corporation trams, was invested with the O.B.E. Order by the King last week, in recognition of the war work he performed in connection with the National Shell Factory, Rochdale.

Bradford City Council has authorised the Electricity Committee to enter into an arrangement with Mr. J. H. Shaw the deputy city electrical engineer, for the retention of his services, part time, for a period of twelve months from April 1st next, on terms to be agreed, not exceeding half the amount of his present remuneration.

Major H. Richardson, M.C., has now been demobilised and has taken up his duties as general manager and enginee of the Dundee electric supply department. Major Richardson resigned his commission in the local engineers a few month before the outbreak of war, and applied to be reinstated immediately war broke out. He was gazetted to his ol company, and after a period of training, proceeded to France in June, 1915. He has been continuously on active service from that date until last week.

With reference to a notice appearing in our last issue regarding appointments at Bo'ness and Musselburgh, we should state that Mr. McCulloch has been appointed chief assistant to Mr. H. C. Babb, and is resident in Bo'ness, but Mr. Babb still retains the position of engineer and manager to the Bo'ness electric power station, which is run by the National Electric Construction Co. Mr. Babb is at the same time engineer and manager to the Musselburgh and District Electric Light and Traction Co.

Mr. S. Cameron Gibson has resumed his duties as borough electrical engineer and manager of the electricity department at Nuneaton, having now been demobilised from the Navy.

General.—To mark the return from war work in the fuse shop to meter work, the employés of Messrs. Ferranti, Ltd., electrical engineers, Hollinwood, Manchester, to the number of about 500, enjoyed a fancy dress masked ball last week. The guests included Mr. and Mrs. Ferranti and Capt. Ferranti. A presentation of a timepiece, constructed as a model of a Ferranti electrical meter, was made to Mrs. Ferranti, and a miniature model of a Ferranti power transformer was presented to Mr. Ferranti.

Mr. E. Brian, of Morecambe, has been appointed chief electrical engineer to the Idris Hydraulic Tin Co. in the Ipoh Province of Perak, F.M.S.

Mr. C. Martin, who has been connected with the British Westinghouse Co.'s turbine business for the past nine years, has resigned, and is now representing Fraser & Chalmers Engineering Works (proprietors, the General Electric Co., Ltd.) at Electricity Buildings, Victoria Bridge, Manchester.

Capt. S. R. Mullard, M.B.E., for many years connected with the lamp manufacturing side of the Ediswan Co., has been demobilised from the R.A.F., and has joined the "Z" Electric Lamp Manufacturing Co., Ltd., of Southfields, as works manager.

Capt. and Acting-Major G. Hooper, Devon Fortress Engineers (Electric Lights Company), has relinquished his acting field rank on ceasing to be employed. Capt. Hooper is the senior captain of the Electric Lights Companies of the Territorial Engineers, his commission being dated April, 1908, and he held acting field rank from July, 1915.

Lieutenant C. J. Evans, Glamorgan Fortress Engineers (Electric Light Company), has been granted the acting rank of captain whilst employed in the command of a company, and Lieut. and Acting-Captain H. K. Benson, of the same corps, has relinquished his acting rank on alteration in posting.

Second Lieutenant C. S. Wait, Tyne Electrical Engineers, has been promoted lieutenant after eighteen months' service.

Lieutenant and Acting-Captain N. Mansfield, Hants Fortress Engineers (Electric Light Company), has relinquished his acting rank. Lieutenant W. D. G. Wilson, Essex Fortress Engineers (Electric Light Company), has been given the acting rank of captain whilst commanding a company.

On Friday evening last, at the Holborn Restaurant, a dinner was given by the sales organisation of the Western Electric Co., Ltd., North Woolwich, in honour of Mr. H. M. Pease, the late sales manager, who has now been appointed managing director. All the branch office managers were present, and a very enjoyable evening was spent under the chairmanship of Mr. A. T. Turney. The toast "Our Guest" was proposed by Mr F. K. Jewson and seconded by Mr. H. H. Markham. The musical items which followed were exceedingly good. The evening was concluded with a presentation to Mr. Pease from the sales staff.

Mr. C. J. Butterworth has been appointed assistant to Messrs. Stevenson & McGuffie, consulting engineers, Glasgow.

Roll of Honour.—Driver W. Collier, R.G.A., who has died whilst with the Army of Occupation in Germany, was employed on the clerical staff of the British Westinghouse Co., Ltd., Trafford Park.

Obituary.—Mr. C. W. Salter.—The death has taken place from pneumonia, at the age of 24 years, of Mr. Charles William Salter, assistant installation inspector for the South Staffs. & Worcestershire Electric Power Co.

Mr. G. H. Mann.—The death occurred, on March 10th, at Leeds, of Mr. George Henry Mann, aged 31, head of the wireless department at the Leeds Central Technical School.

Mr. E. W. Crosland.—The death has occurred at the age of 42 years of Mr. E. W. Crosland, assistant works manager of the British Insulated & Helsby Cables, Ltd., Helsby.

Will.—Lieut.-Col. E. Matthey, C.B.—The late Lieut.-Col. E. Matthey, C.B. (Johnson, Matthey & Co.), left £346,718.

CITY NOTES.

British L. M. Ericsson Manufacturing Co., Ltd.

In his speech at the annual meeting, held in London on March 12th, Mr. W. M. Crowe (chairman and managing director) said that early last year, at the urgent request of the Post Office, they gave up the manufacture of munitions, and put their whole energies on the production of telephone material for the Front, and such a change over could not be done without loss of time, and consequently of money. This turnover had helped them in the end, as they were, when the armistice was signed, working on their legitimate business—telephone work—and this had certainly given them some advantage now. The result was a satisfactory one. Since they met last year they had, at the request of the Government, increased their works considerably, and it was their intention as soon as circumstances permitted, and the time was suitable, to extend still further. They felt that the coming demand for telephone material throughout the world justified such a course, and they were looking forward to a busy time. As they knew, the company was not heavily capitalised, and it might be necessary, in order to finance the proposed extensions and those just completed, to make in the near future a considerable increase in the capital, but they had not yet decided what form that increase would take. The raising of fresh capital might not have been necessary in their case had it not been for the large claims made by the Government for excess profits duty. That duty was simply eating at the vitals of the manufacturing concerns of the country—particularly those companies which had a desire to take advantage of the present splendid opportunities for extending their business. It was to be sincerely hoped that the Government would make some reduction in the duty at an early date, and that it might soon be given up entirely. There were reports of some such course being taken, but the fear was that some other form of taxation, which might be even more harmful than the present tax, would take its place. If some reduction or change for the better was not made it must be expected that foreign competition would be a serious menace to an opportunity such as the country had never had, and might never have again, and if that opportunity was allowed to slip they would certainly not get the same chance again. It was a well-known fact that the new nations of Europe, which were being created chiefly by the help of England, would like to come to this country for their supplies of goods of almost every kind, rather than go elsewhere. Formerly those countries were practically supplied entirely by Germany, and if we could not supply them now they would go where they could be supplied. They must have the goods, wherever they came from. It might perhaps be thought, and he had heard it stated, that those same new nations were so poor that their trade was not worth cultivating, but such a thought, if carried into practice, would be a fatal mistake, as they were, with proper government, nations which would soon recover and make good; and not only the new nations, but also the nations (other than Germany) which a few months ago were our enemies and were in arms against us. Those nations were now almost as much at enmity with Germany as we were, and would welcome British enterprises to their countries. That was an immense question, covering every department of trade, and including almost every country in the world, and particularly those countries which Germany practically held in the hollow of her hand. The fear was that our chances of grappling with this great trade would be, to a large extent, nipped in the bud if the handicap of the excess profits duty or other such tax was to continue. Another menace to the fine prospects before us as a nation was the instability of labour, which apparently could not be depended on for a week on end; indeed, scarcely a day passed without some fresh claim or threat being put forward. Only a few weeks ago almost every business in the country was affected through the caprice of a comparatively small number of hot-heads who, against their own party leaders, and on a paltry question, called out thousands of workers, the great majority of whom would much rather have been getting on with their work. That same thing had taken place again and again, and at the present moment was more threatening than ever, and if it continued the fine prospects before us were to go elsewhere, and elsewhere they appeared to be already going, since they heard of one big firm clearing out in disgust from Glasgow and settling in Vancouver. He, for one, did not wonder at it. In another case reported in the newspapers, the Agent-General of one of our Colonies sent orders for £750,000 value to the States because of the instability of labour in this country. Then the reports of the activities of the Americans in European, South American, Asiatic, and in our own colonial countries, showed that they had got the start of us, and they were to increase that start, if we were to go on fighting among ourselves. The Labour plea of "Not enough work to go round" as a reason for shorter hours was, under present prospects, surely a weak plea. This country, as they had seen, had the chance of taking over a large proportion of the trade formerly held by Germany, in addition to our own former trade, and the fact that the whole world was crying for goods of every kind was enough to show that such a plea was only an excuse for making trouble. Not only should there be enough work for all, but enough for years to come if labour worked day and night. At the present moment it was almost impossible to get work of any kind done. House repairing or decorating, clothing, car repairs—indeed, any class of work—they found impossible because of the shortage of labour. It appeared to him that something must be done—and that immediately—to remedy the present state of unrest, and one way would be for the workers to get an interest in the output results of their respective firms. He was glad, therefore, that the Government had appointed a committee to look into the question of a general all-round scheme of profit-sharing, or, what would be still better, a bonus on output, whereby every manufacturing concern in the country would be put on an equal footing—namely, that there should either be a certain percentage of the profits set aside for the workpeople and divided up according to wages, or in some other equitable way, or a scheme or schemes of payment on output results which should be settled and paid monthly. By such schemes the workers would know that every ounce of energy they put into their work was helping their own pockets, as well as the pockets of their employers, and the pocket of the country generally. Several companies already had such a scheme, and they had a limited scheme working at their factory at Beeston, but he thought it would be equitable and fair if it were made general and compulsory, so that one firm would have no advantage over another. His own opinion was that the better way, and a way more satisfactory to the workers, would be a graduated scale of payments by results depending on the output, and an increasing rate for every increase of output. What the country wanted was output, output, and again output, and if they were to seize on to the opportunities now before them it was first of all output they wanted. Trade bred trade, and output bred output, and the more they turned out the more would be required. The cry of "Not enough work to go round" was absolute nonsense. What they wanted was rivalry among the workers, and they should be paid according to their ability to turn out work, so that the best men should get what they deserved, and the slacker or incapable what he deserved. Why should a man with ability to earn big wages be handicapped by the slacker? And that was in reality what was being encouraged under present rules. The whole trade of the country was suffering by such rules. Did the workers or their Unions realise what they were doing? Only the other day he heard of a case where several British firms and one American firm were asked to quote for certain material. The British firms were within £50 of each other on a £4,000 job, which proved that their prices were in accordance with current costs for material and labour. The American firm took the order at £900 less than the lowest British offer. Then it was stated only last week, before the Coal Commission, that steel was being offered by American producers at prices considerably below the present cost of production in this country, and still the British workmen were crying for shorter hours, which meant smaller output and greater cost, also for greatly increased wages. Those cases, and many others, proved that the cost in this country was already too high, and he was afraid that Labour would realise the fact when it was too late. He trusted, therefore, that the Government would take the question seriously into consideration. Why should we as a country play directly into the hands of America and Japan? And this was what was likely to happen if Labour, and he was afraid Capital as well, had not some consideration and moderation.

Bruce Peebles and Co., Ltd. At the annual meeting, on March 11th, the chairman, Mr. F. E. Andrews, said that now that the war was virtually over, he might state that not very long after it started they rearranged one of their shops for shell work, and by some small additions to the buildings and appreciable additions to the machine tools, were able, practically solely with female labour, to turn out every month with regularity a large number of high explosive shells. Apart from this they had been engaged since the early days of the war on great quantities of parts for aeroplanes, and subsequently on various parts for tanks. They had also done a considerable amount of work for the Admiralty—especially hydrophones. Their main output had, however, all along been electrical machinery of all classes, for which there had been urgent demand for all the extensions and new works which had been built during the last four years. They had no very great upheaval to grapple with in their shops in turning over from war to peace conditions. In the past a large proportion of their output of electrical plant had been destined for export. They had always paid special attention to this part of their trade. During the war this export business had been almost impossible, and had practically disappeared, but it was their intention to cultivate it even more assiduously in the future than in the past, and although they had great competition to meet, no doubt they would achieve their purpose and obtain their fair share of orders, not only in the Colonies and Dominions, but also in the foreign countries in which they were represented. For a long time they had been at considerable disadvantage in the works owing to the want of better facilities for constructing the heavier class of machinery, the demand for which had been increasing rapidly. Their large new shop was now finished and able to relieve the congestion in the main building and deal satisfactorily with the hydraulic engineering work which they took up two years ago. They had always been very desirous of adding some special branch of mechanical engineering, so as not to be entirely dependent on electrical work; therefore, when this was brought to their notice by their colleague, Sir John Cowan, they gladly availed themselves of the opportunity. The new department had quite realised their expectations. It had already made a fair profit, and would add to the general stability of the company. The speaker went on to refer to the reorganisation of capital account. The scheme of arrangement was duly confirmed by the Court, and effect was given to it in the balance sheet. Owing to the conditions that had prevailed in the electrical manufacturing industry, and to the fact that in 1914 the company were only just emerging from their difficulties, they had a bad pre-war standard, and consequently had been, and were, hard hit by the munitions levy and excess profits duty. They were not in a position to consider the payment of a dividend on the ordinary shares; it was impossible to do so until the Government decided on its policy, and the whole question of war taxation on industry was cleared up.

Vickers, Ltd. On Monday next, at the River Don Works, Sheffield, there will be put before an extraordinary general meeting of this company several resolutions under which it is proposed to increase the capital to £26,500,000 by the creation of 6,000,000 new ordinary shares of £1 each and 7,000,000 cumulative preference shares of £1 each. The company has issued a circular explaining that the main object of the resolutions is to place the company in a position to give effect to an offer which has recently been made to the Metropolitan Carriage, Wagon & Finance Co., Ltd., to purchase shares in that company in exchange for shares in Vickers, Ltd., or in the alternative for cash. The circular reads:—

"The chief reason for proposing this arrangement is the fact that the relations of Vickers, Ltd., with the Metropolitan Co. are already so closely linked that it is very desirable, and, indeed, almost essential, in the best interests of the two companies and of the trade of the country as a whole, that the two undertakings should come under one control, so as to realise to the full the obvious advantages of joint working and sales organisation. The two companies have very large common interests, not only in the British Westinghouse Electric & Manufacturing Co., Ltd., but also in other electrical and engineering undertakings.

"The terms on which it is proposed that the transaction should be carried out are that the shares of the Metropolitan Co. should be transferred in exchange for ordinary shares in Vickers, Ltd., and shares of the proposed new cumulative preference issue in the following ratio:—

For each ordinary share of the Metropolitan Co. 1½ ordinary shares and 2 new preference shares of £1 each in Vickers, Ltd.

For each "A" preference share of the Metropolitan Co. 1 new preference share in Vickers, Ltd.

For each "B" preference share of the Metropolitan Co. 1⅛ new preference shares in Vickers, Ltd.

"The offer includes an option to the holders of the shares of the Metropolitan Co. to receive cash instead of shares of the Vickers Co. at the rate of 95s. for each Metropolitan ordinary share, 20s. for each "A" preference share, and 22s. 6d. for each "B" preference share. It is a condition of the offer that it is accepted by holders of not less than 75 per cent. of the Metropolitan ordinary shares. It is expected that the shareholders of the Metropolitan Co. will to a large extent elect to receive the shares of the Vickers Co., but in view of the option given to them to take cash, provisional arrangements have been made for underwriting the whole of the proposed new issues at a commission of 1 per cent. on the price. The directors have decided to give the shareholders of Vickers, Ltd., the opportunity of subscribing for so much of the new capital as may not be taken in exchange by the ordinary shareholders of the Metropolitan Co., at the price of 95s. for the block of 1½ ordinary and 2 new preference shares. Treasury permission has been given for the issue of 7,000,000 £1 cumulative preference shares and 5,100,000 £1 ordinary shares necessary for carrying out the purchase. Four of the directors of the Metropolitan Co. will join the Vickers Board."

Metropolitan Electric Supply Co., Ltd. At the annual meeting, on March 11th, the chairman said that the revenue from sale of current increased by 9 per cent., and the units sold by 6 per cent. The increase in revenue was due to the increases which they had made in conjunction with all other electric supply undertakings to meet enhanced costs. They had taken the opportunity to standardise further the rates for the different classes of lighting, heating, and power. Progress had on the whole been satisfactory. Since the close of the year the units generated had shown some decrease, but the weekly figures showed that this was being gradually made up. If the present labour unrest was settled in a conciliatory manner and industry was permitted to produce with the same intensity on behalf of peace as in the war-time, the demand for electricity would quickly overcome the temporary decrease consequent upon the change-over, and would be limited only by the capacity to supply. Their distribution system in the western area was already fully loaded, and if they were to meet next winter's demand they would have to spend substantial capital on main-laying, and probably on the installation of further plant at Willesden. Costs of production increased by £18,000 with fewer units generated. The principal increase in coal prices only came in the second half of the year. The coal position had caused them considerable anxiety, but the strenuous efforts of the executive had prevented any temporary diminution of supply. He hoped that as a result of the Commission now sitting the apparent impasse would be bridged over; if not there would be a national calamity by which every industry and individual must necessarily suffer. In referring to the advances in wages and in the salaries of technical staffs, the speaker said that these awards and agreements increased the costs, and the customer must realise that the companies must make some corresponding increase in the charge for electricity. He would suggest to the working-man that he should be satisfied with the hours which had now been granted, and the rates of pay which had been agreed, and settle down to give the corresponding value in the work, so that British industry might prove that it could hold and enlarge its place in the industry of the world. It was only by the means of greater productivity and saving that the condition of the working man could be improved, and he should seriously consider the effect of further demands which might cripple, or at least retard, the development of industry, and which, if conceded, would have the immediate boomerang effect of causing increase of unemployment and the consequent lowering of wages. The principal capital expenditure of the year was for the new Babcock boilers and the foundations for the new 4,000-kw. turbine which was about to be installed at Willesden. The accounts of the Uxbridge & District Co. made a very satisfactory showing. There was a dividend on the ordinary shares, and the prospects were good. It would undoubtedly prove a valuable adjunct to the company's development in its western area, which was one of considerable promise. In discussing the Government electricity supply scheme, the chairman said that, whatever might happen, it was almost unavoidable that London must be treated as an area by itself, as the problem was a special one, and it was quite a moot point whether it would not be better for the municipal enterprises on the one hand and the supply companies on the other to amalgamate their interests under two separate bodies or boards, controlling and administering the districts which they at present supplied, inter-connected where necessary, so that bulk supply, as and when required, could be given by one to the other. In this matter the London companies were acting in concert. One of their directors, Mr. George Balfour, was a member of the House of Commons. The speaker paid a tribute to the splendid services of the general manager, Capt. Rendell, the chief engineer, Mr. Markby, and the secretary, Mr. Hipwell.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

The connections at the end of 1918 were 309,051 H.P., an increase of 11,972 H.P. The profit was £342,394, against £309,779. There is carried to reserve for plant renewals and improvements £40,000, as against £60,000. Including £8,468 brought forward, £310,862 is available, against £257,214 last year. Debenture and loan interest absorbs £75,611, and there is put to reserve for special depreciation and contingencies other than the equalisation of dividends, £60,000. The preference dividend of 5 per cent. requires £64,364, and the ordinary dividend of 8 per cent., subject to tax (as last year), £69,458. There is to be carried forward £41,428, against £8,468 brought in. It has been considered advisable in view of present conditions to carry forward a larger amount to the current year, to be allocated later as may be found necessary. £28,710 expended on renewals and improvements during 1918 has been charged against reserve for plant renewals and improvements account. The reserve for special depreciation and contingencies stands at £350,245, after charging the costs and expenses of the issue of shares made by the company in October last and of the issue of shares and debentures of the Tees Power Station Co., Ltd. The revenue of the year was adversely affected by the general dislocation of trade in the district which followed the cessation of hostilities. The additional capital expenditure for the year was £467,169, and represented further extensions at Carville and Dunston power stations and of the company's distribution system. The issue of 500,000 ordinary shares of £1 each offered to the public at a premium of 6d. per share was largely over-subscribed. Preferential allotments were made to the shareholders who applied. Mr. A. Bonnin, of Newcastle, has been appointed a director. Annual meeting: March 25th.

Notting Hill Electric Lighting Co., Ltd.

At the annual meeting, on March 11th, Mr. A. E. Franklin said that though the revenue increased £1,340, the gross profit showed a reduction of £4,254, largely due to the extra cost of labour. The rate of wages had increased between 100 and 200 per cent. during the war, and there was now no man in the company's employ who received less than £2 per week above his wages in 1914. The price to the consumer was raised to 7d. from the March quarter, and to 8d. during the last quarter of the year. With this, but for the Household Fuel and Lighting Order, the accounts would have shown a result equivalent to former years. If the order was removed in the near future the output should increase sufficiently to meet the additional cost of production, but he could not speak with any certainty in view of the doubtful position with regard to the cost of coal and labour generally. The chairman referred to the threatened strike at London power stations as follows:—

> At the last moment the Government announced that the same protection would be given to users of electric current as to those of water and gas. Still, even had a strike been attempted, I believe it would have been possible for us to have carried out our obligation to the public, and to have continued the supply of electricity. At practically all the generating stations in the Metropolis the workmen were quite loyal to their employers, and it is very doubtful whether they would have come out. The majority of the men belonging to the Union which proposed to order the strike are engaged in wiring and other classes of employment for private contractors, and are not connected with generating stations. It would seem, therefore, utterly illogical that through their majority in the Union these outsiders should be able to shut down the whole of the electric supply to London when the workmen employed in providing it were quite content to continue their occupation. We have posted a notice in our works expressing our appreciation of the loyalty of our men in refusing to be coerced into what is pronounced by the Government to be illegal proceedings.

The company's capital of £200,000 was divided amongst 416 holders, and the average amount distributed per annum to each holder was £27, which would be reduced to £24 per holder if the insurance companies were eliminated, less than 10s. a week apiece.

Automatic Telephone Manufacturing Co., Ltd.—Supplementing our brief reference of last week, the report for 1918 states that the profit was £43,781, plus £11,550 brought forward. Directors' fees, £2,450; depreciation on patents, goodwill, buildings, plant and machinery, £8,000; preference dividend, £12,000; dividend of 6 per cent. (less tax) on the ordinary shares, £21,600; carry forward, £11,282. During the first part of 1918 the company continued to supply the Government with considerable quantities of munitions of war, but about the middle of the year orders dropped off, and arrangements had to be made for the cessation of munition supplies and the reorganisation of the factory for the resumption of normal business. This has caused the company considerable loss of time and money. The company has on its books a fairly satisfactory number of orders for telegraph and telephone equipment which will keep the factory busily employed for some time to come. Meeting, March 24th.

British Insulated & Helsby Cables, Ltd.—According to the report for 1918, to which brief reference was made last week, the profit was £288,280, plus £84,792 brought forward. The following are deducted: Directors' and debenture trustees' fees and remuneration to works' committee, £6,280; interest on first debenture stock, £22,500; interest on second debenture stock, £10,000; preference dividend, £30,000; depreciation on buildings, plant, machinery, &c., £25,000; to reserve, £50,000; to first mortgage debenture stock redemption account, £5,000; dividend 12½ per cent. for the year on the ordinary shares (revised capital); carrying forward, after making provision for estimated liability for excess profits duties, £99,292. Whilst some departments of the works have been exceptionally busy during the past year, others have been very short of work. The capitalisation of £500,000 of reserves has been carried into effect. Meeting, March 21th.

Brompton & Kensington Electricity Supply Co., Ltd.—The revenue account shows a credit balance of £18,487 for 1918, plus £5,217 brought forward. £1,000 interest on loan to the Brompton & Kensington Accessories Co., Ltd., and other items, makes £25,093. There is put to credit of depreciation account (restoring it to £85,000) £113, to reserve fund (raising it to £62,000) £7,000, and after paying the preference dividend and 8 per cent. for the year on the ordinary shares, £2,276 remains to be carried forward. The connections increased by 18,843 (35-watt) to 402,682; customers connected increased from 6,860 to 7,013; gross receipts fell from £61,898 to £58,759; expenditure increased from £31,580 to £40,272, net receipts fell from £30,319 to £18,487; average price per unit advanced from 4.05d. to 4.13d. Dividend falls from 10 per cent. to 8 per cent.

Bournemouth & Poole Electricity Supply Co., Ltd.—Mr. J. A. Hosker, at the annual meeting on March 13th, said that the drop in dividend from 6 per cent. to 5 per cent., and the reduced carry-forward were due to the Fuel and Lighting Restrictions Order and the increased costs. The company's business was largely lighting, and its natural sources of development had been arbitrarily cut off. The increase in wages was equal to 76 per cent. for skilled, and 96 per cent. for unskilled labour. They had increased the rates to consumers by a further 5 per cent., and on January 1st, 1919, another increase of 8⅓ per cent. came into operation. When the restrictions were removed, as he hoped they shortly would be, there would be a great increase in the demand for current, and they would have a free hand to connect new consumers and develop the business on the usual progressive lines.

Simplex Conduits, Ltd.—The date of the ending of the financial year has been changed. No balance-sheet has been taken out in respect of the working of the company for 1918. The next report and accounts will cover the period dating from January 1st, 1918, to July 31st next. In order to bring payment of dividends into line with the new arrangement (says the *Financial Times*) an interim dividend will be paid for the seven months ended July 31st, 1918, on the ordinary shares at the rate of 20 per cent. per annum, free of tax, *pro rata* for the seven months.

British Aluminium Co., Ltd.—Profit for 1918, including amount brought forward, after making provision for excess profits taxation and tax, and after charging amounts required for service of prior lien debentures and debenture stock, £249,416. To depreciation £70,000; £70,000 to reserve fund. Final dividend on the ordinary shares at the rate of 12 per cent. per annum, making 10 per cent. for year, carrying forward £31,380.

Midland Electric Corporation for Power Distribution.—Dividend, 6 per cent. on ordinary shares for year; £5,000 to reserve; £500 to debenture stock redemption account; £4,275 written off expenses of issues of debentures and shares during construction; £11,008 for depreciation on plant, machinery, &c.; £21,989 forward, subject to excess profits duty. It is proposed to authorise an increase of the rate of dividend on the preference shares from 6 per cent. to 7 per cent. per annum.—*Financial Times.*

Direct Spanish Telegraph Co., Ltd.—Dividend 10 per cent. per annum on the pref shares, less tax, and one of 6 per cent, free of tax, on the ordinary for the past half-year, making 5 per cent. for the year. Also a bonus of 2 per cent., free of tax, on the ordinary for the year.

Stewarts & Lloyds, Ltd.—Dividend 2s. per share and a bonus of 6d per share on the deferred ordinary shares. £100,000 to reserve, £70,000 for depreciation and excess profits provision; £10,000 to employes' benefit reserve; carried forward, £100,000.

Electrical and Industrial Investment Trust Co., Ltd.—A dividend of 5 per cent. is to be paid on the preferred ordinary shares and £17,183 carried forward. According to a financial paper the reserve fund has been reduced from £33,795 to £32,160.

Gateshead and District Tramways Co., Ltd.—Dividend on ordinary shares for the year 12s. per share and a bonus of 8s. per share. To special reserve £15,726. Carry forward £3,478.

Stock Exchange Notice.—The undermentioned securities have been ordered to be quoted in the Official List:—

North Metropolitan Electric Power Supply Co.—259,980 additional 6 per cent. cumulative preference shares of £1 each, fully-paid (Nos 340,001 to 599,980).

Hastings and District Electric Tramways Co., Ltd.—Dividend 6 per cent. on preference shares. £2,000 to depreciation; £2,000 to suspense; £1,086 forward.

Manila Electric Railroad & Lighting Corporation.—A dividend of 1½ per cent. for quarter ending March 31st on common capital stock.

South Staffordshire Tramways Co., Ltd.—Dividend 4 per cent. on the preference shares.

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STOCKS AND SHARES.

TUESDAY EVENING.

STOCK EXCHANGE markets will be in a better frame of mind next week. Nothing is so bad for them as suspense. Hanging upon what may happen at the end of this week in the Labour world, capitalists—large, medium, small—decide to do nothing until a strike is declared or averted. The poison of uncertainty has crept through everything. Other countries are similarly tried. So even the popularity of foreigners is on the wane, and everyone says he will wait and see.

Home Railway stocks had a special and peculiar burden, above the Labour pressure, in the Parliamentary Bill for setting up a Ministry of Ways and Communications to be armed, as at first proposed, with such autocratic powers as would enable railway nationalisation to be effected on terms very different from any which anticipation has dwelt upon since Mr. Winston Churchill first casually mentioned the Government's intention to nationalise the railways in the near future. Monday night's debate on the Second Reading of the Bill has left a good deal of vagueness in the air. Metropolitans have fallen 1, Districts ½, Underground £10 shares ⅛, while the market in steam stocks is extremely flat.

Home electricity shares are amongst the steady markets. Surmise is busy to account for the reason why some of the companies were able to increase their dividends what time others had to reduce theirs. It is suggested that certain electric light undertakings put into force earlier than others their powers to advance the price of their current. Informed opinion may smile at this explanation: we quote it for what it may be worth. Metropolitan ordinary shares have recovered part of the dividend deducted last week. Otherwise the list is almost unchanged. Demand for Westminster 4½ per cent. preference deserves notice; the price has hardened to 4 5/16. Newcastle-on-Tyne ordinary shares are firm at 23s. 3d. on the report, showing a rise of £33,000 to £342,400 in the net earnings. The dividend is maintained at 8 per cent., but the carry-forward, £41,400, is strengthened by the amount of the extra revenue. The 5 per cent. preference are lower this week at 18s. 9d. They get an extra dividend when the ordinary shares receive over 8 per cent.

British Electric Tractions are down to 46½ for the ordinary and 79 for the preference. Manila ordinary advanced to 95½. Brazil Tractions are better at 55½. Anglo-Argentine Tramways remain weak and depressed. Mexicans are disposed to give way for lack of practical corroboration of the recent hopes that affairs will quickly take a turn for the better under pressure from the newly-appointed protection committees.

British Columbia Electric stocks have been depressed, but show a slight tendency to rally from the worst. Rio Tramways first mortgage bonds at 93 and Sao Paulos at the same price are both ½ lower.

Marconis give evidence of a duller tendency. Canadians receded to 14s. 6d., though Americans remain steady at 29s. 9d. The Eastern group is strong, Eastern Ordinary and Globes both being higher. Anglo-American preferred has improved a little.

The biggest thing of its kind ever attempted in this country is the taking over by Vickers, Ltd., of the Metropolitan Carriage, Wagon & Finance Co., Ltd., particulars of which were announced this week. When everything is completed, Vickers will have a capital of 26½ million pounds sterling. The Metropolitan Wagon Co. has a large interest, with Vickers, in British Westinghouse and in other electrical and engineering undertakings, and the amalgamation is likely to be fraught with far-reaching consequences. The immediate effect has been to bring about a fall in the price of Vickers and a rise in the Wagon shares. Other iron and steel issues are heavy in consequence of the Labour uncertainties.

British Insulated & Helsbys have given way 2s. 6d. to 2⅛ on the reduction in the profit from £363,000 to nearly £75,000 less. The earnings, however, are higher than any shown prior to 1915. The net profit of £224,500 is £45,000 less than that of a year ago. As already announced, the dividend is to be maintained at 12½ per cent., which is equal to the 25 per cent. distributed a year ago on half the present capital. Para Electric ordinary shares have eased off to 5¼, in spite of a satisfactory meeting on Monday. Telegraph Constructions are out of the picture for the moment, but the market will be restored in the new shares as soon as the reorganisation rearrangements are complete. Callenders are ¼ lower. Otherwise, the manufacturing group is unchanged, save that Babcocks gave way sharply to 3⅝ in company with other concerns of this kind. The rubber list is quiet, with a heavy tendency, consequent upon the langour of business, and in base-metal shares there is little doing.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend		Price March 18,		Yield
	1917.	1918.	1919.	Rise or fall.	p.c.
Brompton Ordinary	10	8	7⅜	—	£6 15 7
Charing Cross Ordinary	4	4	3⅝	—	5 10 4
do. do. do. 4½ Pref.	4½	4½	8⅝	—	6 13 4
Chelsea	6	8	3¾	—	4 1 1
City of London	8	8	12⅛	—	6 8 0
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
County of London	7	7	11	—	6 7 3
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	6	—	5 16 8
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	5	6	8¾xd	—	6 13 4
Metropolitan	4	5	8¼xd	+ ⅛	7 13 10
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	9	9	7⅛	—	7 0 4
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6¾	—	6 19 4
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	99	+ ½	6 1 2
do. Def.	1½	33/6	21¾	—	7 13 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	+ ½	*4 19 0
Globe Tel. and T. Ord.	7	7	14½xd	+2/-	*4 16 7
do. do. Pref.	6	6	10½xd	+3/-	5 14 8
Great Northern Tel.	22	22	82½	+ ½	6 16 6
Indo-European	13	13	58	—	5 12 0
Marconi	20	20	4⅛	+ 1/16	4 6 6
Oriental Telephone Ord.	10	15	2½	—	4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	1/3	1/3	1⅛	—	*3 15 0
Western Telegraph	8	8	16⅝	—	*4 14 10
HOME RAILS.					
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan	1	1¼	27	—1	4 12 7
do. District	Nil	Nil	21½	— ½	Nil
Underground Electric Ordinary	Nil	Nil	8¼	— ⅛	Nil
do. do. "A"	Nil	Nil	9/6	—	Nil
do. do. Income	4	5	95	—	*5 5 3
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝xd	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	Nil	8¾	—	—
do. do. 2nd Pref.	—	—	8⅜	— ⅛	—
do. do. 5 Deb.	5	5	68½	—2	7 6 0
Brazil Tractions	—	—	55½	+ ½	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62½	—1	8 0 0
do. do. Preferred	Nil	Nil	44	—	Nil
do. do. Deferred	Nil	Nil	42	—	Nil
do. do. Deb.	4½	4½	61xd	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	62½	—2½	Nil
do. 6 per cent. Bonds	Nil	Nil	53	—	Nil
Mexican Light Common	Nil	Nil	38	—1	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	67	—2	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3⅝	— ¼	4 2 9
British Aluminium Ord.	10	10	1⅛	—	6 6 8
British Insulated Ord.	25	12½	2⅛	— ⅛	5 17 8
British Westinghouse Pref.	7½	7½	2 1/16	—	6 3 0
Callenders	25	25	10¼	— ¼	6 1 11
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	3 5/16	—	6 1 8
Edison-Swan, "A"	—	—	19/-	—	—
do. do. 5 per cent. Deb.	4	5	74½	—	6 14 3
Electric Construction	10	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6½	10¼	—	6 6 10
do. Ord.	10	10	17½	—	*5 14 3
Henley	25	25	2 5/16	—	5 8 9
do. 4½ Pref.	4½	4½	4	—	5 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.		—	6 1/16	—	*8 2 0
Telegraph Con.	20	20	—	—	—

* Dividends paid free of Income Tax.

NOTES ON ELECTRICAL PRECIPITATORS.*

By ERNEST EDGAR THUM.

The Cotterell process has been a godsend to more industries than to metallurgical plant alone. Early developed as a method to mitigate nuisances and damaging fumes, it was soon found that the deposits had considerable value as by-products. The latest installations as an integral part of manufacturing processes point the way for an even greater sphere of application and usefulness. Success depends upon many different conditions, and a large number of installations are preceded by painstaking experiments to determine the best way to clear the gases of their impurities. It is extremely difficult to predict the power consumption, voltage, velocity, and temperature for correct operation until actual preliminary experimentation has been completed on the gas.

The power house should preferably be quite close alongside of the treater, with switchboard and windows so arranged that the electrician can at all times have a clear view of his assistant who operates the knocking mechanism and watches the clearance being effected. The operating platform should be strongly and thoroughly illuminated so that mutual signals may not be interrupted by darkness or foggy weather. Should such a layout be impossible for valid reasons, intercommunication can satisfactorily be maintained only by telephone; receptacles should be installed at a number of points, readily reached by short lines from operator's head-sets. By means of call bells the two partners may thus get into intimate contact without delay. As a safety-first precaution in any case, interlocked coloured lights on the circuit-opening switch at each unit should indicate whether the high-tension current on the treater is on or off.

The operation of the treater plant will be largely adjusted by the appearance of the exit gases. In many cases an excellent recovery of values is effected, although the visual clearance is poor; thus a fair visual clearance indicates a satisfactory recovery. Therefore the method is not only simple but effective. In a large installation, one man will continuously be watching the condition of the gases issuing from the treater tubes. Proper illumination should be provided so as to permit easy observation through openings glazed with acid-resistant panes, the illumination extending to all portions of the treater's interior. Observation of the gas as it issues from the tubes is most essential when the effluent is mixed with other smoke before being discharged from the chimney, or when handling hot, humid gases which condense a cloud of water particles immediately upon mixing with the colder outside air. Watching the smoke from such chimneys evidently is of limited value. In all cases a series of properly made filtration tests is the last resort to determine the actual efficiency of the electrical precipitator.

For the protection of both the man and the treater the plant should be adequately roofed—if conditions are such that a certain temperature of gas in the treater must be exceeded it may even be necessary to house it completely during the winter. Conditions which make for the comfort of the operators will in nearly every case inure to the benefit of the plant operations. Thus, in case the draught conditions are such as to require the use of a fan it should generally be placed beyond the treater so that the latter will operate as a "suction" chamber rather than a "pressure" chamber. Should the pressure inside a treater be greater than atmospheric, fume and smoke may blow out through the seams and openings—an absolutely gas-tight job would then be required. Again, after shutting off the gas previous to repairing a treater section, the atmosphere in a suction chamber may be cleared in a few minutes, much more rapidly than if it were under pressure.

If each section of the treater is connected to its individual electric supply it will be possible to operate each section independently of its neighbours, and the electrical conditions in it can be adjusted to secure the best results.

Two methods of generating energy are in vogue: First, a large A.C. generator of proper rating and design may furnish enough energy for the whole plant, but each treater section will have a separate transformer and its own rectifier driven by a quite small synchronous motor. Included in this classification is the case where an industrial circuit of large capacity supplies the transformer-rectifier-treater units. The alternative power-house layout requires a motor generator and rectifier all on one shaft, the alternating current necessary for the treater unit being generated, transformed, and rectified entirely independently of any other unit.

Experiments at Anaconda indicate that the wave-form has a determining effect upon the efficiency of precipitation. Such being the case, commercial electricity whose characteristics may be suddenly distorted by outside loads should not be rectified. However, this energy can be used to drive a single-phase generator especially designed to produce the correct wave-form.

While the first-mentioned power plant is somewhat simpler, it can be installed but little more cheaply than the second when proper induction voltage regulators are included. At most, the electrical equipment costs but 15 per cent. of the total, and it is false economy to install unsuitable machinery. Horn gaps may be used to assist in protecting the transformer insulation, set slightly further apart than the radius of the treater pipes. Ample precautions should be taken to protect all transformers, rectifiers and other equipment. Permanent series resistances in both high- and low-tension lines are effective in interrupting oscillating discharges and limiting short circuits. Condensers shunted across the generator leads are also useful in absorbing surges reflected from the transformer windings.

It is well to have all the electrical machinery of large capacity. In this relation, the preliminary investigations should determine particularly the electrical characteristics of the precipitated material, since it has been shown that the resistance of the gap between clean discharging and collecting electrodes may be lowered as much as 50 per cent. by a thin non-conducting deposit. The voltage on the system must then be lowered in order that heavy arcs may not trip the circuit breakers. Such discontinuous dielectrics retain their electrical charges and ionise the surrounding gases if the dielectric constant of the particles be large. The remedy is to make the deposit conductive by humidifying the gas or (in case corrosion is feared) by adding a conducting dust like carbon. The wave form of the rectified current, and to a less extent its voltage, is adjusted by rotating the rectifier "brushes" slightly.

Fig. 1 is a sketch of the rectifier now commonly used. It consists of a synchronously rotating disk of non-conducting fibre or composition to the edge of which are riveted the metallic quadrants A and V. Brushes *b*, *d*, *y*, and *z* are metallic horns symmetrically fixed in a movable frame.

It will be seen that as the disk rotates the quadrants A and V alternately connect the terminals *b* and *z* to brushes *d* and *t* respectively. In this manner unidirectional, intermittent current is sent to the wire electrodes in the precipitation plant. Reference to fig. 2 will give the characteristics of the current sent to the treater, where the wave is the ordinary sine curve representing the time-voltage relations of an ideal alternating current. Segment A (fig 1) collects the troughs of the waves during a time on each side of the minima shown by dark portions of the curve, while the peaks are collected a half-period later by segment V. If all the brushes are attached to a frame capable of being rotated around the shaft, turning this frame counter-clockwise will collect the current at an earlier time on the increasing voltage wave. Fig. 3 shows the portion collected in darkened lines as before, and it is plain that each impulse starts at a relatively low voltage, rapidly increasing to the maximum, when it is interrupted. On the other hand, clockwise rotation will first catch the current nearer its crest voltage and deliver an impulse of rapidly decreasing potential (see fig. 4).

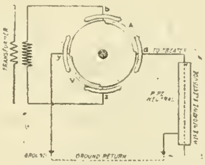

Fig. 1.—Wiring Diagram for Mechanical Rectifier.

In adjusting the treater clearance it is common for the electrician to throw the brush-holder to one limit of its travel, and then move it slowly back and forth until his assistant watching the clearance signals the best location. Then the appearance of the arcing of the rectifier or the reading of a milliammeter on the high-tension line is relied upon to exhibit variation in electrical conditions in the treater. Naturally fine adjustment of these brushes is not essential, since changing conditions in the treaters demand attention from the operatives at intervals. Since the part of the current wave propelled toward the treater depends upon the potential of the crest, the width of the air gap and the length of the brushes (as well as the angular setting of the latter), it is evident that the adjustment of the position of brushes such as sketched in fig. 1 will greatly alter the characteristics of the sparking at the rectifier. The peak only may be collected, resulting in short, snappy arcs at the rectifier, or long flaming arcs may almost envelop the circumference of the disk when commutating long portions of the wave. The latter obviously transmits a greater amount of energy into the treater.

The potential wave actually existing across the electrodes is very flat, quite different from that existing at the brushes, since the treater acts like a condenser, and discharges very slowly by transport of charged particles.

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* From *Chemical and Metallurgical Engineering*. Abstract.

The smelter smoke to be cleaned usually flows from a hopper to a collecting flue through upright pipes or between parallel sheets. This whole structure is earthed. The negative current is distributed to wires, chains, or thin pipes, stretched by weights or springs through these collectors and accurately centred at both ends by latticed frames. These frames, in turn, are supported by cross-beams extending through openings in the hopper and flue walls, there resting on proper insulators and protected from accidental contact by a basket or "pent-house." However, it is not desirable to depend upon air seepage to keep the dust from gradually settling on the insulators, especially in case the gas carries free sulphuric acid (as do copper converter and roaster gases).

In the latter case a treater designed to catch dry dust must operate at a temperature above that of any considerable condensation of the free acid, and any infiltering cold air would speedily deposit a tenacious acidic film upon the insulators, causing earths and punctured insulator petticoats. In such cases it has been found desirable to frame a beam into the ends of those supporting the latticed frames, which beam will extend longitudinally outside the flue walls. This longitudinal beam is then supported by insulators placed centrally some distance from the openings. The whole is enclosed by an iron box, preferably welded air tight at all joints, with weather-stripped doors of glass opposite each insulator, all as shown in sectional plan in fig. 5. An excellent precaution is to have the levers controlling the high-tension tower switch so arranged as to extend in front of these doors when the current is on. In order to get into the insulator box it is then necessary for the attendant to move the switch levers, thus cutting off the current before being able to open the door.

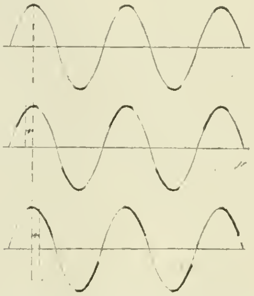
Fig. 2.

Fig. 3.

Fig. 4.

Fig. 2.—When brushes are set at theoretical point of maximum voltage.
Fig. 3.—When brushes are rotated counter-clockwise through an angle φ.
Fig. 4.—When brushes are rotated clockwise through an angle θ from theoretical position.

Figs. 2-4.—Part of Current Wave Rectified.

The collecting tubes or plates, of course, should be quite clean and smooth so that no electrical leakage at shortened air gaps may occur. As precipitation proceeds, a fume deposit builds up on both pipe and wire, facilitating point-discharges and decreasing the air gap as well. In order to restore the tubes to their normal condition it is necessary to shake this dust free at intervals. Mechanical rapping may be done by hammers hung from an oscillating horizontal shaft between alternate rows of pipes striking on welded pads, and a similar hammer striking compression springs fixed on the latticed frames supporting the electrodes. The current of electricity must evidently be interrupted during shaking of the charged electrodes, and is usually stopped when rapping the collecting electrodes, but in any case the jarring mechanism should be earthed in two independent ways. All rapping is best done by power.

Whether the gas current should be interrupted during shaking depends largely upon conditions. In large sectionalised installations the provision of one complete unit in precipitator and power plant is desirable. In the case of inflammable or explosive fume it is essential that the treater be large enough that both the gas and electricity may be in-disastrous fires.

The snapping discharge of spark-overs can be heard by the treater tender or located by looking into the upper flue or lower hopper. If a thorough rapping of electrodes will not stop the trouble, or if a localised arcing discharge is robbing the bulk of the tubes of their supply of electricity, it may be necessary to shut down the section, and remove the cause.

Snappy spark-overs do not affect the treater operation seriously, since they consume but little power, and the generating system and transformer are protected from the effect of the momentary short circuit by the rectifier. Localised arcing is instantly recognised by a jumping ammeter needle and heavy flames at the rectifier. Such arcs should open the circuit breakers before damage is done, or can be made to introduce a protective resistance in the low-tension circuit automatically. Wire electrodes are seldom burned off or fused, owing to the relatively low amperage of the spark-overs.

A thin non-conducting deposit, a thick conducting deposit, or a derangement of electrode spacing, may reduce the treater voltage, as already noted. In addition to this, leakage over wet or defective insulators may be very hard to locate and cause serious trouble. Again, at more than 50,000 volts stretched wire electrodes tend to vibrate in elliptical orbits on account of unbalanced attractive forces being suddenly relieved by a local arcing discharge. Damping rods or the use of chain electrodes cures this tendency—very high voltages may require rigid electrodes. A further cause of lowered voltage is the screening of the discharge due to a high concentration of dust or fume in the gas. Since the efficiency of the precipitation depends upon the maintenance of the maximum voltage in the treater, constant attention to all such points is required of the careful operator.

Properly made experiments preliminary to construction will determine the best conditions of voltage, pipe lengths, and diameter for all normal variations in temperature, composition, and velocity of the gases. It is not so easy to translate the results attained with one or a few pipes to an installation containing hundreds. Perhaps the most trying thing is the attempt to insure equal gas distribution to all the dozens of pipes in one section, especially with the low velocities desirable.

If the main intake is merely a pipe opening into the side of the dust-collecting hopper, there may be large differences in pressure in the collectors with their varying distances from the intake. In some cases the gases are discharged through a ventilator-like hood set in the centre of the hopper. Then the corner and middle pipes may suffer. The design should be such as to prevent eddies as far as possible. Nearly ideal gas distribution could be provided in a vertical-pipe treater if set directly above a furnace outlet, connection between the two being made by a straight, uniformly tapering flue. Where head-room is lacking or a tall structure seems undesirable, a distribution as good as any attainable after a sharp turn may be had by introducing the gas near the top of the housing around the collecting electrodes, as sketched in fig. 6.

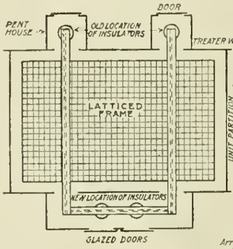

Fig. 5.—Method of Placing Insulators Distant from Openings into Body of Treater.

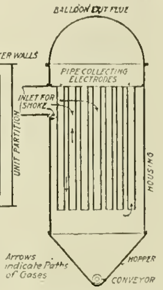

Fig. 6.—Sketch of Top Inlet for Uniform Gas Distribution.

Even with the most perfect mechanical design, however, furnace operations vary enough to make large differences in temperature, volume, and composition of the gas to be handled. Fume-laden gases are often cooled, and at the same time their electrical conductivity and the efficiency of the precipitation bettered, by water sprays discharging into the flue leading to the precipitating plant. This last method must be used with circumspection, however, if acids are liable to be formed and collected in the precipitator. Besides the fact that a rise in temperature lowers the arcing voltage, it causes large differences in the volume of gas to be treated, and consequently its velocity through the treater.

Combustible dust should be removed from the neighbourhood of the electrical discharges as rapidly as collected. Screw or drag conveyors for this service should be made several times as strong as the designer ordinarily thinks is necessary, so that they may break up and remove the wet, caked dust remaining after a fire has been extinguished without themselves breaking.

Submerged Coal Storage.—In 1912 the Indianapolis Light and Heat Co. constructed a concrete pit to contain 13,000 tons of coal submerged. Recently the company constructed a reinforced concrete coal pit holding 8.000 tons. The two pits have a total capacity of 20,000 tons submerged and 10,000 tons of coal above the water line, giving a 60-day supply if both pits are filled. The total cost of the two pits was $60,000, or $2 per ton of storage.

The results of under-water storage have fully met the company's expectations, in that it prevented fires and preserved the heating value of the coal. Comparative tests of freshly mined coal and coal which had been stored under water for approximately one year, from the same mine and the same vein, showed that the coal had lost during storage only 317 B.TH.U. out of 12,518 B.TH.U. per ton.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electric Welders.

Of the many advances that have come forward during the war, perhaps there has been nothing that has developed more than electric welding. An efficient line of spot, seam, and butt welders, marketed by the A.1. Manufacturing Co., Sunbridge Road, Bradford, has been engaged on a munition contract, and has given effective results. The stakes or arms of these machines can be made in varying lengths to reach into difficult positions. The machines are efficiently guarded, and the arms are thoroughly water cooled. A point about the machines is the perfect balance; even if run continuously all day, the movement of the machine is as easy at the end of the day as at the beginning. The current does not pass through any moving parts, but is conveyed direct from the transformer to the stakes by suitable flexible connections. We understand that these machines are supplied power driven, if desired, to facilitate continuous spot welding.

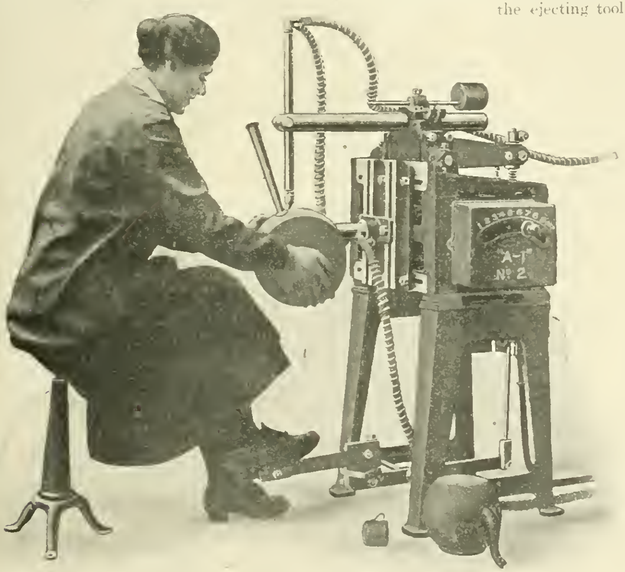

Fig. 1.—"A.1" No. 2 Spot Welder.

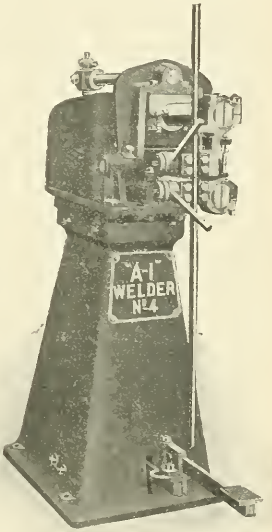

Fig. 2.—"A.1" No. 4 Convertible Spot, Butt, or Seam Welder.

In fig. 1 we illustrate a development which is especially interesting to the hollow-ware, jewellery, and other trades, where light welding is required at high speed, and where awkward places are to be reached. The double face-plate on this machine enables the lower arm to be moved up or down, right or left, and the long water-cooled electrode in the upper arm will also be noted. This upper arm will swivel to right or left, so that the point will always be in line with the bottom electrode. Also, this upper arm can be drawn out or pushed back, so as to accommodate longer and shorter lower arms. It is claimed that a speed of 60 to 100 welds per minute on 30-gauge metal can be attained continuously.

Another feature of the machine is the trip-switch, which is entirely automatic. The pressure on the pedal causes pressure to be mechanically applied to the article. Continued pressure on the pedal turns on the current, and further pressure cuts the current off and increases the pressure on the weld. This switch can be so set that the duration of the application of the current can be regulated to a nicety.

The ordinary standard type of spot welder can be converted in a few moments to a butt welder for light work. Fig. 2 illustrates a No. 4 "A.1" system spot welder, to the arms or stakes of which suitable blocks have been fixed. It will be seen that two ⅝-in. rods have been fixed in position ready for welding. This machine will spot-weld up to ¼ in., or occasionally ⅜ in. in thickness. By the adjustment alluded to it is converted into a butt welder, which will efficiently weld up to ⅝ in. in thickness, or by another attachment of a somewhat similar nature it can be converted into a seam welder, to weld up to ⅛ in. added thickness. These features make the machine of very general utility where it is not profitable to have a special machine for each process.

The Finsbury Dolly Press.

For the manufacture of dry cells the Hillbar Press, of 76, Finsbury Pavement, E.C. 2, which specialises in battery-making machinery, has introduced the improved type of dolly machine illustrated in fig. 3. The design is the result of a great deal of experimental work, and the operation of the machine is exceedingly simple; for each three movements of the working parts a perfect dolly is obtained.

In fig. 3 A is the capstan head, which swivels about a centre and so brings the ramming tools D or E into position as required. The handle B is directly connected to a pinion which, engaging a rack on the back of slide J, enables the tools to be advanced into the mould G for the purpose of ramming.

C is the handle of the bottom traversing gear which operates the ejecting tool F. H is an adjustable stop. The machine is adaptable to any size of dolly up to Giant Torch, all that is necessary being a change of tool heads and mould.

Special sets of tools are made, in sections, so that the wear that takes place does not scrap the whole tool, but only the loose replaceable heads. Mould casting dies are also provided; one mould will last while 4,000 dollies are made, which is the daily average output of the machine.

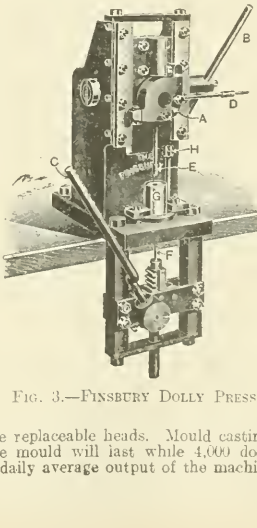

Fig. 3.—Finsbury Dolly Press.

THE DETERMINATION OF THE EFFICIENCY OF THE TURBO-ALTERNATOR.

At Manchester, on February 25th, Dr. S. F. Barclay's and Dr. S. P. Smith's paper (an abstract of which appeared in our issue of March 7th, 1919) was read and discussed before the North-Western Centre of the Institution of Electrical Engineers.

Dr. Miles Walker said that in the past end-plate, eddy-current, and open-slot features had caused very heavy losses, and it would be a great achievement if the authors threw light on them. He agreed that the method of measuring the temperature rise and the air flow was a sound one in arriving at losses; the main difficulty seemed to be in the accurate measurement of the air. The method used by the authors was, he thought, a good one, but it was open to the objection that they were not quite sure of the shape of the curve of losses. It was not easy to ascertain exactly how the curve rose, and it did really create a difficulty in practice. Even as it was, the method was much more satisfactory than other methods of arriving at the stray losses. There was a relationship between the temperature rise of the air and the losses; it was quite worth while to invert the process and measure the amount of air that was passed from the temperature rise. Suppose it was desired to know how much air went into a certain apparatus. Before the air was put in it could be passed through a ring in which there was a resistance. There would be also vanes and a number of thermo-couples. By passing a continuous current through that resistance one had a perfectly ascertained loss in the machine. The difference in temperature gave a very good measurement of the amount of air going through. The temperature could be measured to a hundredth part of a degree, and if there were 5 deg. rise in temperature in the air going through one got a very good measure of the air. It would be quite possible in turbo-generators to have something of that kind in the ducts, and in that way a very much more accurate measurement of the amount of air could be made. With regard to measurement of the temperature of the air going out, thermometers were rather troublesome. Using an ordinary shop thermometer the temperature might be read very carefully, but usually it was not worth while to do so. A very much better method was to put a large number of thermo-couples in parallel.

Mr. J. S. Peck said that a method which would enable losses to be measured under running conditions on site was likely to be generally adopted if it was found reliable. The important point in the paper seemed to him to be the design, which the authors had worked out for securing a uniform distribution of air in the exhaust. The results which they had obtained were really remarkable; they were closer than one would expect to get any commercial measurements. If further tests showed that such accurate results could be obtained, he thought there was no doubt this method would be generally adopted for measuring the efficiency of turbo-alternators.

Mr. J. Firth said Dr. Walker had touched upon what was really the main point. He explained that Dr. Cramp and he had done a little work on the commercial measurement of air flow, and he then exhibited and explained the apparatus that they used. He thought it was a weak point to favour the anemometer because it did not take into account the direction of the air flow. In a duct such as the authors used air might be going in at one place and out at another. A "Pitot" tube would give the outward component of the air, which was what was wanted. The Morris resistance method would give too big an estimate of the quantity, and apparently did not differentiate between air going in and that coming out. Another method which might have been brought out more fully was only hinted at in the paper. A resistance heater was put right across the top in the form of a net, and a given amount of energy was supplied to it. The device was practically a platinum thermometer. The temperature rise could be measured very accurately as well as the amount of energy being put into the machine. It practically resolved itself into a rule of three, and did away with all air measurement. Of course, it was a direct calibration method, and it had been used very largely to measure the commercial rate of flow of gas in pipes. This method differed slightly from that suggested by Dr. Walker, and it seemed to the speaker that putting the platinum wire across to get the average temperature was better than putting thermo-couples in parallel. The heated thermo-couples would be sending current through the colder thermo-couples, which would alter the temperature.

Mr. H. C. Lamb thought the paper was of special interest to station engineers, because everyone who put in plant wished to test it himself after it was installed, but up to the present they had had to accept figures furnished by the makers, and he thought tests should be made by independent parties. The method described in the paper would settle disputes that might arise very easily on site, and the efficiency of alternators might be checked in this way, and a comparison made with the figures furnished by the makers. Recently he had tested a 20,000-kw. alternator which had been tested at the maker's works before delivery. The load was kept constant for several hours at 17,000 kw., 0.85 p.f., 6,600 volts. The air was measured by an anemometer similar to the one shown in the paper. It had been specially put in order for the test by the Manchester instrument department. The discharge duct was divided by cast-iron wedges into 16 compartments. The velocity was taken in each one of the 16 divisions, and the air volume worked out at 67,840 cu. ft. per minute. The inlet air temperature was 68.20 deg F., and the outlet air temperature—which was taken by specially calibrated thermometers on the average of 24 readings—was 110.67, showing a temperature rise of 42.47. That gave the energy carried away by the air as 855 kw.; he assumed the loss through bearing friction at 100 kw., which gave 955 kw., and the radiation loss was neglected. Those two losses gave an efficiency of 94.7 per cent., and the efficiency furnished by the makers, taken from the curve of the tests at their works, was 94.6. After reading the paper, he measured up the surface of the carcase, which was 210 sq. ft., and, allowing 0.006 watt per sq. in., it gave 7½ kw. of loss. When that was allowed for it brought the efficiency to 94.65, against the 94.6 given by the makers; he thought that was a remarkably close result. He felt quite sure the method would be very widely used; it removed from his mind any lurking suspicion regarding the figures furnished by manufacturers—at any rate, by the particular manufacturer in question.

Mr. Kayser said that some years ago they had used the calibrated air temperature method on some large turbo-alternators to get an idea of the stray losses. They tried it on a 20,000-k.v.a. machine; the test was, however, not very accurate, but it showed that there was a fair agreement between the short-circuit and the load losses. Referring to the calibrated air-temperature method, he inquired why it was necessary to make two tests. He used one single test—either the full load or the short circuit. If the idea was to eliminate the short-circuit losses from the calibration losses, he did not see why it was necessary to do so. This loss was known just as accurately as the final loss, and it had the same effect on the temperature of the air. By including this loss in the calibration loss a greater effect could be obtained, and the expenditure would be reduced.

Mr. S. Juhlin thought the calibrated-motor method had very distinct advantages in so far that it was of extreme value to the designer to be able to segregate the losses in the machine with as much accuracy as possible. If it were necessary to run the machine until the temperature was perfectly steady, the time spent in making the tests must be very great, and he was afraid that power-station engineers generally would object to being tied up when the machine was ready for running. Results obtained by taking air measurements from a 5,000-kw. set were certainly encouraging. The discrepancies amounted to about 12 per cent., roughly speaking, between the loss obtained by ascertaining the separate losses and taking into account the short-circuit loss and the loss calculated from the air measurement and the temperature rise, but greater accuracy could be obtained with very careful measurement. It was really astonishing to see the steady flow of air which could be obtained by the use of the chimney. One or two points in the paper needed some clearing up. On page 2 the authors referred to the fact that, under short-circuit conditions, losses had been experienced which were not present on load conditions—at least, there was a temperature rise which indicated such losses. He would hardly think that was general experience. He thought that an agreement between the value of the stray loss on load and on short circuit, which was stated to be partly accidental and not to be expected in all cases, might be due to air measurement, and not to the losses, changing. Mr. Lamb's estimate of the bearing loss was very much above the actual figure. Tests had been made by taking the inlet and outlet temperatures of the water, and the actual loss in the two bearings was not more than 33 kw.

Mr. R. E. Grime agreed with Mr. Frith in his criticism of the Morris resistance method of measuring the air loss. What was required to be measured at the outlet of the exhaust chimney was the average velocity normal to the outlet. If the air was not moving normal to the plane of the outlet there were side components which were all included in the measurement by the Morris apparatus, and the average absolute velocity was higher than the average normal velocity. It was the latter that should be measured, not the absolute velocity. A point that would have to be considered relative to air filters was the effect of suspended moisture in the air. The humidity of the air did not matter much, but if there was any suspended free moisture in the air which was evaporated in passing through the machine greatly inaccurate results might be obtained.

Dr. Cramp said that the difficulties in connection with the method which the authors had put forward might be divided into two classes. The first of these referred to the amount of heat which went into the machine itself owing to the specific heat of the material of which it was made; it seemed to him certain that the machine itself could not have reached anything like a final temperature at the time the loss was measured; and nothing was said about the amount of heat which went into the machine during the calibration period; that was also true of the first method. Measurements must be taken at the end of a long run, and a correspondingly long run must always intervene between the time when the test was taken on one load and the time when the test was taken on another load. That made the whole method rather slow. The other difficulty was that of measuring the radiation from the exterior of the machine. It seemed to him that the rule the authors gave for ascertaining the loss was far too rough to be of any service. Some machines were smaller in diameter than others. He was very much surprised that the authors referred to the anemometer as a satisfactory instrument. The process of taking readings over numerous sections was slow, and would lead to inaccuracies. The air velocity could not possibly be measured by traversing a "Pitot" tube across the discharge opening. The static gauge was more likely to give trouble than the dynamic, but there was no reason why the static tube should not be inside the duct, and square or flush with it. A safe place to put the tube for really accurate measuring was at the head of the duct, and a small hole quite flush with the face would give the best results. For really accurate measurement it was desirable to use a round, and not a rectangular, pipe for the air to pass through. He asked for the sizes of the machines tested, which the authors had not given.

Dr. S. P. Smith, in reply, said there might be some relation between the distribution of the magnitude of the stray loss on short circuit and on load; but he did not know that it had been discovered. With regard to the accurate measurement of the air velocity, he thought they ought to distinguish between commercial accuracy—the accuracy expected in an ordinary test-house or power station, which was good enough for practical purposes—and the accuracy expected when a scientific investigation was made. The accuracy obtained on those tests was sufficiently good for strictly scientific work, but if they could measure the mean velocity of the air to within 2 or 3 per cent. it was quite good enough for all practical purposes. He referred to Prof. MacGregor-Morris's instrument, and said there, again, it was not a question of absolute accuracy from their point of view. Prof. Walker and Mr. Frith had shown forms of good apparatus, and their methods doubtless were good, but they were really only other forms of what they had called the "calibrated air-temperature" method, and they should have the gear as simple as possible, so that it could be erected with very little trouble. No doubt thermo-couples could be used to measure the temperature, but they had not found any trouble with the thermometers, and the accuracy obtained with them was remarkable. They were very handy, and quite suitable for the purposes in view. With regard to the time occupied in the tests and the cost, he thought the results accruing therefrom would justify them; it was not a very serious matter to have to wait until the temperature became steady, and he thought that under most conditions a fairly constant load could be kept on the machine, even when it was working on a network load. They had found it so on large machines that they had tested. Large machines were too valuable and the results too important for small details to be considered too seriously. Mr. Lamb's figures were interesting, and very close—94.6 against 94.65—and such agreement between the maker and the power-station engineer was not always to be expected. Mr. Lamb had shown that on his 20,000-k.v.a. machine the radiation loss was only 7½ kw., and it only affected the efficiency by 0.05 per cent. Under those circumstances, it was not going to be an important item.

In addition to the brief abstract already reported on p. 276 of our issue of March 7th, we are now able to reproduce curves, and to give fuller details of Capt. A. H. Law's contribution to the discussion on this paper in London.

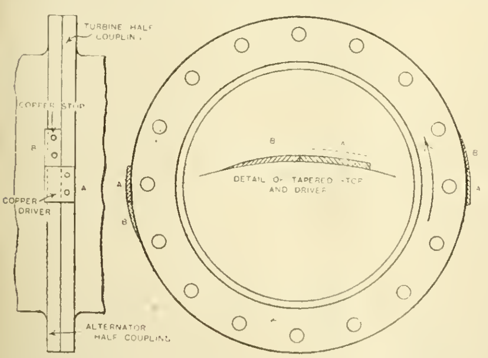

Fig. 1.—Coupling for Slipping Turbine when Motoring the Alternator.

Capt. Law expressed his appreciation of the paper, and said that in his opinion it would place on a satisfactory basis what had for a long time been a matter of discussion between the turbine builder and the electrical designer. His own firm had had two or three cases in which the efficiencies of alternators designed by other manufacturers had been questioned, and since 1910 he had constantly used air calorimetry for determining the efficiency of alternators of all sizes. Now that a description of these methods was to be on the records of the Institution there would be less hesitation on the part of persons interested in accepting them as accurate. The precautions which must be taken were clearly shown by the author, and he had little to add to these. It was worth remembering, however, that an anemometer was usually calibrated in cold air. It had been found, possibly owing to varying friction in the bearings of the instrument, that this calibration was not strictly accurate for air of the temperature which was usually reached in the outlet from turbo-alternators. The chimney method of air velocity measurement had been found to give good results. The "calibrated air temperature" method was used by Messrs. Parsons in 1910, when it became necessary accurately to determine the efficiency of some large alternators to which new and up-to-date turbines were being fitted. The method was almost exactly that described by the authors of this paper. The alternators were run as motors, and the power input and temperature rise accurately measured. This gave an indication of the quantity of air passing through the alternators, which were then run on load, and the efficiency was determined in the manner described by the authors. The method was also used in 1913, when there was a question of the efficiency of some large single-phase machines built on the Continent. It was found, as was expected, that the efficiency was considerably lower than the guaranteed figure. A method of determining the efficiency which included stray losses was of especial importance in the case of single-phase machines where these losses might be very considerable. He was not quite in agreement with the authors when they suggested that when using the "calibrated air temperature" method, the efficiency could not be determined solely by tests on site. In both the above cases the efficiency was determined solely in this way, and eventually figures were arrived at which satisfied all parties. The obvious difficulties in getting a large machine of this type up to synchronous speed and paralleling it in on the system independently of the turbine were got over by the use of the device shown in fig. 1. The coupling bolts which normally joined the halves of the flexible coupling were removed, and the halves of the coupling were connected by a soft copper driving strip A A, riveted to the turbine half of the coupling. This strip engaged with a tapered projecting stop piece on the alternator part of the coupling, as shown at B.B. When the turbine was started, A drove B, and the alternator was run up to speed and paralleled. The turbine was then shut down, when B ran ahead of A, and, being tapered, forced outwards that part of A which projected over the alternator half coupling, thus freeing the alternator from the turbine. The authors expressed doubts as to the accuracy of the retardation method of obtaining the no-load losses. He could not agree that this method was inaccurate if it was carefully done. It was used in 1912 for determining

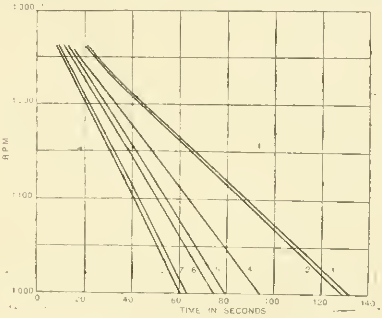

Fig. 2.—Retardation Tests.

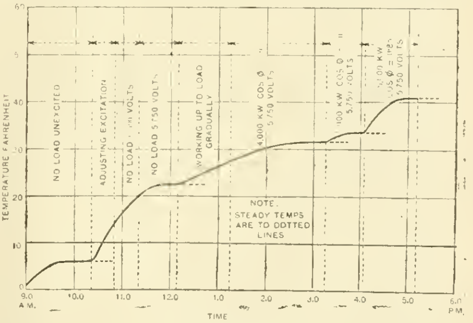

Fig. 3.—Curve Showing Temperature Rise of Outlet Air Above Inlet Air.

the no-load losses on one of the 5,000-kw. turbo-alternators at Carville. Fig. 2 showed a set of retardation tests which were made on one of these alternators. No. 1 curve showed the rate of slowing up of turbine and alternator when the alternator was unexcited. No. 2 was a similar curve with the alternator running at about one-tenth of its rated voltage. No. 3 was the deceleration curve at one-tenth voltage and with a load of 100 kw. as a calibration. Nos. 4, 5, 6, and 7 were deceleration curves with no load and at different terminal voltages. Curve 3, when used in conjunction with calculations of the stored energy of the parts, supplied a calibration for determining the no-load losses for the different voltages represented by curves 4, 5, 6, and 7. The normal speed of the machine was 1,200 r.p.m.; in taking these tests the speed was run up to over 1,300 r.p.m., the readings being commenced at about 1,260 r.p.m. The voltage of the alternator was kept steady by hand manipulation of the regulating rheostat. Fig. 3 showed the final stage of the efficiency determination, the whole of the tests having been carried out between 9 a.m. and 5 p.m. on the same day. In each case the curves were artificially steadied up by raising the voltage or load to a rather greater amount than that shown opposite each flat portion of the curve. As soon as the estimated temperature was reached, the load was brought to the stated amount, and in this way steady readings were quickly obtained.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

4,065. "Reduction of distortion of electric signalling currents." Western Electric Co. (Western Electric Co., U.S.A.) February 18th.

4,068. "Electric incandescent lampholders." C. G. M. Bennett. February 18th.

4,098. "Electric bell construction." A. E. Hughes. February 19th.

4,099. "Self-locking incandescent electric lampholders." C. J. Crockett. February 19th.

4,101. "Method of locking electric lamps in holders." J. H. Collie. February 19th.

4,110. "Storage-battery separators and insulators and process of making same." D. A. Palmer. February 19th.

4,111. "Detachable fixings for electric lamps, &c." Fuller Accumulator Co. & A. P. Welch. February 19th.

4,116. "Inter-communication telephone systems." L. C. Bygrave. February 19th.

4,128. "Anodes." J. Schledorn February 19th.

4,149. "System for transmitting high-frequency electric currents." Western Electric Co. (Western Electric Co., U.S.A.) February 19th.

4,151. "Electrical resistances." L. F. A. Fogarty & C. T. Lehmann. February 19th.

4,153. "Switches." J. Etchells, C. H. Stedman & Vickers, Ltd. February 19th.

4,162. "Electrical contact makers." J. L. Scott. February 19th.

4,166. "Induction regulators." G. Pestarini. February 19th.

4,168. "Rotary current collectors for electric machines." G. Pestarini. February 19th.

4,169. "Arrangements for increasing power factor of asynchronous motors." G. Pestarini. February 19th.

4,176. "Switch apparatus for ignition circuit of automobile." A. G. Tonks, C. A. Tonks, C. W. Tonks, G. A. Tonks and E. Tonks & Sons. February 20th.

4,178. "Alternating motor and measurer." F. W. Bawden. February 20th.

4,188. "Electrical switches." J. H. Thorne. February 20th.

4,192. "Trolley-wheel mechanism of overhead electric tramway systems." H. V. Richardson. February 20th.

4,196. "Connecting span wires and fittings for suspension of trolley wires in overhead wire systems of electric traction." Brecknell, Munro & Rogers and A. M. Willis. February 20th.

4,214 to 4,219 & 4,221. "Electric switches." J. A. Crabtree. February 20th.

4,220. "Electric plug and socket switches." J. A. Crabtree. February 20th.

4,222. "Self-regulating dynamo-electric machines." Brolt, Ltd., & W. Holt. February 20th.

4,234. "Electric lamps." J. Drabble & E. Farnsworth. February 20th.

4,244. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. & H. M. Friendly. February 20th.

4,253. "Long-arm for removing, replacing, or cleaning electric globes, &c." R. Taylor. February 20th

4,268. "Devices for carrying out chemical processes by electrolysis." V. Gerber. February 20th.

4,286. "Controlling electrical energy." C. D. Ehret. February 20th.

4,291. "Multi-speed dynamo-electric machines." F. Creedy. February 20th.

4,299. "Magnetic deflectors for electric arcs in lamps, searchlights, &c." J. P. Yorke. February 20th.

4,320. "Electric furnaces." H. Etchells, H. A. Greaves, W. Travis, and T. H. Watson & Co. February 21st.

4,342. "Electro-mechanical device for variable-speed transmission." T. Humphreys & H. H. Wright. February 21st.

4,375. "Electric starters for internal-combustion engines." A. H. Midgley and C. A. Vandervell & Co. February 21st.

4,382. "Electrolytic cell." J. Harris. February 21st.

4,386. "Electric storage batteries." E. W. Clarke & London Battery Co. February 21st.

4,387. "Assembling electric batteries." E. W. Clarke & London Battery Co. February 21st.

4,459/60. "Electrical signalling systems for mines." Automatic Telephone Manufacturing Co. & H. Green. February 22nd.

4,469. "Electric iron." R. F. Bruce & Gortholme Aircraft Co. February 22nd.

4,472. "Mono-polar electrode electrolysers." G. G. Hepburn. February 22nd.

4,483. "Telephone indicators or annunciators." F. G. Bell & Sterling Telephone & Electric Co. February 22nd.

4,488. "Multiplex telegraphs." G. Pestarini. February 22nd. (Italy, April 3rd, 1917.)

4,490. "Production of nitrogen compounds containing hydrogen with aid of electric discharges." F. Gros et Bouchardy. February 22nd. (Switzerland, February 25th, 1918.)

4,509. "Electrical accumulators." C. H. Worsnop. February 24th.

4,520. "Protector for electric lamp globes." C. V. Burton. February 24th.

4,542. "Sparking plug." A. Sproul. February 24th.

4,555. "Rotary switch." C. Braun. February 24th.

4,564. "Self-starting synchronous motors." H. O. Burge & Crompton and Co. February 24th.

4,573. "Electric terminals." J. W. Ewart. February 24th.

4,579. "Arrangement and connector for jointing electrical wires." J. S. Mollerhoj. February 24th.

4,586. "Ignition magnetos." E. C. R. Marks (Splitdorf Electrical Co.). February 24th.

4,592. "Electromechanical pocket lamps." K. K. K. Moller. February 24th.

4,600. "Production of nitrogen compounds containing hydrogen with aid of electric discharges." F. Gros et Bouchardy. February 24th. (Switzerland, October 2nd, 1918.)

4,622. "Electrodes for electrolytic recovery of metals from solutions." H. Wade (Central Coal Mining & Investment Corporation). February 24th.

4,623. "Electrolytic recovery of metals from solutions." H. Wade (Central Mining & Investment Corporation). February 24th.

4,630. "Method of electrically welding platinum, &c., disks to ends or heads of metal screws or rods." W. Meacher. February 25th.

4,637. "Dynamo-electric machinery." D. D. Rayner. February 25th.

4,650. "Electric flashlamp, bell, &c." J. F. Lister & G. Verity. February 25th.

4,671. "Reception arrangements for wireless telegraph and telephone systems." L. J. B. Verdier. February 25th.

4,709. "Alternating-current lighting apparatus." S. Salto. February 25th. (Italy, February 28th, 1918.)

4,710. "Electric motor cars." K. H. O. Lubeck. February 25th. (Sweden, February 25th, 1918.)

4,726. "Telephonic systems." E. A. Graham. February 25th.

4,745. "Electric connections." G. Duveau. February 25th. (Belgium, March 18th, 1914.)

4,751. "Electric selective signalling." Western Electric Co. February 26th.

4,755. "Telegraph systems." Automatic Telephone Manufacturing Co. and H. H. Harrison. February 26th.

4,791. "Circuits for incandescent lamps." C. C. Garrard & A. H. Railing. February 26th.

4,798. "Electric heaters for internal-combustion engines." H. G. Byrnes and S. B. Depree. February 26th.

4,811. "Fittings for electric, &c., lamps." E. H. R. W. Eyre & W. Harrison. February 26th.

4,817. "Means for securing electric lamps or lampholders to hand lamps, &c." E. H. R. W. Eyre & W. Harrison. February 26th.

4,828. "Electric helm indicators." Siemens Bros. & Co. and F. Turner. February 26th.

4,832. "Electric discharge devices." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 26th.

4,836. "Lock-out switches." R. P. Bossom & V. Breeze. February 26th.

4,840. "Ignition switches." A. H. Midgley & C. A. Vandervell & Co. February 26th.

4,841. "Induction coils." A. H. Midgley & C. A. Vandervell & Co. February 26th.

4,847. "Magnetic chucks." F. S. Blackhall. February 26th. (U.S.A., February 26th, 1918.)

4,848. "Electrodes and welding, &c., rods used in soldering and depositing metals." Alloy Welding Processes, Ltd., & E. H. Jones. February 26th.

4,850. "Trolley wheels for transmitting electricity for electric traction." G. H. Armitage, J. H. Rogers & S. W. Shaw. February 26th.

4,865. "Electric switches." E. A. Fagerlund. February 26th. (Sweden, September 6th, 1918.)

4,870. "Electric time switches." H. Goldman. February 26th.

4,876. "Alternating-current electrical apparatus for selective transmission of signals." F. M. Lewis. February 27th.

4,879. "Motor starters, rheostats, &c." L. K. Virr. February 27th.

4,887. "Automatic electric control apparatus." S. H. Adams. February 27th.

4,897. "Electric motors." F. Foster. February 27th.

4,898. "Coverings of conduits for laying electric cables." C. G. Warne. February 27th.

4,923. "Chemical processes conducted in electrical furnaces." H. Dreyfus. February 27th.

4,940. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) February 27th.

4,948. "Electrolysis." M. A. Adams, J. Fieldhouse, A. T. Mabbitt & J. Stevenson. February 27th.

4,955. "Trolley for electric tramways." G. Odierno. February 27th.

4,970. "Production of tone currents for telephone circuits." W. H. Grinsted and Siemens Bros. & Co. February 27th.

4,973. "Combined telephone pad and directory holder." H. J. Carter and C. W. H. Westell. February 27th.

4,982. "Sockets for electric lamps." J. Wegmann. February 27th. (Switzerland, June 18th, 1918.)

4,983. "Self-contained battery lamps." British Ever-Ready Co. & M. Goodfellow. February 27th.

4,990. "Electrical push apparatus for mines, &c." A. H. Marsh. February 28th.

4,999. "Electric poultice." G. S. Plant. February 28th.

5,006. "Combined electrical couplings and base-plates." R. W. Bill and W. T. Bower. February 28th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

10,243. Electric heaters. A. A. Buck. July 16th, 1917. (123,106.)

14,991. Electric accumulators. H. F. Joel. October 16th, 1917. (123,110.)

18,453. Electric cables. W. Williams and Callender's Cable & Construction Co. December 12th, 1917. (123,124.)

18,649. Electric pocket lamp. J. Chatwin (E. G. Comp, Phœbus). December 15th, 1917. (Convention date not granted.) (113,953.)

18,750. Electric ignition apparatus for internal-combustion engines. J. Courtier & P. Courtier. July 12th, 1917. (Patent of addition not granted.) (118,080.)

1918.

411. Electron emitting cathodes for vacuum discharge tubes, and process for making the same. Western Electric Co. (Western Electric Co., U.S.A.) January 8th, 1918. (123,126.)

423. Electrically-fired small arms. L. M. Bowman & W. A. Smith. May 29th, 1917. (116,257.)

474. Incandescent electric lamps for projection purposes. D. Lely and Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 2nd, 1917. (116,686.)

2,415. Protection of electric supply distribution systems in which shunt wires are employed. A. V. Downton. February 11th, 1918. (123,143.)

2,416. Electric measuring and circuit-protecting apparatus. A. V. Downton. February 11th, 1918. (123,144.)

2,494. Electric current controllers. Y. Uchida. February 12th, 1918. (123,148.)

2,515. Electric master and secondary clocks. P. P. Andersen. February 12th, 1918. (123,155.)

2,768. Apparatus for demonstrating systems of electric wiring. D. Rowan. February 16th, 1918. (Cogante application 4,397/18.) (123,170.)

2,800. Electric clocks. P. P. Andersen. February 16th, 1918. (123,171.)

5,774. Electrical speed-controlling apparatus. V. Bibire. April 4th, 1918. (123,216.)

THE
ELECTRICAL REVIEW.

VOL. LXXXIV. MARCH 28, 1919. No. 2,157.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

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THE PRICE OF ELECTRICAL ENERGY.

Now that the prices of commodities of every description are invariably much higher than was the case before the war, no surprise has been occasioned when, from time to time, the price of electricity for power, lighting, and heating has been raised. Railway, tramway, omnibus, and cab fares have also been increased, and in this country the enhanced charges have been brought into force with hardly any public comment on the subject.

It is, therefore, with a certain amount of astonishment that we have read the American technical papers lately—in fact, for the past few months. Those devoted to the interests of electrical traction have been, and still are, filled with appeals for increased passenger fares. Reasons are given—some fairly convincing, others redolent of the flatulent nonsense which was so strenuously boomed even here a few years ago, in the shape of "selling talk" and "advertising efficiency."

We are aware, of course, that the raising of tramway fares is not the simple matter there that it is here. Tramways, light railways, and most public utilities in the United States are almost always worked by private companies, whose rates and charges are subject to the approval of public utility commissions. Approval has, therefore, to be sought, and in some cases a vote has to be taken, before any change can be made. In addition to this, it appears to be the general usage to make a fixed charge per journey, irrespective of the distance travelled, just as the Central London Railway did in the days when it was the "tuppenny tube." The system of graduating fares according to distance, almost universal in this country, is there called the "zone system."

The American papers whose interests are concerned with power and industry are also devoting considerable attention to this problem, and an extremely interesting article, entitled "Cost *versus* Value of Service in Rate Making," written by Prof. John Bauer, appeared in the *Electrical World* on August 31st and September 7th, 1918.

We do not remember to have encountered in the British Press, or in books, any attempt on the part of the professor or student of the science of economics to consider the very important and far-reaching problems bound up with this subject. It is true Sir William Ashley spoke at the British Association meeting at Sheffield, some years ago, when Mr. E. W. Cowan presented a paper which dealt, to some extent, with the matter.

In the early days of electricity supply, many engineers, coming freshly up against the subject, armed with nothing in the shape of previous economic education, but only with sound engineering common-sense, evolved systems of charging of their own, and contributed knowledge and wisdom which, strengthened by the experience of subsequent years, have sufficed until lately to satisfy the requirements of the situation. The names of Arthur Wright and John Hopkinson will readily occur to the reader ; and a veritable crowd of less famous men have made important contributions to the subject, particularly in the earlier years. It was, and probably still is, possible in Germany to patent a system of charging, and numerous freak systems, each involving a particular kind of freak meter, were put forward—but this is by the way. Of recent years, in Great Britain, a supply authority has fixed a rate or method of charging, or amended an old system, the consumers have accepted it, the Press has not commented upon it, economists have ignored it—or have, more probably, been ignorant of it—and the subject has been treated with the fine contempt and disregard characteristic of the British people when confronted with any really important matter. Suffragettes, Sinn Fein, and other excitements occupy the nation's mind, to the exclusion of housing, education, health, and matters affecting the well-being of every man, woman, and child in the community.

Now, let us ask ourselves one or two questions. What is the fundamental notion—the eternal verity, if you like—underlying the satisfactory working of an electricity supply undertaking ? The answer to this is simple, but involves further questions. It is nothing more or less than this :—The lowest possible cost of manufacture, combined with a selling price which exceeds the cost, but is not so high as to drive the consumer to use some alternative means of obtaining what he wants, or to go without it.

The questions raised by this answer are many and various. One is—what is the cost of manufacture ? With this, at the moment, we do not propose to deal, because we are anxious to consider another, of equal if not greater importance, viz. : What ought to be the selling price ?

The very title of Prof. Bauer's article, "Cost *v.* Value," gives food for thought. The value of a thing may be out of all proportion higher or lower than the price paid for it in money. Who is there that does not possess some inexpensive article which he or she has come to regard as indispensable and irreplaceable ? That is an example of value exceeding cost. On the other hand, slum property is regarded as a profitable investment, and large rents are obtained for premises which have less than no value, which are plague spots and sinks of degradation, filthy and abominable to the last degree.

The principle of charging what the traffic will bear, is advocated by many, and must certainly be considered. It cannot, however, be regarded as ideal, even in the railway world. It leads directly towards discrimination between consumers.

The traffic may be able to bear charges considerably in excess of the cost of service. Many are paying 8d. per unit for electric light nowadays rather than be without it. Again, the traffic may be quite unable to bear the cost of manufacture. No one can afford, as a commercial proposition, to pay ½d. per unit for heating water for domestic purposes. The price would have to be much less.

In addition, then, to the consideration of what the traffic will bear, there is the question of providing a reasonable return on capital invested. Does the revenue derived from charging what the traffic will bear provide such a return or not ? If not, what shall be done to bring in revenue ? If so, what shall be done with the surplus ?

Prof. Bauer says quite flatly :—" If the revenues exceed a fair return, the rates are too high, and are reduced ; but if they are less, then the rates are too low, and are raised." On this, our contemporary quotes one A. C. Dunham as having commented that every time he had lowered his rates he had increased his net profits. Contrast this with the famous Bermondsey clause, which required Prof. Bauer's principle to be carried out.

If the traffic will bear high charges, it may be asked whether the return to the investor can ever be described as unreasonably high. This, in the United States, is the point at which the Commission is supposed to step in, and it has to decide whether the consumer shall be protected by low prices, or whether the revenue shall be artificially high and the profits appropriated for public purposes. Since the consumer pays, it may seem that the public purposes are being carried out without public expense, but a little consideration will, we think, expose the fallacy of this view. If electricity is expensive, the cost of the product turned out by its aid will be higher. The general public will pay, for there is no other reservoir from which the money can be drawn.

The question of ability to pay must also receive attention. Income-tax, super-tax, doctor's bills, rates, all of these depend on this principle. The question of willingness to pay cannot be neglected—a fact which is borne out by the American traction papers, which now frequently contain revelations of the unpleasant fact that a 20 per cent. increase of fares produces something like a 5 per cent. increase in the revenue. The *Electric Railway Journal*, in a recent issue, frankly records its opinion that " the zone experiment has been postponed too long." Make your fares too high, charge 3d. or 3½d. for any distance, when people have been accustomed to pay 2½d., and your passengers will desert you. They will walk, or buy a Ford car. The competition of the private motor-car is a serious thorn in the flesh of many tramways in America.

Running costs increase when wages increase and when coal becomes dearer. In the case of a stagnant undertaking, this is all that increases ; the sum invested remains the same, because the output makes no progress. In such a case, the only way of passing on the increased cost is to increase the price.

A progressive undertaking, with increasing output, has to increase the amount invested by buying new plant. The price of plant has increased, and coal and wages cost more, *but* there is a larger revenue. It is more than likely that with a properly-formed tariff, the increased revenue will offset the increases in cost. If this is the case, then the price should not be increased. Increase of output brings down overhead charges ; increase of output is brought about by low selling prices. Therefore, overhead charges are brought down by low selling prices. There must be a profit, and a good one. Far too much of British engineering, and particularly of the earlier electrical work done, is excellent as a monument to the soundness of our engineering practice, but it has not, up to the present, brought much in the way of dividends to the shareholders. It is not necessary to mention any one concern, for they are all tarred with the same brush.

Let a profit be made, but see that it is not unreasonably high. This policy protects the consumer, and advances the prosperity of the supplier along the right path. It is no solution of the problem to hand over large sums to relieve the rates, for the relief goes mostly into the wrong pockets. Even when the case is reached that a municipality can take a penny either off the price of gas or off the rates, the penny should come off the price of gas.

A correct system of charging should be based upon cost, and should graduate its charges in accordance with value of service. Neither one element nor the other should be the only one. Hence all systems of uniform fares are wrong, and all systems of charging for electricity by current limiters without meters are wrong, though they may (improbably) sometimes be (or seem) expedient. It is not worth so much to ride from Ludgate Hill to Charing Cross as it is to ride from the Bank to the Marble Arch, and it is wrong to charge a uniform fare. The increase in cost for the greater distance is not in exact proportion, but the cost is not the same. Thus from both points of view, uniformity is wrong, and the Americans will have to change their system if they want to improve the prospects of their tramway undertakings.

National Electricity Supply.

Time goes on going on, but there is still no sign of the introduction of the Electricity Supply Bill into Parliament by the Board of Trade. In the meantime, the Ways and Communications Bill is before Grand Committee, and nothing is heard as to its progress—though we imagine that it is undergoing a strenuous experience. How the two Bills are to be reconciled it is impossible to say until both drafts are before us; it looks as if the Transporters had jumped the claim of the Traders—stolen their lightning, so to speak; but we must wait for enlightenment on this point.

Meanwhile, perplexity reigns in the minds of the public, as may be gathered from various items in the lay Press. Those are not wanting who, somewhat furtively, cast doubt upon the merits of the super-station; one well-known municipal electrical engineer prefers to pronounce it "superstition," a shrewd thrust indeed—whilst others are developing alternative schemes, which they claim will prove equally economical. For instance, at the revived annual dinner of the West Ham Electricity Department, a fortnight ago, Mr. J. H. Bowden said that an independent report was being prepared on the subject of electricity supply in West Ham and Poplar, and when that was ready he thought the super-station question would bear a different complexion. Mr. J. B. Braithwaite, presiding at the meeting of the County of London Electric Supply Co., Ltd., last week, expressed agreement in general with the recommendations of the Electric Power Supply Committee, particularly with the proposal to place the electricity supply of the whole country in the hands of one body, but he said that in the Transport Bill this recommendation appeared to have been abandoned; the Bill would paralyse private enterprise. With regard to the supply of the Greater London area, he advocated the extension of the companies' tenure and the grouping of the companies and municipalities respectively into two great concerns which would be well able to cope with the requirements of the situation by linking-up their undertakings. This proposal obviously will not please the Municipalities of Greater London which are so anxious to eliminate all company control in the metropolitan area, and are, in fact, preparing a scheme of their own.

In the Provinces, as our columns have shown, numerous movements are on foot with the object of anticipating the proposals of the future Board of Electricity Commissioners, and staking out claims for the possession of super-stations, while the Board of Trade's activities in a similar direction occasionally come to light—witness the report by Sir John Snell and Mr. C. H. Merz on South Yorkshire, abstracted in our last issue, and the conference of North-West Midland authorities, reported the week before. The interim report of the Board of Trade Committee on Water-Power Resources of the United Kingdom, of which we give an abstract to-day, embodies a more optimistic view of this subject than any previous expression on the part of the Government, though it follows so closely on the lines of Mr. A. Newlands's paper, abstracted in our issue of February 8th, 1918, that it adds little to the information already available. The subject of "National Electricity Supply" is certainly very much alive, in spite of the dilatory methods of Government Departments.

Not only in this country is the movement progressing; similar proposals are being seriously considered in Canada, Australia, and New Zealand, as well as in Germany, Austria, Hungary, Bavaria, Spain, and other countries. The importance of electricity to the national welfare is everywhere appreciated, and it is clear that, given settled conditions, there is a period of unexampled prosperity before the electrical industries.

Returning to the Transport Bill, a mass of opposition to the proposal to place the control of electricity supply under the new Ministry is accumulating, especially on the part of municipal authorities, as is shown elsewhere in our columns to-day, and there appears to be little prospect of this part of the Bill getting through Parliament. We have already expressed our strong objection to the proposal, for which we see no justification whatever. To treat electricity as a mere adjunct to transportation, when in point of fact it is in itself a prime factor in the nation's concerns, and worthy of a Ministerial Department to itself, would be a fatal error. If it must be subject to a Ministry, let it be the Ministry of Commerce that shall be thus honoured.

State Electricity Works in Germany.

The intention of the Republican Government in Germany to vest in the possession of the State the control over existing sources of energy in the country, to which reference was made recently in this journal, coincides with the publication by Prof. Klingenberg of a memorial to the Government and the Federal States in relation to the nationalisation of the supply of electricity. In the professor's opinion, the principal requirement is the formation of great supply undertakings with the co-operation of the State, and he assumes that it is solely opportune for the State to become the owner of productive sources in bulk, whilst the time is not yet ripe for the State to take in hand the distribution of energy. On this basis it is suggested, for instance, that Prussia should be divided into eight main supply districts—the Saar, the left bank of the Rhine, the right bank of the Rhine, the Ruhr, the Bitterfeld lignite district, Berlin and environs, Hamburg—Lubeck, and Upper Silesia, and that eight State companies should be constituted, the most suitable form being that of joint stock enterprises with registered shareholders. As the essential rights of the State would be guaranteed by the statutes of the companies, which would be uniform throughout, it is not considered unconditionally necessary that the Republic and States should possess more than 50 per cent. of the share capital, especially as important decisions would be subject to a majority of two-thirds the votes. It is proposed that the Republic should contribute one-half of the authorised capital, so as to facilitate financing by the Federal States; while, on the other hand, the State, even during the war, has become the proprietor of large electricity works, or a participator in such undertakings, which would be incorporated in the State companies previously mentioned. In this connection are cited the Golpa power station, the Inn works in Bavaria, the projected Erft works, and the Walchensee works.

The majority of the other shareholders, in the opinion of the professor, should be composed of those provincial, communal, and private companies which already own electricity undertakings, and which would transfer them to the State companies in exchange for shares and debentures in the latter. It is suggested that the development of the State undertakings should be assured by legal regulations giving them preferential rights, in order to induce the existing undertakings to co-operate with the State companies. The owners of works who do not decide in favour of such a connection should be authorised also to continue their works for a long time within their area of supply. It is recommended that suitable compensation should be paid on the taking-over of "parts of installations." On the other hand, the professor contends that, in order to assure to the State undertakings the advantages expected from the development in the sale of energy, and to guarantee the greatest possible economy in fuel, the State companies should be given the right of preventing the execution of extensions, the erection of new works, and the reconstruction of power stations which serve for public supply purposes. In connection with this, the proposal is also put forward that the State companies should be vested with the right of sanction in the case of reconstructions and extensions, together with the right of expropriation and of demanding any information for this purpose.

The memorial holds that the scheme set forth would not involve any financial risk for the Republic or the State. The financing of the project is declared to be a simple matter in consequence of the gradual formation of the State companies, which would at once yield surplus profits, especially as most of the money could be raised by way of loans. It is finally suggested that the State companies should be gradually amalgamated, and thus ensure the uniform regulation of the supply of energy throughout the country.

LARGE ROLLING-MILL PLANT.

(*Concluded from page* 284.)

The following article, the substance of which is taken from the *British Westinghouse Gazette*, illustrates and describes an electrical equipment for a 38-in. reversing cogging mill recently installed in the Cleveland district, which is designed to roll 3-ton steel ingots 18 in. × 22 in. to 4 in. × 4 in. billets, with an output of 60 tons per hour.

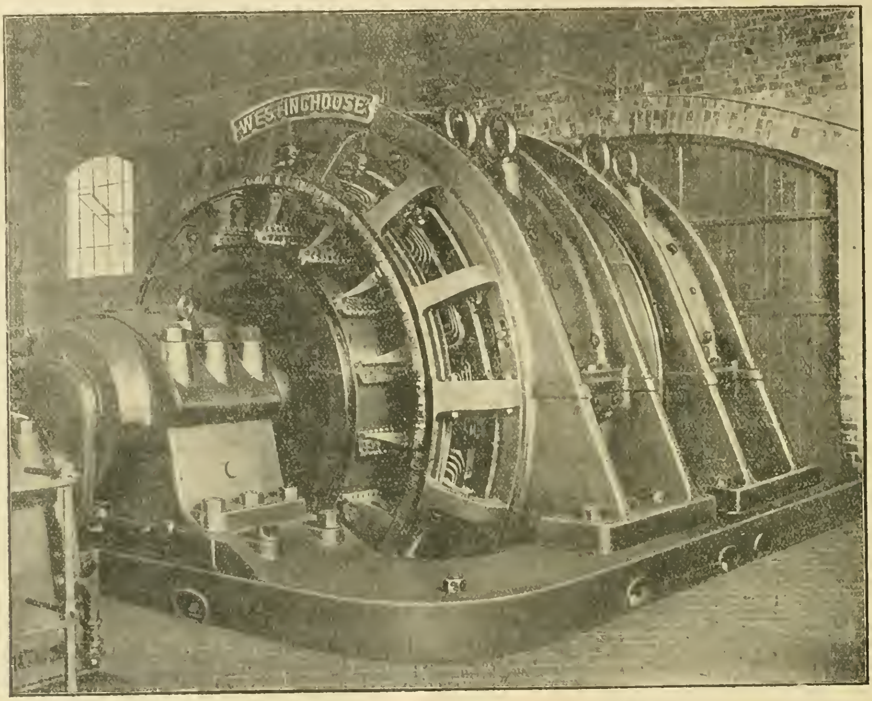

Fig. 5.—Double-Armature Westinghouse 13,700-h.p. Rolling-Mill Motor.

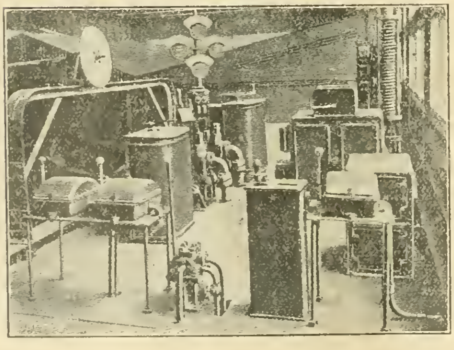

Fig. 6.—Driver's Control Platform.

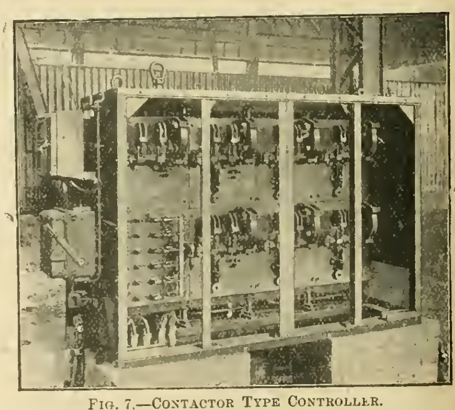

Fig. 7.—Contactor Type Controller.

The electrical equipment of the plant, supplied by the British Westinghouse Electric and Manufacturing Co., Ltd., of Manchester, consists of the following machines :—A mill motor rated at 4,800 h.p., r.m.s., or 13,700 h.p. peak, at speeds ± 0 to 100 r.p.m. ; three generators of 1,500 kw. each, and a 2,500-b.h.p. induction motor running at 600 r.p.m. synchronous speed, the supply being three-phase, 60 periods, at 2,400 volts. The fly-wheel weighs 30 tons, and has a peripheral speed of 22,500 ft. per minute, while each machine is separately excited. The mill motor (fig. 5) is a double-armature machine, and is forced-ventilated, dry air filters and blowers in duplicate being provided.

In this particular motor the insulation of conductors and mechanical construction have received special attention. Mica is used both for the insulation between coil and coil, and coil to earth, while the keying of core to spider is very substantial in character.

The motor and equipment are so designed as to be capable of giving over 30 reversals per minute up to ± 32 r.p.m. These quick reversals are obtained by forcing the generator field for a limited time during every acceleration period—that is to say, the voltage im-

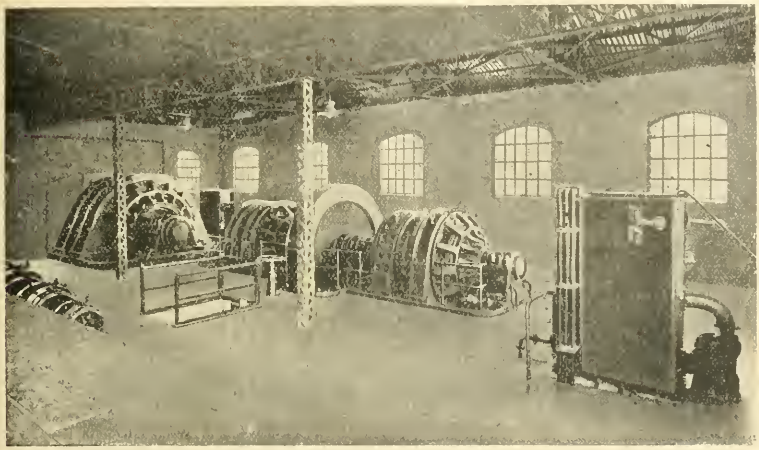

Fig. 8. — Electrical Plant Showing Mill-Motor, Motor-Generator Set and Liquid-Type Slip Regulator.

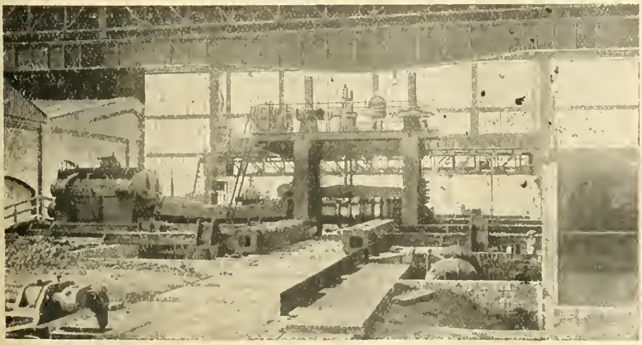

Fig. 10.—View of the Rolls.

pressed on the fields for this period is very much greater than normal. The initially high impressed voltage is brought back to normal by means of a relay connected across the main armature connections and operating when the voltage in those leads has risen to a predetermined value. At this moment the relay reinserts a resistance in the field of the main generator exciter, and consequently the forcing ceases. By these means, almost any required rate of acceleration is obtainable through adjustment of the initial exciter voltage. Fig. 11 shows the connections and the relay and resistance for speeding up the acceleration. There are three exciter machines coupled together on one bedplate and driven by an induction motor of 150 B.H.P. The small machine excites the fields of the two larger exciters, and the Ward-Leonard controller operates on the fields of the exciters and not on the main fields; thus the controller handles less than one-fiftieth of the main field watts. In consequence the size of the controller is much reduced, the ease and accuracy of its operation being largely increased. That any sluggishness which may be present is negligible when "forcing" is used, is proved by the acceleration figures—viz., 30 reversals per minute for this mill.

The fly-wheel of the motor-generator set, fig. 9, is a steel casting specially annealed, and is designed to give undiminished strength at its centre. The shaft does not pass through the fly-wheel, but is provided with two spigoted faces, which are taken by corresponding recesses on the solid forged shaft couplings.

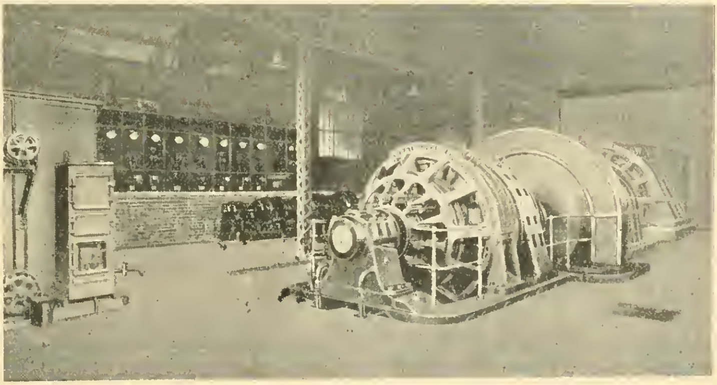

Fig. 9.—Motor-Generator Set, 30-Ton Fly-wheel. Peripheral Speed of 22,500 Ft. per Minute.

The automatic slip regulator of the liquid type has its weir, which controls the level of the electrolyte in the regulator, operated by a separate D.C. motor. This motor is started in either direction or stopped through the action of an A.C. relay in the form of a torque motor, which takes its power supply from the main A.C. circuit through single-phase transformers. The current flowing in the torque-motor stator is, therefore, proportionate to the load, with the result that through the action of the relay, the D.C. motor being controlled thereby, it continuously adjusts the position of the weir to give the required change of resistance or slip called for by the varying load. The relay remains stationary, and the weir at its closed position, from no-load up to a predetermined load, when the varying adjustment of resistance suitable to the load takes place automatically. The action of the relay and D.C. actuating motor being extremely rapid and dead beat, the position of the weir is varied with accuracy and certainty. The load at which the relay will operate may be varied by means of suitable tappings on the series transformers, so that the stored energy in the fly-wheel may begin to be utilised at any of several different load values.

A very complete system of forced lubrication for emergency and for running under usual working conditions is provided. Should the flow of oil cease from any cause, the motor-generator set will automatically shut down, and should the main oil tap be closed the set cannot be started up. A flow indicator of the sight-feed type is fitted at each bearing, and a flow-indicator trip switch is fitted to give an alarm should the flow cease at any time.

On the driver's platform (fig. 6) is fitted the Ward-Leonard controller, the usual set of driver's instruments, and an emergency push button.

The master switches for live roller, screw-downs, and other electrically-driven auxiliaries, are fitted adjacent to the controller, also the hydraulic controllers.

The safety device S D in fig. 11 is an arrangement which, when operating due to low voltage or no volts on the exciter, first inserts resistance in the small exciter field, and then opens that circuit, thus taking the field off all the D.C. machines. In the event of the exciter volts falling below normal from any cause, the generators would be subjected to heavy overloads, as the torque over all the peaks, due to rolling, must be maintained; as the torque is dependent on current and mill-motor field strength, when the latter is decreased the former must be increased, and therefore an overload sufficient to operate the breaker may easily occur under these circumstances. The safety device is, therefore, set to cut out the fields should the exciter voltage drop to danger point or fail altogether; it may also be tripped on emergency by the driver by means of a switch fitted on the platform.

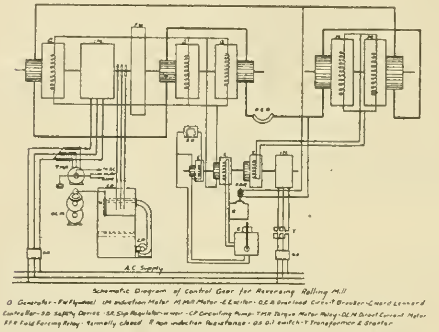
A.C Supply
Schematic Diagram of Control Gear for Reversing Rolling Mill
G Generator - FW Flywheel IM Induction Motor M Mill Motor - E Exciter - O.C.B Overload Circuit Breaker - L Ward Leonard
Controller - SD Safety Device - SR Slip Regulator - CP Circulating Pump - TMR Torque Motor Relay - D.C.M Direct Current Motor
FFR Field Forcing Relay - Normally closed R non induction Resistance - OS Oil switch - T Transformer & Starter

Fig. 11.—General Scheme of Connections.

The mechanical parts of the rolling mill were designed and made by Messrs. Davey Bros., Ltd., of Sheffield.

MORGAN'S PATENT ELECTRICALLY-HEATED CRUCIBLES.

Last week we had the pleasure of visiting the Battersea Works of the Morgan Crucible Co., Ltd., to inspect a series of electrically-heated crucibles of entirely novel design, which has recently been perfected by the company, as the outcome of experiments and research extending over a period of 20 years. The work was nearly completed when war broke out, necessitating the concentration of the company's activities on apparatus more directly connected with the manufacture of munitions; now that the emergency has passed the former work has been resumed, and the successful results obtained are of exceptional interest in view of the developments which have taken place during the war, in connection with the wide-spread adoption of electrical heating for melting and refining metals.

Hitherto electric furnaces for melting metals have been almost wholly of the arc type in its varied forms, and these have been applied mainly to the treatment of steel; difficulties arise in the melting of non-ferrous metals, particularly alloys containing zinc, owing to the volatility of that metal, which renders the use of the arc very objectionable, owing to the excessive waste of a costly metal, and to the possible contamination of the melt with carbon or deleterious gases. Attempts have been made to get over the difficulty by various methods, especially in the United States, where the excessive cost and bad quality of the crucibles obtainable during the war compelled brass-founders to seek other means of melting the metal. In our issue of August 10th, 1917, we described a brass-melting furnace in which the crucible was heated by radiation from troughs containing a granulated carbonaceous material heated by the passage of a current; and in our issue of September 13th, 1918, we described the "rocking-type" of furnace devised by the U.S. Bureau of Standards, in which metal was heated by radiation from an arc, whilst the whole furnace was slowly rocked to and fro, to keep the metal thoroughly mixed, and thus prevent the evaporation of the zinc from the overheated surface of the melt. Naturally, this type of furnace is very costly, while the method of applying the heat is far from efficient, and the consumption of electrodes, wear of linings, skilled attendance, &c., add to the expense and the volatilisation of zinc is only mitigated, not avoided.

The most economical method of heating metal, *prima facie*, is to pass a current through its substance, as in the induction type of electric furnace; but while this has been successfully employed for steel, it is quite unsuitable for metals of high electrical conductivity such as brass, owing to the very large current required, and the resulting strong "pinch" effect, which causes the molten metal to draw apart and break the circuit. The next best system is obviously to generate the heat in the walls of the crucible containing the metal. From this it is a long step in the direction of inefficiency to adopt the method of transmitting heat from outside to the walls of the crucible by radiation and convection, but, nevertheless, this is the method in general use. The Morgan crucible is of the second type—that which is heated by the passage of current through the walls of the crucible itself—and, therefore, makes use of the most efficient system that is commercially practicable.

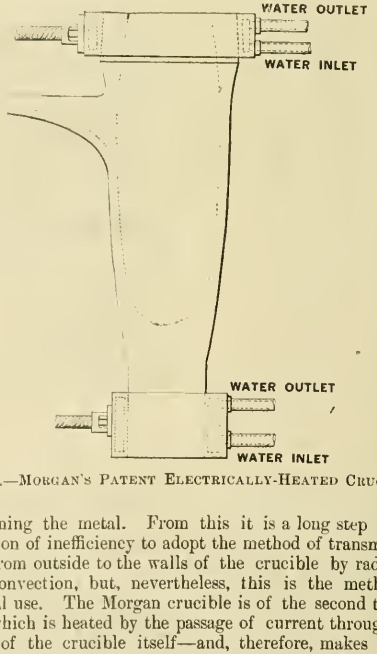

Fig. 1.—Morgan's Patent Electrically-Heated Crucible.

It has been well known for many years that crucibles made of a mixture of clay and plumbago can be heated by this means; many patents have been taken out based on this principle, but none of them has hitherto proved successful, owing to the many obstacles met with in practice. Amongst these are the difficulty of so shaping the cross-section of the crucible that the heat generated produces uniform temperature over the heated area; and the heavy current at low voltage that has had to be employed, owing to the low specific resistance of the material and the thickness of the walls necessary to withstand the stresses to which they are subjected under working conditions. A high percentage of plumbago is necessary to enable the crucible to endure the wide and frequent changes of temperature without failure, and hence attempts to increase the resistivity by reducing the proportion of plumbago failed.

Another grave difficulty was met with in designing terminals suitable for carrying the heavy current, and the mounting of the crucible in such a way as to secure freedom for expansion and contraction, and adequate support for the crucible (which is very soft when hot), presented a tough problem. When the resistivity of the different parts of the crucible was modified by varying the percentage of plumbago in those parts, the resulting variations in the percentage of shrinkage in those parts led to difficulties in manufacture, and the fact that the material had a negative coefficient of resistance with temperature, rendering it liable to local overheating and consequent failure of the crucible, necessitated the adoption of special precautions.

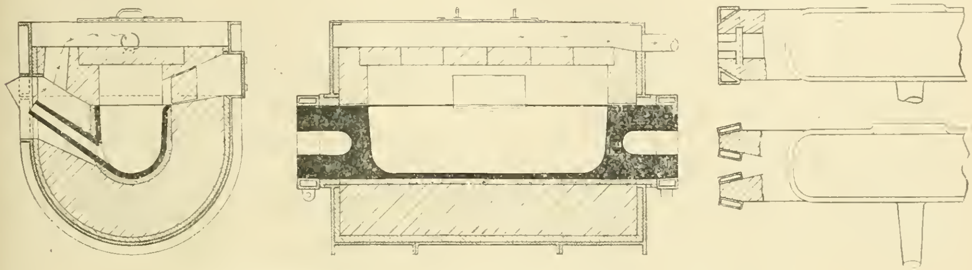

Fig. 2.—Sections of Morgan's Patent Electrically-Heated Trough Crucible.

The Morgan Crucible Co. claims to have overcome all these difficulties, and is now in a position to make electrically-heated crucibles capable of dealing with charges of one ton and more. The various patterns so far standardised are illustrated herewith.

Fig. 1, p. 342, shows the upright pattern of electric crucible, generally similar in form to the ordinary externally-heated type; it will be seen that heavy water-cooled gun-metal terminals are employed, which are clamped on the thickened ends of the crucible. This pattern holds up to 150 lb. (brass), and takes a current of about 1,000 amperes at 20 to 40 volts, either D.C. or A.C. It is provided with a special pouring spout, integral with the body of the crucible, and is arranged to tilt about the centre, the mounting consisting of a cylindrical steel casing carried on trunnions, to one of which is fitted a worm wheel engaging with a worm. The top extension of the crucible forms a charging hopper for metal, and is closed with a refractory cover. The casing is lined throughout with heat-insulating material, and a refractory lining, the small space between the latter and the crucible being filled with suitable refractory material. The interior of the crucible is provided with a thin refractory lining, which prevents the metal from making electrical contact with the crucible and thus diverting the current.

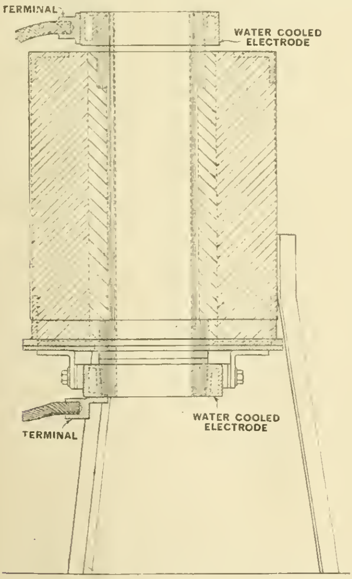

Fig. 3.—Section of Morgan's Patent Electrically-Heated Tube.

The outfit is simple and compact, requiring neither foundation nor chimney; the crucible is at practically the same temperature as the melt, and the temperature is easily regulated to a nicety; the absence of carbon electrodes facilitates charging, stirring, and pouring, and the comparatively low temperature of the hottest part—a special feature of the system—relieves the operator from discomfort. As the surface of the metal is not overheated, the losses by oxidisation and volatilisation are reduced to the minimum; no harmful gases are generated, and, in fact, it is easy to protect the metal with an inert gas, if desired. The crucible is not exposed to mechanical damage, and its refractory lining is very durable—in the case of a crucible which had been used for 20 heats, and then sawn through, we could see no evidence at all of wear or fluxing; and as the heat is produced only where it is required, and effectively retained by the lagging, the efficiency of the apparatus must be very high. The hygienic conditions of operation are obviously all that could be desired, for the whole thing is completely closed except when stirring or skimming the charge, and there are no products of combustion to be got rid of. Moreover, coke or gas stoves, forced-draught fans, storage for fuel, &c., are dispensed with.

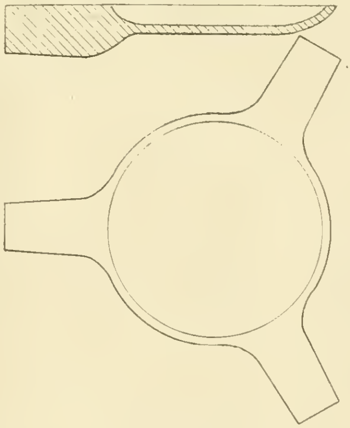

Fig. 4.—Morgan's Patent Three-Phase Electric Hearth

In fig. 2 is shown a much larger pattern of electric crucible, on entirely different lines; it consists of a horizontal trough, with a spout at the middle, and is mounted in a larger trough of cast-iron, from which the crucible is isolated by refractory linings, as in the pattern described above. The drawings are self-explanatory, but we may draw attention to the arrangement of the charging door.

the spout, and the cover. It will be seen that the air is drawn off from the space above the lining through a duct connected to an exhaust fan, and that provision is made to capture any fumes that may escape from the spout. The whole apparatus can be arranged to tilt for pouring in any way desired. The terminals in the example illustrated are of a similar type to those of the upright crucible, but other forms are shown separately, one being attached by means of a kind of bayonet joint, and the other being of a twin pattern. This furnace is made to melt 800 lb. of brass, requiring about 60 KW. (1,500-1,800 amperes at 30-40 volts) for two hours, equivalent to 15 units per 100 lb. Thus, at 1d. per unit, the cost of energy is 0·15d. per lb. of metal. The regulation of the furnace is confined to the reading of instruments and the manipulation of switches, so that one man can charge, stir, and pour the metal without strain or discomfort. In fact, one man should be able to control three of these furnaces. All the advantages adduced in the case of the upright furnace apply equally to this type, and, in addition, it will be observed that the shape of trough lends itself to ease in stirring and mixing the charge, and to the charging of large ingots and long pieces of scrap. We saw the attendant put a piece of metal into the bath with his hand, showing that the heat radiated was very small in quantity. The spout draws from the bottom of the trough, so that the metal is always clean, and the crucible can be completely emptied. In the case of failure of the crucible, it can be lifted out and replaced by another without disturbing the lining. The conditions of melting and stirring and temperature regulation are obviously favourable to the production of the best quality of metal. As the lining of the plant is separated from the crucible by a layer of granular insulating material, it is at a lower temperature than the molten charge, and therefore is very durable; the company has had a furnace in constant use with the same lining for over a year.

The following figures give the results of a trial melting of 65/35 brass for strip castings:—The charge consisted of two-thirds webbing and one-third virgin metal, the zinc part of the virgin metal being put in at the end of the charge: 800 lb. of metal were put into the charge, and there was a loss of only ½ per cent. Even this small loss would have been largely obviated had proper pouring appliances been available for this trial run. The time taken for the melt was approximately two hours, and the total energy consumed was 120 units, giving a consumption of 15 units per 100 lb. of metal. This trial was the second heat of the day, and lower figures can be obtained in subsequent heats, as it takes two or three heats for the furnace to reach its maximum melting efficiency.

In fig. 3 is shown a vertical electrically-heated tube, suitable for the continuous heating of materials as in hardening and tempering tool steel, annealing, &c., a class of work which is expected to develop very considerably; for instance, the annealing of bright brass strip without tarnishing, a process hitherto used only in Germany, will be possible with a heating tube of this kind. One of these tubes in operation at Battersea is 8 in. in diameter, and 40 in. long, and can be used up to a temperature of 1,250° C.; larger sizes can be made, and the temperature can be regulated closely up to a maximum of 1,350°—1,400° C.; it is hoped ultimately to reach 1,500° or 1,600° C. In the furnaces, steel punchings have been melted experimentally, but at present the crucibles are not supplied for metals requiring a higher melting-point than 1,300° C.

Fig. 4 shows a novel and ingenious design for an electric "hearth"; it consists of a basin with three equidistant terminals, for connection to a three-phase supply. This is not ready for marketing, but we saw one in operation, and noted that, thanks to the distribution of the material and the current, the temperature over the whole surface of the basin was practically uniform. Such a device will certainly prove very useful to metallurgists.

Various detailed patents have been taken out in connection with electrical melting units: one for a trough-shaped crucible, one for a crucible of ordinary shape, one for a three-phase hearth, one for means of heating the pouring spout, and one for means of regulating the voltage across the crucible by adjusting the resistance at the water-cooled terminal.

One of the most interesting features of the demonstration was the use of special refractory-insulating bricks made by the company. These have a specific gravity of less than 0·9, and, consequently, absorb extremely little heat, whilst they act as heat insulators, a very important factor in connection with electrical melting units that are used on day shifts only. These bricks have been employed in the construction of a very fine kiln which has been built by the company during the war, and is in constant use in the manufacture of plumbago crucibles; the walls consist of reinforced concrete, and heating is effected by producer gas. From an inspection of the interior of some of the heating chambers it was seen that the refractory brick lining was, to all appearances, as good as the day it was put in, two years ago. The whole of the kiln is above-ground, and the arrangements for controlling the gas and air supply and the temperature are very complete.

In concluding this article and thanking the company for the opportunity of witnessing a most interesting demonstration, we wish to congratulate the directors on the successful development of an entirely new industry, British from start to finish, which is not only in itself a valuable addition to the national assets, but also is likely to prove of great utility to other industries. The invention is mainly due, we believe, to Mr. C. W. Speirs, M.I.E.E., who has been working at the subject for many years.

DIELECTRICS IN ELECTRIC FIELDS.

On Thursday, last week, a discussion took place at the Institution of Electrical Engineers on this subject, following on the three lectures delivered by Mr. G. L. Addenbrooke.

Mr. Ll. B. Atkinson was called upon by the President to open the discussion, and drew attention to Mr. S. Evershed's paper on a similar subject; he pointed out that the conclusions arrived at by Mr. Evershed with regard to the part played by moisture in dielectrics were in harmony with those of Mr. Addenbrooke. He submitted an alternative explanation of the phenomena observed, on the basis of elementary condensers formed by the moisture and dielectric, in series with resistances (the conducting paths through the moisture) which would behave after the manner described by Mr. Addenbrooke. The accumulation of the moisture in the dielectric he attributed to the property of fine tubes, which lowered the vapour pressure of water and caused condensation; if a dried dielectric such as celluloid contained pores 0.002 mm. in diameter, the vapour pressure within the pores would be halved; hence, if the humidity of the atmosphere was about 80 per cent. of saturation, an ordinary value in this country, vapour present in the pores would at once condense. Oil and water would not enter such minute cavities in liquid form, but water vapour could enter them, and would then be condensed, so that drying would be ineffective if the material were afterwards exposed to the air.

Mr. G. F. Mansbridge pointed out that dielectric materials used in the manufacture of cables and condensers were dried before use, up to the point where no further improvement in insulation resistance was gained; he doubted whether the remaining moisture was responsible for all the losses in the dielectric. Tests which he had made showed that with A.C. the losses varied as a power greater than the square of the voltage, somewhere in the neighbourhood of 2.4. The power factor was proportional to the frequency, and increased with the applied pressure; the curve cut the axis at a point above zero, showing that there was still a loss at zero frequency. The reduction of that loss, consequent on a knowledge of the cause of the loss, would be a step in advance. He thought there was "mass" action as well as that due to the moisture. The efficiency of condensers was now from 99.5 to 99.7 per cent. The condensers made by the British Insulated & Helsby Cables, Ltd., had a power factor of 0.003, and had been brought to a high pitch of reliability; the self-sealing property of the foiled paper was shown by Mr. Addenbrooke's curves, when a condenser built for 100 volts was tested to destruction and withstood pressures up to 750 volts.

Mr. E. H. Rayner said that the most important measurement on a dielectric was the energy loss on reversing the field. With high voltages, very simple apparatus served quite well for technical purposes; he described his own apparatus, which had a range up to 15,000 volts. Voltage tests alone afforded no criterion of quality—frequency tests were also necessary.

Mr. W. M. Mordey thought that even if the material were absolutely dry, there would still be a loss due to mechanical effects; at high pressures the mechanical attraction of the oppositely-charged electrodes exerted a pressure of several pounds per square foot, which might produce a frictional loss. With the power factor 0.01 commonly attained in cables a three-phase cable with a capacity of 0.3 mfd. per mile, working at 10,000 volts, would dissipate enough energy to light an 8-c.p. lamp every 20 yards.

Mr. Philip, referring to the determination of moisture in oil, said that he had devised a method by which one part of water in a million of oil could be determined. On removing the moisture from oil which stood a breakdown pressure of 22,000 volts between points 100 mils apart, the breakdown pressure was raised to 58,000 volts. A small amount of water produced very large effects in oil.

Mr. H. M. Sayers thought that Mr. Addenbrooke's methods would be useful in cable shops. He did not think that moisture was the sole cause of breakdown; sudden pressure rises could breakdown cables without accumulation of effect. He raised the question of measurement of the d.c. loss, pointing out that in cable tests there was a continuous rise in insulation resistance with time of application of pressure. He suggested that sulphur would be an interesting subject for study, owing to its being obtainable in three forms. The Electrical Research Committee should see that the experiments were continued.

Mr. A. P. Trotter said that he had followed the development of Mr. Addenbrooke's research with interest, and referred to the effects of osmosis on the insulation ot conductors on tube railways, &c.

Mr. A. G. Collis expressed a desire for information with regard to impregnated fabrics, moulded insulating materials, oils, and bitumen compounds.

Another speaker said that work done on the Continent confirmed Mr. Addenbrooke's results. The ordinary worker found electromagnetic apparatus easier to manage than electrostatic.

The President (Mr. C. H. Wordingham) stated that the I.E.E. Research Committee had already instituted investigations in connection with all the materials mentioned by Mr. Collis except bitumen compounds. Mr. Addenbrooke's reply to the discussion would appear in the *Journal*.

WATER POWER IN GREAT BRITAIN.

Interim Report of Water-Power Resources Committee.

According to a special article in the *Board of Trade Journal*, the recent investigations of the Water Power Resources Committee of the Board of Trade, appointed in June, 1918, demonstrate that upon the basis of the present average practice in coal-fired power stations in Great Britain, nine potential water-power schemes alone out of a large number existing in Scotland and in other parts of the country would represent an annual saving of 1,850,000 tons of coal if they were fully developed and utilised.

It first became clear to the Government that a systematic survey of the water-power resources of the United Kingdom was a question of practical importance through the investigations of the Nitrogen Products Committee, appointed in 1916 by the Ministry of Munitions. The Committee recommended in December, 1917, that a thorough investigation should be made of the water-power resources of the country, and the President of the Board of Trade decided, with the concurrence of the Minister of Reconstruction, to appoint a fresh Committee to go thoroughly into the whole question.

The Interim Report of the Committee deals principally with selected schemes in Scotland, but the Committee is fully alive to the possibilities in other parts of the United Kingdom. It is anticipated that the investigations now in progress will reveal the existence of a substantial aggregate of smaller water powers in England and Wales. The problem in Ireland is being dealt with locally by a special Sub-Committee. The Interim Report deals with only that portion of Scotland concerning which surveys and estimates are ready. The Committee considers that nine powers can be developed on a sound commercial basis, and that it would be practicable to transmit the electrical energy developed at the water-power stations to industrial centres in Scotland. The report is issued as a Parliamentary Paper (Cmd. 75). Its contents are abstracted below:—

The main purpose of the report is to bring to the notice of Sir Albert Stanley certain practicable water-power schemes which may prove of assistance at once to the Board of Trade and to the Ministry of Reconstruction in providing employment for labour, not only on the works themselves, but also in consequent and auxiliary trades. The Committee has collected a very large amount of data and taken evidence from a number of witnesses, while four well-known civil engineers have been retained for carrying out preliminary surveys in certain selected areas in Scotland and in North Wales.

The reports in the possession of the Committee dealing with a portion of Scotland alone show that nine water-power schemes are capable of generating a continuous supply of 183,500 electrical h.p., corresponding to an output at the hydro-electric stations of 1,200 million Board of Trade units per annum. Allowing for losses in transmission and transformation, the nine schemes in question could deliver at least 1,000 million Board of Trade units within a radius of supply of from 80 to 85 miles. If the nine schemes were fully developed, they would be capable of supplying about double the present output for power, traction, and lighting purposes in Scotland. Industries dependent upon considerable blocks of cheap power, for example, the manufacture of carbide or calcium cyanamide, or other electrochemical or metallurgical processes, could be established close to those of the water power stations which would be conveniently situated as regards railway and water transport. The Committee emphasises the fact that the whole of this potential water power is now running to waste.

The nine Scottish schemes are briefly described in the following table; a full report upon each scheme is in the possession of the Committee.

Group.	Scheme.	Continuous E.H.P.	Estimated capital cost.		No. of men required.
			Total. £	Per E.H.P. £	1st to 3rd year.
A	Loch Laggan ...	38,000	1.742.000	45·8	2,000—3.000
	„ Treig ...				
B	„ Ericht ...	42.000	1.580.000	37·6	2,000—6.000
	„ Laidon ...				
	.. Rannoch ...				
	„ Tummel ...				
C	.. Quoich ...	27.000	1,069,000	39·5	1,000 - 3,000
	.. Loyne ...				
D	.. Clunic ...	9.200	393,000	42·8	500— 900
	R. Moriston ...				
E	Loch Monar ...	7.200	315.000	44·0	250— 750
F	Lower Farrar ...	7,600	288,000	38·0	250— 750
G	Loch Affric ...	31.000	1,133.000	36·5	750—3,250
	„ Mullardoch..				
H	Kilmorack Falls...	9,500	160,000	17·0	250
I	Loch Awe ...	12.000	395,000	32·9	500—1,000
	.. Nant ...				
	Total	183,500	7,075,000	38·5 (average)	

Except in the case of Group A, the figures for the capital cost do not include an allowance for interest on capital during construction.

The estimated costs of development are based upon pre-war contract prices with an addition of 50 per cent. The costs are inclusive of all civil engineering and hydraulic works, power houses and plant, and of reasonable compensation for rights and property that would have to be acquired to carry out the developments.

The surveys and estimates of the nine schemes give a total continuous power of 183,500 electrical h.p. at an average capital cost of £38.5 per effective electrical h.p. developed at the water-power stations.

With similar conditions in regard to transmission and distribution, it would be possible for a water-power scheme of say, 5,000 e.h.p. or upwards to compete on an equality with the very best steam-power station (with coal at 10s. per ton delivered), provided the cost of developing the water power did not exceed about £60 per effective e.h.p. It will be seen, therefore, that the above schemes are well within the limiting cost for development on a sound commercial basis.

If the above schemes were fully developed and fully utilised, the average cost of the electrical energy generated, inclusive of all running expenses and capital charges, should not exceed 0.15d. per unit at the water-power stations, for the continuous use of practically the whole output by works situated near the power stations. For ordinary industrial demand of a less continuous character, the cost would, of necessity, be greater. The energy could be delivered into the industrial districts of Scotland at a cost which would be considerably lower than the present cost of electricity.

The Committee is of opinion that these potential water powers are to be regarded as national assets, and that any rights or property necessary for their utilisation should be acquired by the nation at reasonable and proper purchase costs. The water powers should either be developed by the State, or leased to a public or commercial undertaking for a sufficient term of years to enable the lessees to redeem the large capital expenditure by means of a small annual sinking fund.

If some of the schemes are to be begun at once for the useful employment of labour in 1919, the only possible way appears to be for the Government to promote a short Bill giving the Board of Trade powers to acquire the necessary rights, and for the Board to instruct the engineers at once to make further surveys where such are necessary, to prepare plans and to estimate quantities, so that actual construction could be begun in the early summer.

The Committee is in possession of further reports and estimates based upon surveys carried out in Scotland and in North Wales, and promising schemes are indicated in each report. For example, there is a source in North Wales which is capable of developing 4,400 continuous e.h.p. at an estimated capital cost of £41.8 per e.h.p. There appears to be numerous small water powers in many parts of the country, ranging from 100 E.H.P. to perhaps 2,000 E.H.P. The powers could be developed in automatically-controlled stations, which would deliver energy into a general electrical transmission network or would serve to supplement existing coal-fired power stations.

There are two outstanding factors which have been prominent in arresting the wider development of water-power schemes on a large scale in this country, namely:—

(a) The costly, protracted, and inefficient system of obtaining the necessary authority by means of a Private Bill.

(*b*) The multiplicity of interests to be reconciled.

With regard to the former, the Committee is of opinion that if the rights necessary for the development of all water powers above a certain size were secured by the State, as and when required, many of the difficulties experienced in the past would disappear and preliminary waste of capital be obviated.

With regard to the question of multiplicity of interests, there is no doubt whatever that the powers now vested in numerous departments, boards, and other bodies concerned with different aspects of the water problem, require thorough revision and co-ordination. The need of a simple, inexpensive and expeditious procedure for adjusting the claims of the several interests is vital.

Strong evidence has been submitted to the Committee regarding the lack of adequate training facilities in the universities and technical institutes of the United Kingdom for young engineers wishing to enter the field of hydro-electric development. In view of the very large extension of water-power development that is practically certain to take place in the near future, the Committee considers it important in the interests of British industry that steps should be taken to remedy this state of affairs. Government support should be given where necessary for the initiation of special lectureships and courses in the subject of universities and technical institutes.

ELECTRICITY *v.* GAS.

Discussing the subject of "The Distribution of Heat, Light, and Motive Power by Gas and Electricity," before the Royal Society of Arts, Sir Dugald Clerk, K.B.E., said our industrial civilisation to-day was founded upon the use of the coal deposits of these islands, and the problem of coal conservation possessed an importance far greater than that of mere technical interest; it concerned the whole population in a vital manner. The gas industry of the United Kingdom consumed about 20,000,000 tons of coal per annum, of an average calorific value of 13,000 B.TH.U. per lb. The electrical industry of the country, according to Mr. D. Wilson, the technical adviser to the Coal Controller, in the year ending March 31st, 1918, generated 4,674,000,000 electrical units with a coal consumption of 3.47 lb. of coal per unit; the calorific value of the coal was 11,600 British thermal units per lb., the thermal efficiency of generation, 8.5 per cent., and the total consumption of coal in the year, 7.3 million tons. Electric heat supply, if substituted for gas heat supply, would necessitate the consumption of four times the fuel or thermal value. The case was different, however, when light was produced by the two systems. The inverted incandescent lamp required the use of 47 B.TH.U. at the gasworks for each candle-power hour obtained by the consumer. The one-watt electric lamp required the use at the generating station of 54 B.TH.U.; the half-watt lamp only required 31 B.TH.U. The upright type of gas burner was less efficient, requiring 82 B.TH.U. per candle-hour. If they assumed the gas-lighting system to consist of equal numbers of vertical and inverted burners, then 64 B.TH.U. would be required per candle-hour. High-pressure incandescent burners reduced the heat consumption to 23 B.TH.U. per candle-hour, and flame arcs in electric lighting used only 15 B.TH.U. From these figures it was evident that the competition between gas and electricity in lighting was very keen, and conditions other than heat economy would determine the system to be applied. The motive-power position was much less complicated, and the efficiency of the gas-power production and distribution was over 1.6 times that of the electric system. The extension of the industrial stage of our civilisation could only be made possible by the co-operation of the Government of the country with the gas, steam, electric, and hydraulic engineers, in order to ensure the full utilisation of all sources of heat, light, and motive power for the good of the community, even at the cost of some legislative interference with the immediate profits of some industries. Great sources of energy on which they depended for their very existence should be conserved with the greatest care.

Lord Moulton, who presided, in the course of discussion said that if the population of a nation was to get the full value out of a piece of coal it must be used very largely in the household. No one would doubt that the great waste of coal in a civilised country like England was its use in open fires. If that was going to continue, then the amount of coal they saved by the suggested methods of coal conservation would only go a little way towards making up for the waste in open fires. But if they desired to have an economical substitute for the open fire, then gas left electricity entirely out of calculation.

Mr. F. W. Goodenough (of the Gas Light and Coke Co.) said he felt there would be great disappointment in many hamlets and farms and towns in the country at the disappearance of the vision of the supply of cheap electricity that was going to do everything in the direction of heating, cooking, and firing throughout the country, because no Legislature could possibly sanction measures to foster proposals that would lead to such costly waste of the fuel resources of the country—all too limited as they were—as would be involved in the displacement not merely of gas as used at the present moment, but of coal as used in the homes of the country by electricity. An official of the Coal Mines Department told him he thought 40,000,000 tons about represented the consumption of proved coal for domestic purposes in the country at the present time. Taking Sir Dugald's estimate of the possibilities of gas production in the future, a destruction of 20,000,000 tons of coal at the gas works could displace the 40,000,000 tons a year used in fuel form in the homes of the country at the present time. On Sir Dugald's figures it would take 120,000,000 tons of coal destroyed at the average electrical generating station to-day to give that equal service, or 60,000,000 tons at the promised super-stations.

Mr. W. H. Patchell pointed out that Sir Dugald Clerk had dealt with the subject from the thermal point of view. Unfortunately, coal was not the monetary standard of this country; they had to look at everything from the financial point of view. If they had only a currency in coal, he agreed that Sir Dugald had proved his case up to the hilt. If gas was so very superior to electricity for lighting, heating, and motive power, he would ask why electricity had been so very largely used for the purpose of driving machinery upon which the winning of the war had depended. The production of gas had increased, but all the factories had not been driven by gas; many had been driven by electricity. Neither gas nor electricity would cure everything. Until they gave up their partisanships, and looked at these things broadly as tools, they would not get very far.

Professor W. E. Dalby agreed that what they had to do was not to depend upon one form of energy, but use them all as they served their purpose best. Electricity was a most useful way of transmitting power and of transmitting light in certain circumstances, and whether they used electricity or gas, they had to get back to the coal and burn it somewhere or other.

Colonel Crompton, C.B., remarked that the pendants in that room were put up forty years ago. The people who used the older thing—gas—were violently for gas, and the electrical new-comers were violently for their baby. Their baby now was an old man, and he drew attention to the convenience of the old man. He sympathised with the cottager who cowered over a small fire in his cottage, and wished to give him an electric radiator, for he would then get his comfort with fewer units of coal burned. They who wished to live comfortably did not want heat by convection. They did not want to live in hot rooms; they wanted to have something resembling sunlight. The radiating effect of the sun on the skin could be imitated to some extent by the electric radiator, but he did not think that could be done by any gas radiator he had ever seen. They could apply heating to the old man or the invalid, and give him his radiator within a few feet of his skin. They were obliged, however efficiently they made the gas radiator, to put it over on one side of the room, whereas the portable electric radiator could be taken up to the old man or the invalid's bedside, and it was the greatest comfort to them that it was possible to conceive. The late Coal Controller—who was killed by hard work—conferred with all of them, and it was only after a great deal of trouble that a schedule was fixed. It was a fair schedule, and he had proved over and over again that the price of electricity against gas then fixed was a fair way of putting it. In that, the great convenience with which they could use their electricity supply in extremely small quantities if they wanted it was taken into consideration. They could use it for heating, power, or light, and it was for that reason he thought that distributed electricity in the villages of England would be an immense boon to the rural population, and he did not think the extra coal that would be burned would be very great, simply because of its more economical use.

Sir Dugald Clerk, replying to the discussion, said electricity was admirably suited both for lighting and for power. If they were to stand on relative cost, electricity would disappear in many of its uses. As regarded the electric radiator, no doubt there was a great deal in Col. Crompton's point that it could be brought closer. They were willing to compete in a perfectly friendly way with the electricians, and the latter were willing to compete with them if the politicians did not interfere too much

Rewards for War Inventions.—The Royal Commission, whose appointment we mentioned in our issue of March 14th, to determine the awards to inventors in respect of devices used by the Government in the war, has been instructed not to award to any patentee a larger gross amount than £50,000, in addition to allowance for expenses.

BUSINESS NOTES.

Turbine Plant for Glasgow.—The English Electric Co., Ltd., in which are now consolidated the interests and activities of the Coventry Ordnance Works, Dick, Kerr, Phœnix Dynamo Manufacturing Co., United Electric Car Co., and Willans & Robinson, have recently secured an order for a second 18,750-kw. turbo-alternator set for the Glasgow Corporation, being a duplicate of the machine now in an advanced stage of manufacture.

The contract includes, in addition to the turbo-alternator set, condensing plant and step-up transformers, and completes Mr. Lackie's first scheme of five sets for the Dalmarnock power station.

The turbine will be a single-unit machine of the firm's standard type, arranged to run at 1,500 r.p.m., and will operate on steam at 250-lb. pressure, superheated to 650° F., and exhaust into a vacuum of 29·1 in. It will be coupled to a 6,500-volt, 25-cycle, three-phase alternator, having a maximum continuous rating of 24,000 k.v.a. at 80 per cent. power factor.

The machine will be of the self-ventilating type, and will be electrically connected to a bank of three single-phase oil-circulated water-cooled transformers, stepping-up the pressure from 6,500 to 20,000 volts. An overhung exciter will be provided, as well as air and oil-cooling plant for alternator and transformers respectively. The condensing plant will be of the Willans surface type, with duplicate air extraction plants on the Willans rotary water-jet system and extraction pumps in duplicate.

Reconstruction Problem.—Two further pamphlets have been issued by the Ministry of Reconstruction, as follows:—No. 16, "Prices During and After the War"; No. 17, "Art and Industry."

The Outlook for Dutch Industries.—It was stated at a recent meeting of the Hengelo Chamber of Commerce that the prospects of the Dutch engineering industry are not brilliant, since it is doubtful whether Germany will be able to continue supplying raw materials. and even if she does, if it will be possible to export articles manufactured from German raw materials. If rumour is justified, the Allies intend to extend to the Dutch Colonies their rule that goods manufactured in Holland may only contain German raw materials to the extent of 5 per cent. Such a rule would entirely prevent the export of Dutch machinery. Even if raw material were obtained from England, Sweden and America, the price would be so great that the Dutch engineering trades' capacity of competition would be seriously restricted. The prospects of the electrotechnical industry are not much better. With regard to the Hengelo textile industry, now at a complete standstill owing to a shortage of raw material and yarns, the latest rumour is that raw materials will be rationed in such a way that it will only be possible to produce between one-third and one-quarter of the output of normal years.—*Welthandel*, February 14th.

London County Council Committees.—The following have been appointed members of the Highways Committee for the year 1919-20:—

Messrs. P. Dawson, J. M. Gatti, H. J. A. Glanville, H. H. Gordon, G. H. Hume. J. H. Harley, J. J. McClelland, S. March, A. Cooper Rawson, A. H. Scott, J. Speakman. W. J. Squires, R. G. Taylor. H. Ward, Brigadier-General W. W. Warner, Lieut.-Colonel E. W. Morrison-Bell, Lieut.-Colonel A. C. H. Kennard, and Captain A. O. Goodrich.

The Council Members of the Stores and Contracts Committee are:—Messrs. E. Cruse, D. Hazel, W. Hunt, W. C. Johnson, H. Marks, R. Taylor, and Major Isidore Salmon.

The Asylum and Mental Deficiency, Education, Fire Brigades, Highways, Main Drainage, and Parks Open Spaces Committees have each to appoint one representative.

The Special Committee on London Electricity Supply consists of the following:—

Mr. P. Dawson, Mr. C. Urquhart Fisher, Mr. G. M. Gillett, Mr. H. F. Golds, Mr. H. H. Gordon, Mr. H. Gosling, Mr. P. A. Harris, Mr. F. C. Harrison, Mr. G. H. Hume, Sir Cyril Jackson, Lieut.-Colonel A. C. H. Kennard, Mr. H. Mills, Major Isidore Salmon, and Mr. H. Ward.

French Accumulator Co.—La Société des Accumulators Dinin, of Paris, is increasing its capital from £60,000 to £120,000.

Exports to China.—In the *London Gazette* for March 21st there appear further additions to the list of firms, &c., in China to whom exports may be consigned.

German Electrical Prices Advancing.—According to the *D.A.Z.* for February 21st, the prices of raw materials and half-finished goods required in the German electrotechnical industry increased again in February, and further increases were later announced. The increased wages were making the prime cost of the industry's production larger. The Price Committee of the Central Associations of the German electrotechnical industry decided not to increase prices during March, but after that month a great rise in prices was anticipated.

Trading with the Enemy.—A further list of names of bodies and persons in several countries with whom trading is prohibited. or whose names have now been removed from the list, is published in the *London Gazette* for March 21st.

Exports to the Continent.—It is announced by the Department of Overseas Trade that arrangements have now been made which will enable goods to be dispatched to Belgium, the left bank of the Rhine and Alsace-Lorraine *via* Holland, without the production of N.O.T. certificates. Any exporters who desire to dispatch goods by that route can do so provided the goods are consigned in transit and the bills of lading are made out to the Standard Bank of South Africa Rotterdam, for account of the sub-consignee. Goods on Sec. C of the list of prohibited exports. and not. therefore, requiring a licence for export to Alsace-Lorraine or to Belgium. may be exported without licence or N.O.T. certificate *via* Holland, provided they are consigned as above. Goods for Switzerland may also be forwarded *via* Holland, but in the case of such goods they must be consigned to the Standard Bank of South Africa, Rotterdam, for account of the S.S.S. for account of the actual consignee. His Majesty's Customs have been requested to allow goods for Switzerland to proceed *via* Holland, if consigned as above, even though the licence may specify another route. The object of these arrangements is to enable goods to be exported to Holland in transit without the production of N.O.T. certificates, as the Standard Bank of South Africa at Rotterdam have undertaken to ensure that no goods consigned to them shall be detained in Holland, but shall be forwarded by them to their ultimate destination.

Export Prohibitions.—The *London Gazette* for March 21st contains a further list of goods, the export of which to Turkey, Bulgaria, and ports on the Black Sea. is prohibited.

Electrical Organisation in France.—There has just been formed at Lyons an office Syndical de l'Industrie Française. whose object is to group into one association a number of small industries, thus giving to the whole the importance of a large firm, with the advantage of diversity of manufactures. The members are arranged in groups for the sale of their products, and the orders taken are distributed according to the speciality of each. The office is already able to fulfil orders for railway material. agricultural plant, aviation. motor vehicles, mining plant, mechanical works, &c.

Among newly formed French companies are the Constructions Electriques du Rhône (Procédés Dick, Kerr). with a capital of 8,000.000 fr., headquarters. 19. Rue Louis-le-Grand. Paris; Roé d'Albert. Perrier et Cie, manufacture of cables. capital 100,000 fr.. Clichy (Seine); Sciaky Fières, production of electricity. 400.000 fr.. Paris; Société Hydro-Electrique de l'Isère, falls near St. Nazaire-en-Royans (Isère), capital 8,000,000 fr.. Lyons: and Société des Installationes Electro-Mecaniques. capital 120,000 fr., Paris.

The lessons of the past are not being lost on the French, and they are setting about the "organisation" of trade, in which both they and we were so much lacking before the war, with a vigour which promises to yield great results in the near future. The Comité d'Action Economique—a body called into being since the war to further French commerce generally—has decided to create a "regional office" for the electrical industry in the twelfth—Teulouse and Pyrenees—of the several "regions" into which France is divided, the fifteenth region being already donated with a similar "office." The programme of operations of these offices is as follows:—To group all the consumers of electric current in such wise as to produce an intensive consumption, both from an agricultural and an industrial standpoint: to group the local producers of electric current in a similar manner. the more needed. as these tend in this region to daily become more numerous: to bring these two groups to consultation together for the fixing of the sale price. the multiplication of centres of distribution, and the best possible dispositions for the transport of current to a distance. Thanks to the organisation of these permanent relations between producers and consumers, the greatest possible utilisation of current will become possible in this region. On the one hand, the producer will not find himself face to face with a crowd of inexperienced consumers, little acquainted with the manifold adaptabilities of the electrical current, especially to agriculture. On the other hand, the consumer, organised into groups, may have his voice heard in the settling of the price, and obtain installations of a kind different to that which he might obtain were he dealing as an individual alone. It is worthy of note that the above measures were anticipated in the Hydro-Electric Bill introduced by the Government into the French Chamber of Deputies in July, 1914 10 days before the outbreak of the war, with a view to fixing the terms of concessions.

Recent Tramway Contracts.—A number of contracts for tramway material have recently been placed with Messrs. Dick, Kerr & Co., Ltd, which. under the recent consolidation scheme embracing this and other firms. will now be carried out by the English Electric Co., Ltd. These include orders for tramway cars complete with equipments and for car bodies, tramway motors. controllers &c, from the Corporations of Nottingham. West Hartlepool, Morecambe, Southport, Brighton, Huddersfield, Bradford, Liverpool, Manchester. Burton-on-Trent, and others.

Armstrong-Whitworth.—We recently referred to the opening of a number of branch offices by Sir W. G. Armstrong, Whitworth & Co., Ltd. In this connection the *Times* is informed that the company are now reorganising all the departments of their various works, with a view to undertaking a wide range of commercial engineering products, and assisting thereby to meet the requirements of the engineering industry both at home and abroad in connection with industrial reconstruction. The company has formed a Central Commercial Department, with headquarters at 8. Great George Street Westminster. This department will control all matters relating to publicity and the commercial handling of the engineering products manufactured by the various departments of the concern. This department will apparently act as a central selling agency for the undertaking.

Birmingham Rails Contract for U.S.A.—According to the daily Press the Birmingham Corporation Tramways Committee has placed a substantial order for tramway rails in the United States. The contract was made with the American firm because they were able to offer earlier delivery than the competing British firms.

It is stated that the order has gone to the Lorain Steel Co., of Cleveland, U.S.A., for 1,000 tons of steel girder rails at £16 15s. per ton. delivered at port, and that only three tenders were received—two English and one American.

Lead.—In their report dated March 22nd, Messrs. James Forster & Co. say :—

"A greatly increased demand for electrical purposes is certain to be experienced before long."

Messrs. G. Cawson & Co., reporting on the same day, say :—

"Electro works are gradually getting busier, and see prospects of large consumption before them, and are naturally ready to cover for prospective orders."

Retarding Factors.—The British Engineers' Association has issued an important pamphlet (G 39). containing a memorandum written by Mr. D. A. Bremner, O.B.E., director of the Association (at the request of a Government Department), on some factors retarding the reconstruction and development of our Peace industries. and the full employment of the available workers of all classes. Labour unrest, fiscal policy, Excess Profits Duty. working capital, credit risks, Government surplus stores, uncertainty as to future prices, lack of financial confidence, and demands for nationalisation, are all briefly considered.

Export Restrictions Relaxed.—The *London Gazette* for March 21st contains a notice of further relaxation of export restrictions.

Book Notices.—We have received a copy of the new issue of *Flying* (weekly 6d.), which will in its enlarged form aim at reflecting chiefly what is called the "human interest" of the world of flight. It contains a great deal of matter regarding current topics, and has many quite interesting illustrations.

"Science Abstracts." Vol. XXII, Part 2. February 28th, 1919. Sections A and B. Indexes to Vol. XXI, Sections A and B. London : E. & F. N. Spon, Ltd. Price 1s. 6d. net each.

"New Town." A Proposal in Agricultural. Industrial. Educational. Civic, and Social Reconstruction. By W. R. Hughes. Pp. 141. London : J. & M. Dent & Sons, Ltd. Price 2s. net.

The *Mechanical World Year-Book*, 1919 (Manchester : Emmott and Co., Ltd. Price 2s. net), now issued for the thirty-second year, has been provided with a new section dealing with the properties of metals and alloys, and one on the subject of steam heating, together with new tables on the weights of balls and rivets. and tables of foreign weights and measures. The sections on grinding, cutting speeds, and mathematical data, have been extended, and other improvements have been introduced.

Trade Announcements.—Mr. Thos. Hall, electrical engineer, has commenced business at 4, New Row, Kenilworth.

Mr. F. J. Lock, electrical engineer, has resumed business at Station Road, Taunton, on his release after nearly four years' service in the Army.

Mr. George Morrison, electrical engineer. of Birley Street, Blackpool, has opened premises at 81, Fishergate, Preston.

Mr. E. L. Tappin, electrical engineer. of Lewes (Sussex). has disposed of his wholesale general business at 20, Fisher Street, to his brother, Mr. A. K. Tappin, and has removed his own business to 14 and 16. Fisher Street.

Mr. C. W. Dixon, late chief electrical engineer at the Great White City, having been demobilised by the Admiralty, has commenced business at 1a, Clark's Buildings, Shaftesbury Avenue, London, and wishes to receive lists and catalogues.

Mr. T. H. Hunter and Mr. J. G. Ogle, for many years past district manager and chief assistant respectively in the Birmingham office of the British Thomson-Houston Co., Ltd., have commenced business on their own account as electrical engineers and manufacturers' agents. They will trade under the title of Hunter, Ogle & Co., at 174, Corporation Street, Birmingham.

Messrs. Miles and McCaffery, for six-and-a-half years electrical staff foremen with Messrs. Cammell, Laird & Co., Ltd., are opening premises at 1. Euston Street, Blackpool, as electrical engineers and contractors.

A Public Technical and Commercial Library.—The chief librarian of the Birmingham Public Libraries (Mr. Walter Powell) is organising a technical and commercial library. The library already possesses a patent library and a reference library, the latter being one of the finest in the provinces, containing an extremely fine collection of technical books on electrical, mechanical, and civil engineering, on mining and the metal industries, and industrial chemistry. This collection is being enlarged and separated from the ordinary reference collection ; and on the commercial side it is proposed to form a collection of trade catalogues, which would become a medium of quick reference to the sources of supply of any particular class of goods. The chief objects of the collection are to secure representative instances of sound design in various branches of industry : and to bring the buyer into touch with the manufacturer or merchant. With the question of prices and discounts the commercial library is not concerned, but it is pointed out by the librarian in a letter that catalogues from which this information is omitted or cancelled would be suitable for inclusion in the collection. He invites manufacturers to send copies of their catalogues addressed to the Chief Librarian, Ratcliff Place, Birmingham.

Italy.—There has been formed at Milan a company styled Società Idroelettrica Riviera di Levante, with a capital of 300,000 lire.

Società per le Forse Lidsauliche dell'Alto Grembo is the style of a company formed at Milan, with a capital of 10,000,000 lire, for the production and distribution of electrical energy.

Catalogues and Lists.—Messrs. Marshall, Sons and Co., Ltd., Gainsborough.—Illustrated circular relating to their locomobiles. Particulars and code-words are tabulated for standard sizes ranging from 50 to 250 h.p.

Hyatt Roller Bearing Department, Broom & Wade, Ltd., High Wycombe.—Illustrated folder showing their Hyatt roller bearings, and setting forth their advantages.

Prices After the War.—The concluding observations in the Ministry of Reconstruction pamphlet (No. 16) on "Prices During the War and After" read as follows :—"It is not likely that the business of the world, as a whole, will expand more rapidly in the years of painful post-war reconstruction than it did in 1904-14. And we have seen that in those years prices were rising, partly, at any rate, owing to the gold position ; or, in other words, the world's money supply, based on gold, was expanding faster than the world's business, so that prices went up. In the post-war decade, people having learnt to do without gold and to multiply other forms of money, we may expect this process to be intensified. That is why it seems reasonable to assume that, when all the transition obstacles have been surmounted—successfully, let us hope—the general level of prices at which we shall arrive will be a good deal above the 1914 level. With luck it might be only 25 to 30 per cent. higher. But it may prove to be higher still, for very much depends on unknown factors, the wisdom of future Governments in all the countries of the world, the course of international relations, the efficiency of industry and the world's peace, peace among nations, and peace among classes."

Spanish Companies.—The Società Pirelli e Cia, of Milan (rubber. gutta-percha, and electric cables), has increased its capital from 24,000,000 to 40,000,000 lire.

The shareholders of the Società Lombarda per Distribuzione d'Energia Elettrica have authorised the increase of the company's capital from 26,000,000 lire to 32,000,000 lire, and eventually to 52,000,000 lire, when the council deems the occasion opportune.

British Industries Fair (Birmingham Section).—In consonance with the diversity of Birmingham manufacturers, the section allotted to the city at the British Industries Fair, to be held in February of next year, as already announced in the Electrical Review, will be of an extensive and important character. Three centres have been selected for the purposes of the exhibition, and at each of these, various trading products will be exclusively dealt with. Thus London will be responsible for the light trades ; Birmingham for brass and metal work ; and Glasgow for furniture, textile, and food products. The three sections will be open simultaneously for a fortnight. The Birmingham Chamber of Commerce has acquired the use of nearly all the public buildings of the city, and it is intended to provide upwards of a couple of thousand stockrooms for the inspection of overseas buyers. Electric light fittings and accessories will constitute an important feature of the schedule, table lamps, hall lamps, and standard lamps being specially mentioned, but electric pocket lamps are excluded ; another important section has relation to aeronautical motor appliances.

LIGHTING AND POWER NOTES.

Axbridge (Somerset).—E.L. Schemes.—An application from Mr. H. C. Teek, solicitor, of Cheddar, for permission for a local company to erect overhead mains for the supply of electricity in the district, was considered by the R.D.C. It was decided not to grant the application until the intentions of a company at Winscombe, which applied for similar powers before the war. had been ascertained.

Baildon. — E.L. Scheme. — The Bradford T.C. has informed the U.D.C. that the question of a supply of electricity in bulk to the U.D.C. would have to stand in abeyance until the Government's proposals were developed, and that probably nothing could be done for at least five years.

Barnsley.—Street Lighting.—The T.C. has decided to extend the system of public lighting by clusters of four 100-c.p. half-watt lamps.

Battle.—E.L. Scheme.—The U.D.C. has approached the Hastings T.C. with a view to a supply of electricity in bulk, the approximate cost of the scheme being £8,000 to £9,000.

Bideford.—E.L. Scheme.—At a meeting of the U.D.C. it was stated that applications had been received for an E.L. installation for the town, and the Council decided that, whilst considering a lighting scheme, it would approach the Bideford-Westward Ho ! Railway Co., with a view to the electrification of its line.

Calne.—Prov. Order.—The T.C. has decided to await the action of the Government before taking any definite action for a prov. order for electric light.

Cannock.—E.L. Scheme.—The R.D.C. has approved a scheme submitted by the Wolverhampton Corporation for the supply of electricity in the Council's area.

Chertsey.—Mains Extensions.—The R.D.C. has consented to the Egham and Staines Electricity Co. laying underground mains to Thorpe.

Continental. — Hungary. — The "Engineers' and Architects' Council" has submitted a scheme to the Budapest Magistracy for the reorganisation of electric power production. The scheme suggests the co-ordination of the 16 electricity works in Budapest and environs which supply power for lighting, railway, and industrial purposes, and about 240 works which supply factories and public works. The consequent saving in coal is estimated at 500,000 tons.—*Pester Lloyd.*

France.—A new company has been formed at Lyons, with a capital of £20,000, under the title La Société pour l'Amenagement du Rhône de Genissart au Sud de Lyon, the object being to improve the navigation of the River Rhône and to establish plant to utilise the water power of the river for the generation of electricity.

Plans are being prepared for utilising the waterfalls near Genothac, department of the Gard. The installation will comprise a barrage and 12,000-kw. turbo-generators. The estimated cost of the works is 21,000 million fr.

The Société Française des Forces Hydrauliques du Rhône has been authorised to utilise the water power from the Rhône needed to work an installation in the commune d'Eloise (Upper Savoy). This arrangement is temporary. pending the granting of larger extraction powers from the upper Rhône, for which it has already made application.

An influential Committee has been formed, under the auspices of the Ligue Maritime, to advocate and agitate for the utilisation of "blue coal"—in other words, the generation of electricity from the sea. The promoters have no ideas of a simple demonstration, but an undertaking carried out "on a vast scale," capable of affecting the industrial future of the country.

Sweden.—Among the new companies organised in Sweden to establish electricity supply undertakings are the Blasmarks Elektriska Aktiebolag, formed at Blasmark, and the Hillareds Elektriska Aktiebolag, registered at Hillared.

Bavaria.—Detailed proposals have been prepared for distribution of electricity throughout the whole country, there being considerable water power available in the Bavarian Highlands. An annual output of 166,000,000 kw. is obtained at Walchensee, and a further 253,000,000 kw. from the mountain rivers Lech, Iser, Amper, &c. There are also large deposits of cheap lignite in Lower Bavaria, and it is proposed to inter-connect these various sources of power by H.T. conductors, with branch connections to the chief towns. It will then be possible to utilise the available water power to its full extent, and steam power for peak loads. The total estimated cost of the project is £14,195,000, and the annual expenditure is estimated at £1,682,500. The cost per kw.-hour, with a load of 944,000,000 kw.-hours per annum, is therefore 0·43d. per kw.-hour. The proposal is that the Bavarian Government should be the principal shareholder. with the option to purchase outright, also that the chief municipalities should hand over their power works, take electricity in bulk at low rates, and confine themselves to the distribution of current in their districts. The new company must pay an average price of 0·198d. per H.P.-hour for the use of existing plant, and is entitled to charge 0·372d., the difference of 0·174d. per H.P.-hour being the profit to the new company. The H.T. conductors would be designed for 100,000 volts, with a total length of 789 miles, of which 373 miles are to be in duplicate. The success of the project depends to a great extent on the installation at Walchensee, as there is a very large storage capacity for water at this point. There is no storage at the other hydro-electric power stations, and the power is lost unless it is immediately utilised. With a national distribution scheme it will be possible to utilise the power of the rivers, when in flood, to store water at Walchensee, and to save coal at the steam power stations.—*Technik und Wirtschaft.*

Dartmoor.—Water Power.—The *Western Morning News* states that during the last three months elaborate surveys have been made on Dartmoor, with the consent of the Duchy of Cornwall, in connection with a scheme for the utilisation of the water power of the district. The subject has been before the Water Power Committee of the B. of T., and leave has been granted to introduce a Bill in Parliament this session. The rainfall is almost the highest in England, and falls of 400 to 600 ft. can be obtained.

Edinburgh. — Portobello Station. — The T.C. has agreed to an increase of 82½ per cent. on the contract for the erection of the Portobello power station, and to offer further building extensions to public competition.

Epsom.—Price Increase.—The U.D.C. has applied to the B. of T. for powers to increase the maximum charges for electricity by 50 per cent.

Eton.—Street Lighting.—The U.D.C. has decided to meet the Windsor Electrical Installation Co., the present contractors for public lighting, with reference to a new contract being entered into.

Faversham.—Proposed Extensions.—The T.C. proposes to extend the E.L. works and plant, at an estimated cost of between £10,000 and £12,000.

Gillingham (Kent).—Inquiry.—The T.C. has decided to take expert advice, and to have an exhaustive inquiry into the working of the electricity undertaking, for which £66,000 has been taken from the rates since the town acquired the undertaking.

Huddersfield.—Year's Working.—The total income of the electricity department for the year ended December 31st, 1918, amounted to £103,026, an increase of £15,437, and the expenditure to £89,233, an increase of £25,282, leaving a surplus of £13,792, as against £23,638. After allowing for interest on loans, &c., there was a deficiency of £8,237.

Proposed Price Increase.—The T.C. has referred back the Electricity Committee's proposal that the charges for energy for power and lighting to ordinary consumers be increased from 50 per cent. to 75 per cent. above pre-war charges.

India.—Water-power Shortage.—The Tata Hydro-Electric Co., of Bombay, has given notice that, owing to the low water-level in its lakes, the supply of electricity may have to be entirely stopped about April unless steps are taken to conserve the supply by reducing the consumption. Wherever possible the supply has been discontinued, and millowners have been given the option of working five days a week or 10 hours a day, instead of 12.—*Indian Textile Journal.*

Isle of Wight.—Proposed Price Increase.—The E.L. & P. Co. has applied to the B. of T. for an Order to increase the maximum price of electricity supplied to Ventnor, Bonchurch, Ryde, and St. Helens from 8d. to 9d. per unit.

Kings Lynn.—Mains Extension.—In order to supply the shipyards with electricity, the Electricity Committee has decided to lay a cable to West Lynn, at a cost of £6,700.

London.—Islington.—Loan Sanction.—The L.C.C. Finance Committee has recommended that the application of the B.C. for a loan of £4,593 for electricity purposes (mains, £1,559 ; transformers, £2,673 ; meters, £281 ; services, £80), be granted.

Battersea.—The Electricity Committee recommends that the charges for electricity for lighting be advanced to 5d. per unit, plus 10 per cent., and for power to 1¾d. per unit net.

Mansfield.—Price Increase.—The T.C. has decided to increase the charge for electricity through slot meters from 5d to 6½d. per unit.

Municipalities and the Transport Bill.—The following municipalities have passed resolutions "viewing with grave concern the proposal that the future control of electricity is to be taken out of the hands of the B. of T. and put under the control of the proposed Ministry of Ways and Communications":—

London : Hackney, Hammersmith, Stepney, and Stoke Newington.

Provinces : Maidstone, Manchester, Swansea, Bradford, Carlisle, Colchester, Colne, Edinburgh, Glasgow, and Huddersfield.

Nottingham.—L.G.B. Inquiry.—An application of the T.C. to borrow £75,800 for additional plant and mains in connection with the electricity undertaking, into which Colonel T. C. Ekin held an inquiry recently, was opposed by Mr. H. W. Cox, of the Cantie Switch Co., and Mr. J. Farr, a member of the T.C. The town clerk explained that the demand for power could not be met next winter under existing arrangements, and the proposed new station was to bridge over the period which must elapse before the Government's Electricity Supply Scheme was established ; the scheme had been approved by Sir John Snell. Messrs. Boots had offered to supply 1,000 kw. at £3 per kw., plus 8d. per unit, with coal at its present price, and were prepared to increase the supply in September. Mr. J. H. Rider, the Council's consulting engineer, decided against this offer, on the grounds that it would involve the expenditure of £10,000 for new mains and the voltage would have to be increased from 400 to 440 to be of service. The Electricity Committee, therefore, declined the offer, and the tender of Messrs. Dick, Kerr & Co., at £43,000, was provisionally accepted for the plant required for the new scheme. The borough electrical engineer, Mr. H. Talbot, said that there were 140 new applications for supplies, 72 premises to be reconnected, and inquiries for 715 kw. of three-phase supply, a total of 1,100 kw. Messrs. Players also required from 500 to 600 H.P. before next winter, and a new firm would require 160 H.P. to commence and 600 H.P. when its factory was completed. He considered that Messrs. Boots' offer was useless, and was confident that the Council had adopted the right course in refusing it. When Messrs. Cammell, Laird started making shells, the T.C. sold them three 440-kw. sets for £5,000 odd. Messrs. Boots' maximum demand was about one million units per annum before the firm installed its own plant. He had heard rumours that a super-station was to be erected at Gainsborough, in which case the St. Ann's and Talbot Street stations would become sub-stations. Mr. J. H. Rider anticipated that the new plant would result in a saving of £16,000 per annum in fuel, and thought the proposals were the best that could be devised. Mr. R. H. Swain, chairman of the Electricity Committee, said that everything connected with the tenders was perfectly straightforward. Two of the new inquiries in hand for power would mean the establishment of new industries in the town.

Portrush. — E.L. Scheme. — Mr. W. Pleasance, of Belfast, has submitted to the U.D.C. a revised estimate in connection with the proposed E.L. scheme. The cost is now put at £10,332, or £8,032 if overhead wires are used. He estimated that a gross profit of £923 per annum, and a net profit of £83, would be obtained. The Council is to decide whether to proceed with the scheme or not at its next meeting.

Reading.—Breakdown.—Owing to a breakdown in the boiler house, the electricity supply failed at half-past seven on Friday evening last: the supply was resumed in two hours' time.

Rochdale.—Proposed Loan.—The Electricity Committee has decided to apply to the L.G.B. for sanction to a loan of £68,000 for additional plant, transformers, switchgear and mains, and for £5,000 on account of sums overspent on previous work.

Southend.— Proposed Extensions.— The T.C. has appointed Mr. C. H. Wordingham, C.B.E., to report as to the most suitable scheme for the extension of the electricity undertaking to meet present and future requirements.

Swindon.—Price Increase.—From April 1st the charges for electricity for power and lighting are to be increased by a further 25 per cent.

Swinton.—Proposed Loan.—The U.D.C. has applied for a loan of £2.000 for mains extensions and other electrical purposes.

Warrington.—Extension of Supply.—The St. Helens Cable and Rubber Co. has decided to take a supply of electricity from the T.C., instead of generating at its own power station; it is estimated that the change-over will effect a saving of £1,600.

Warmley.—E.L. Scheme.—The U.D.C. has decided to ask the Bristol T.C. whether it would be prepared to supply electricity in bulk, to be distributed by the U.D.C.

TRAMWAY AND RAILWAY NOTES.

Baildon.—Proposed Extension.—The Bradford T.C. has informed the U.D.C. that a Bill for the extension of the tramway system from Bradford to Baildon cannot be promoted until October.

Bingley.—Charges for Electricity.—The U.D.C. has applied to the Bradford T.C. for a revision of the price paid for energy for tramway purposes.

Bradford.—Track Renewals.—The Tramways Committee has authorised the payment of a royalty of 5s. per ton to Mr. C. P. Sandberg for the use of his patent high-silicon steel process on steel rails to be purchased for track renewals. The renewal of track on the Manchester Road and Thornton Road routes is to be proceeded with as soon as possible.

Continental.—Hungary.—Railway Electrification.—In view of the great coal shortage, the President of the State Railways has submitted a proposal to the Minister of Commerce urging that immediate steps be taken for the electrification of the Budapest Railways. By the electrification of the section in question (2,200 km.) 1½ million tons of coal would be saved. Two experts have been entrusted with the working out of the scheme. —*Pester Lloyd.*

Sweden.—Railway Electrification.—The State Railway Administration has come to the conclusion that the railway system can be electrified in 30 years, at a cost of 192,000,000 kronor. The whole of the power required could be obtained from eight generating stations, the traffic capacity would be considerably increaed, and a great saving in staff costs would be effected. In the first place, the water-power resources of the country would be made available for this purpose.

Norway.—Railway Electrification.—The Government is building a hydro-electric power station for the Christiania—Drammen Railway. The power will be derived from three Pelton wheels, each of 5,000 h.p., with a head of 1,170 to 1,270 ft. A fourth wheel, of 200 h.p., is intended for the exciters, lighting, and heating. The three main wheels are coupled direct to a.c. generators, which at 300 r.p.m. produce 2,700 kw. at a pressure of 5,500 volts and 15 cycles per second. They are able to sustain a momentary overload up to 4,500 kw., such as may occur in starting trains. The Pelton wheels can be regulated to run between 270 and 333 r.p.m. The voltage is stepped up to 60,000 volts by static transformers, and transmitted through h.t. overhead cable to step down transformers along the railway line. All the machinery is made in Norway, and the whole installation—which is the first of its kind in the country—is to be ready by October, 1920.—*Teknisk Ukeblad.*

Italy.—The scheme for doubling the section Molinetto di Grego—Sesto San Giovanni of the electric tramway from Monzo to Milan, applied for by the Società Italiane Edison, has received official sanction.

The Ministero dei Larori Pubblici has granted a concession to the Carrara Versilia Electric Railway and Power Co., of London, for the construction and working of an electric tramway at Versilia, in the Province of Lucca, 23 miles in length.—*l'Elettricsa.*

Doncaster.—Proposed Extensions.—The Tramways Committee is considering the extension of the tramway system to Rossington and Armthorpe.

Inverness.—Proposed Light Railway.—The Aird District Committee has applied for the construction of a light railway from Beauly to Cannich.

Leeds.—Proposed Extensions.—The T.C. is considering a housing scheme for the Middleton district, which includes the construction of an electric railway in the area.

London.—North London Railway.—The North London Railway Co. is to run a 15-minute electric service between Acton and Broad Street, commencing on May 1st.

Owing to a goods train on the East London Railway becoming derailed at Whitechapel Junction early on Saturday, electricity was cut off between 5 and 6 o'clock on the section of the District Railway between Whitechapel and the Mansion House to enable the line to be cleared.

Faulty Tramway Track.—At an inquest on a woman who was killed as a result of a motor van skidding on the tramway track, a police constable stated that the check rail was completely gone for 10 or 12 yards, and some of the wood blocks had sunk 3 or 4 in. The Coroner said that the disgraceful condition of the tramway track should not be allowed to continue, and, in its verdict, the jury considered that death was due to the faulty condition of the track.

Tube Congestion.—In the House of Commons, on Monday, it was stated that the B. of T. was in communication with the Railway Executive Committee regarding the overcrowding on the underground railways, and every effort was being made to obtain additional equipment.

Proposed Extensions.—The City Corporation has decided to oppose the Bill which the L.C.C. is promoting for the extension of the tramways within the City boundary.

Norwich.—The B. of T. has extended the time limited by the Norwich Electric Tramway Act, 1914, for one year.

South Africa.—Pretoria.—Strike.—Pending a report within three months of a Commission appointed to inquire into the whole industrial position, the tramway strikers and the municipality have come to terms, and the men have returned to work. The new scale of wages ranges from £5 7s. 6d. per week for the first year's service to £6 2s. 9d. for the third year, with a minimum of £4 10s.

Southampton.—Rate Relief.—The tramways department is to contribute £8,000 to the relief of next year's rates.

Swindon.—Fare Revision.—The T.C. has applied for the sanction of the B. of T. to increase workmen's tramway fares by 50 per cent.

Tramway Men's Hours.—The negotiations for securing a 48-hour week for tramway employés throughout the country have been successfully completed. The new conditions will come into operation on Monday next, and will include times of signing on and booking off.

Wages.—A Court of Arbitration sat at Westminster on Monday to hear an application referred by the Ministry of Labour for an advance in the war wage of 15s. a week for all employés engaged in electricity generating and sub-stations and on high-tension cable work, &c., in connection with all the London tubes and electric railways and the electrified portions of the main trunk railways. The Court's award will be issued in due course.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Owing to the large volume of traffic and the number of cables which are interrupted, the Pacific Cable Board announces that there is a delay of approximately five days on messages to Australasia, and messages are only accepted on that understanding and at sender's risk.

Egypt.—During the recent disturbances, telegraph communication between Cairo and Alexandria was cut, and the Upper Egyptian and other services were interrupted.

Enemy Cables.—The Supreme War Council, at Paris, has decided on the future status of the submarine cables captured from the enemy, and terms of reference regarding the same have been referred to a Drafting Committee.

Guernsey.—The annual report for 1918 of the Guernsey States Telephone Department, of which Mr. R. McLean is manager and engineer, shows that the income from all sources was £8,251, an increase of £411, and the expenditure £8,039, an increase of £751, leaving a net profit of £212, a decrease of £340. The number of subscribers' lines, &c., was 2,343, an increase of 62; the mileage of wire was 1,640 overhead, and 1,166 underground. The number of calls dealt with was 1,634,841, an increase of 97,964.

Snowstorm.—Last week's snowstorm in the Bradford district put more than 500 local telephone lines out of order, and rendered communication with 60 junctions impossible, especially to the north of the city. Various trunk lines were disconnected, and telegraphic communication between Bradford and the Midlands was entirely suspended.

Mr. Pike Pease, assistant P.M.G., in reply to questions in the House on Tuesday, stated that consideration would be given to applications by subscribers for a rebate of rental where the communication had been interrupted for a considerable period.

United States.—The *Financier* states that the Postmaster-General has removed Mr. C. H. Mackay from the presidency of the Postal Telegraph Cable Co., and has appointed Mr. A. N. Adams as his successor. Since the refusal of the Government to grant the compensation to the company asked for by Mr. Mackay, the Postal Department states that the company has failed to follow instructions issued to the management of the company, to put in operation a new wage-scale and an eight-hour day. It is also alleged that there is a discrepancy in the company's report on its net income as a basis for compensation, as compared with that submitted to the Interstate Commerce Commission.

Wireless Operators' Strike.—The wireless operators who were on strike at Liverpool withdrew their notices last week, and accepted the award of the Shipping Controller of £3 per month for war risks.

Wireless Telephony.—The announcement that the Marconi Co. has established wireless telephonic communication between Ireland and Canada has brought forth from the U.S. Navy Department a statement that the latter has been able to communicate with Honolulu and Paris for "a long time" by wireless telephone. Responsive messages have, however, failed to arrive.

The wireless telephone message to President Wilson's ship, the s.s. *George Washington*, on its recent return from France, was sent from the Navy tower at New Brunswick, N.J.

Mr. Thomas Rabb, managing director of the Marconi office at Montreal, thinks that wireless will be used in any trans-Atlantic flight. By steamship and land the stations will keep in touch all the way. Aeroplanes will have wireless telephone and telegraph sets, but the ships will have wireless telegraphy only. Newfoundland has a splendid wireless telephone base. Its Government is co-operating. Wireless telephone communication has been established experimentally overland from Newcastle, New Brunswick, to New Jersey.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Sydney.—April 28th. Municipal Council. Power transformers. Electrical Engineer, Town Hall, Sydney.

May 15th. Department of the Treasury, Brisbane H.T. switchboard, storage battery and motor-generator set for the electric power house, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Melbourne.—May 14th. Victorian Railway Commissioners. Cells, renewals, caustic soda and mineral oil for caustic soda batteries. (Contract No. 32,194.)

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

Bedford.—Corporation Electricity Department. Geared turbine to drive an existing alternator. (March 21st, 1919.)

Birmingham.—April 12th. B. of G. Rewiring internal telephone installation, call bells, &c., at the 2/1st Southern General Hospital, Dudley Road. (See this issue.)

Grimsby.—April 10th. Corporation Electricity Department. One 3,000-KW. steam turbine, 6000/6600-volt, 3-phase alternator, condenser, pumps, &c.: two water-tube boilers, stokers, superheaters, fans, steel chimney, &c.; cooling tower, &c. (March 21st, 1919.)

Ipswich.—Corporation Electric Supply Department. Pipework in connection with the new steam turbine. (March 14th.)

London.—H.M. Office of Works. Two 10-ton, three-motor type, 450-volt, D.C. travelling cranes, 42-ft. span and 60-ft. span. (See this issue.)

Sale.—U.D.C. Electricity Department. 200 250-KW., 460-volt, Diesel engine and generator, switchboard panel, &c. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Barnes.—U.D.C. Four electrically-propelled dust vans:

Edison Accumulators, Ltd.	(accepted)	**£1,317** each.
Electromobile, Ltd.		1,020 ,,
General Vehicle Co., Ltd.		1,178 ,,

London.—Stepney.—Electricity Committee:—

Two new boilers to replace two of those supplied by the Howden Boiler Co.:—

Babcock & Wilcox, Ltd.	(accepted)	**£34,612**
Stirling Boiler Co., Ltd.		35,100
Clarke, Chapman & Co., Ltd.		37,830

Two valves for the second turbine at Limehouse station:—

J. Hopkinson & Co.	(accepted)	**£175**

12 feeder and 25 disconnecting boxes:—

W. Lucy & Co.	(accepted)	**£217**
B. I. & Helsby Cables, Ltd.		241
Universal Electrical Mfg. Co.		300
W. T. Henley's Telegraph Works Co., Ltd.		375

The Committee has purchased a Ford delivery van, £228, from A. E. Gould, Ltd., and a second-hand motor car from Bayard Cars, Ltd., £452, for the purpose of the delivery of materials and the carrying of the personnel of the undertaking.

Government Contracts.—The undermentioned contracts were placed during February, 1919:—

Post Office.

Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd.
Telephone and telegraphic cable.—General Electric Co., Ltd.; Johnson and Phillips, Ltd.
Telephone cords.—London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone & Electric Works, Ltd.; Siemens Bros. & Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.; Gates and Green, Ltd.
Insulators.—Bullers, Ltd.; Doulton & Co., Ltd.; Macintyre & Co., Ltd.; Taylor, Tunnicliff & Co., Ltd.
Mouthpieces for telephones.—Crystalate Manufacturing Co., Ltd
Spindles for insulators.—Bullers, Ltd.
Telephones.—Automatic Telephone Manufacturing Co., Ltd.
Copper binding wire.—British Insulated & Helsby Cables, Ltd.
Enamelled and silk-covered copper wire.—Concordia Electric Wire Co., Ltd.
Laying conduits.—Liverpool, R. M. Parkinson; Grimsby, Immingham, O. C. Summers.

H.M. Office of Works.

Electrical lifts, H.M. Stationery Office, Manchester.—Etchelle, Congdon and Muir, Ltd.

India Office, Store Department.

Copper wire.—T. Bolton & Sons; Elliott's Metal Co.; Shropshire Iron Co.
Telephones.—Automatic Telephone Manufacturing Co., Ltd.; Peel-Conner Telephone Works.

Newport (Isle of Wight).—T.C.—

Belt-driven fan for generator.—Ruston & Hornsby, Ltd., £150.
3-H.P. motor and underground main.—Isle of Wight E.L. & P. Co., Ltd., £102.

Weymouth.—T.C.:—

E.L. and bells installation, 11, Belvidere.—Brooking & Co., £50.
Intercommunication telephones, Enderby House.—Brooking & Co., £20.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, March 28th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Discussion on "Metrology in the Industries," to be introduced by Sir R. T. Glazebrook, F.R.S.

Junior Institution of Engineers.—Friday, March 28th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Wanderings along the Future Commercial Air Route," by Col. the Master of Sempill.

(North-Eastern Section).—Tuesday, April 1st. At the Mining Institute, Newcastle. At 7.15 p.m. Paper on "General Electrical Indicating Instruments," by Mr. S. Evans.

Royal Institution of Great Britain.—March 29th and April 5th. At 3 p.m. At Albemarle Street, Piccadilly, W. Lectures on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson.

Roentgen Society.—Tuesday, April 1st. At the Royal Society of Arts. At 8.15 p.m. Paper on "Some Biological Effects Produced by Small Quantities of Radium," by Mr. W. S. Lazarus-Barlow.

"Dynamicables."—Wednesday, April 2nd. At 7 p.m. At the Trocadero Restaurant, Piccadilly Circus, W. Anniversary dinner.

Electrical Power Engineers' Association (Manchester and District Section).—Thursday, April 3rd. At the Grosvenor Hotel, Deansgate, Manchester. Paper on "Thermometry," by Mr. E. B. Pausey.

Institution of Electrical Engineers.—Thursday, April 3rd. At the Institution of Civil Engineers, Gt. George Street, S.W. At 6 p.m. Lecture on "The Development of Army Wireless During the War," by Lieut.-Col. A. G. T. Cusins, R.E.

(Students' Section).—Friday, March 28th. At 7 p.m. At the City and Guilds (Engineering) College, South Kensington, S.W. Lecture on "The Organisation of Technical Engineers," by Dr. J. F. Crowley.

(Western Centre).—Monday, March 31st. At 7 p.m. At the Merchant Venturers' Technical College, Bristol. Lecture on "Planning a Works Research Organisation," by Mr. A. P. M. Fleming, O.B.E.

(North-Eastern Centre).—Friday, April 4th. Annual dinner.

London Association of Foremen Engineers.—Saturday, April 5th. At 7 p.m. At Cannon Street Hotel, London, E.C. Paper on "The Science of Fine Measurements," by Mr. V. Williams.

NOTES.

Summer Time.—Summer time is to commence on the night of Sunday next, March 30th-31st, and to continue until the night of September 28th-29th.

The Industrial Reconstruction Council.—The Right Hon. J. H. Whitley, M.P., has accepted the office of president, and Lieut.-Col. C. L'Estrange Malone, M.P., the office of chairman of the Executive Committee, of this body. The Council, which was founded by Mr. E. J. P. Benn, is a propagandist body having for its object the awakening of national interest to the need for a complete system of industrial self-government, based on the principles of the Whitley Report.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following are the arrangements for the ordinary meetings between now and the end of May :—

April 3rd.—Lieut.-Col. A. G. T. Cusins, R.E., "Lecture on the Development of Army Wireless during the War."
April 10th.—R. J. Kaula, "Notes on Surface Condensing Plants, with Special Reference to the Requirements of Large Power Stations."
April 24th.—Major A. C. Fuller, R.E., "The Fullerphone, and its Application to Military and Civil Telegraphy."
May 1st.—Dr. C. Chree, F.R.S., lecture on "Magnetic Storms."
May 8th.—Joint meeting (at 2.30 p.m.) with the Iron and Steel Institute. Papers on "Electric Furnaces."
May 15th.—E. A. Laidlaw and W. H. Grinsted. "The Telephone Service of Large Cities with Special Reference to London."
May 22nd.—S. Chapman, "Electrical Phenomena Occurring in High Atmospheric Levels."
May 20th.—Annual general meeting.

Junior Institution of Engineers.—At Newcastle-upon-Tyne. on the 18th inst.. Mr. E. A. Oakford delivered an address to the members of the N.E. Section of the Institution on "Electricity Applied to Coal Mining," forming one of a series devoted to the Coal Conservation Committee's Report.

Illuminating Engineering Society.—The Society celebrated the completion of 10 years of existence by a dinner on March 18th, at which the President, Mr. A. P. Trotter. presided. The toast of "The Illuminating Engineering Society" was proposed by Mr. Thos. Goulden (Institution of Gas Engineers). and seconded by Mr. C. H. Wordingham (President I.E.E.). Both speakers paid a tribute to the value of the impartial platform provided by the Society for the discussion of matters of common interest to both gas and electrical engineers. Mr. Trotter. replying for the Society, recalled that it was just 10 years since the Society was formed at a dinner given by Mr. L. Gaster. when 27 people were present. The present gathering showed how the activities of the Society had expanded since then. He emphasised especially the union of science and practical work exemplified by the work of the Society.

Physical Society of London.—At the meeting held on Feb. 28th, a paper on "Simplified Inductance Calculations, with Special Reference to Thick Coils," by Mr. P. R. Coursey, was read. By the aid of a single sheet of curves giving values of the correction factors for various coil thicknesses, the inductance of any form of coil likely to be met with in practice may be readily calculated, using only one simple standard formula for all cases. Reasonable accuracy is obtained even in the limiting example of a single turn of wire. The results arrived at agree well with other published charts, which are usually of more limited application, while the use of a single formula for all cases lessens the liability to error.

Prohibited Imports.—Sir Albert Stanley has appointed a Council to consider the subject of prohibited imports and to determine what percentage of normal imports should be admitted up to September 1st, 1919. The Council consists of representatives of manufacturing, distributing, and labour interests, as well as representatives of Government Departments and others, under the chairmanship of Lieut.-Colonel Sir Samuel Hoare, C.M.G., M.P. Five sub-committees have been appointed by the Council to deal respectively with textiles and apparel, glass and leather, motor-cars and woodwork, machinery and hardware, and fancy goods and miscellaneous manufactures. Persons desirous to make suggestions to the Council should address the Secretary, Mr. H. J. Phillips, Department of Import Restrictions, 22, Carlyle Place, S.W. 1.

It will be noticed that there is no separate reference to electrical goods, which apparently must figure under "machinery and hardware" or "miscellaneous manufactures"; this appears to be a serious defect, for the electrical industries especially need relief from the burden of unrestricted competition, and are of sufficient importance to demand a sub-committee to deal with them alone. We trust that steps will be taken to impress this fact upon the Council.

The B.E.A.M.A.—We have received too late for handling in this issue a report of the Council of the B.E.A.M.A. for the year 1918, together with a brief summary of the proceedings at the annual meeting. We would suggest that the Council should in future see to it that its report is issued simultaneously to all the electrical journals.

The I.M.E.A. Annual Convention.—The Annual Convention of the Incorporated Municipal Electrical Association is to be held this year at Felixstowe on June 17th, 18th, and 19th. Owing to the limited accommodation available in Felixstowe—it being expected that there will be a large influx of ordinary visitors this year—the Convention is being restricted to members of the Association. A preliminary programme will be issued to each member shortly.

National Electricity Supply.—In reply to a question in the House of Commons, Mr. Bonar Law said a report had been presented to the War Cabinet by the Ministry of Reconstruction dealing with proposals for the reconstitution of the electrical power system of this country.

At a meeting held at Needham Market, Suffolk, the Government proposals were discussed. Mr. Napier Prentice, of the Suffolk Electricity Supply Co., explained the objects of a scheme which his company had in hand: instead of putting down permanent plant at Stowmarket, which might in a few years be superseded by the national scheme, it was proposed to extend the mains to Ipswich, and obtain a supply of electricity from the Ipswich Corporation. By this means it would also be possible to supply the towns, villages, and farms between the terminal points. At Stowmarket, he said, they had doubled their output during the war. There was a great future for electricity, which would develop rural industries and utilise coal more economically. His company had urged the Board of Trade to include in its Bill powers to purchase the gas interests in any district where the national scheme was put in operation. Mr. Prentice strongly advocated public support of the scheme for national electricity supply in East Anglia.

The Award of the E.P.E.A.—A member of the E.P.E.A. writes unofficially, pointing out that the retrospective award of the Arbitrator appointed by the Ministry of Labour, granting an increase on salary of 20 per cent. plus £90 per annum to technical engineers in the E.P.E.A., appears to have been accepted by many undertakings with very ill grace. Many supply undertakings were paying in 1918 a paltry war bonus such as 10 per cent. and 15 per cent. to members of the technical staffs who, with this meagre increase, simply could not exist; in these cases, without question, the loyalty of the staffs was being imposed upon. There were many cases where the staffs in responsible positions in supply stations were getting far less in total earnings than men under them, and this sort of thing could not go on indefinitely. What appears to have escaped the notice of many heads of undertakings was the fact that it was partly owing to these awards to labour and high wages paid to munitioneers that prices soared until the necessaries of life were slowly getting beyond the reach of most of the staff with the paltry 10 per cent. or 15 per cent. bonus, and the E.P.E.A. unquestionably came to the rescue none too soon. To-day the *staff* get 20 per cent. on salary and £90 per annum; the *men* get 28s. 6d. bonus plus 12½ per cent. on all earnings.

"Take concrete examples as under :—

Staff.			Men.		
Basic per annum.	Bonus per annum.	Increase per cent.	Basic per week.	Bonus per week.	Increase per cent.
£200	£130	65	40/-	37/1	93
£250	£140	56	50/-	38/4	77
£300	£150	50	60/-	39/7	66
£500	£190	38	70/-	40/10	58
£700	£230	33	80/-	42/1	53

"A careful study of the above serves to show that the staff and men are now about on an equality as regards bonus received, and unquestionably the E.P.E.A. Award is fully justified. Taking, for example, a member of the staff getting £300 a year basic, who now gets £150 war bonus, we find on analysing the position, the following :—

	Pre-war.		Present.	
Basic salary	—	£300	—	£300
Rent, rates, and taxes...	£50	—	£50	—
Income-tax	£8	—	£20	—
Savings...	£20	—	£20	—
Insurance	£10	£88	£10	£100
		£212		£200

"In other words, in pre-war days, £212 was available to meet general living expenses and, say, an annual holiday, and it must be admitted that such costs have gone up, compared with pre-war days, fully 100 per cent. Assuming, therefore, that to-day the cost would be £400, then under the E.P.E.A. Award the amount received is £200 plus bonus of £150 = £350, and an economy of £50 per annum must be enforced, which is nothing but reasonable, right, and proper.

"Similar arguments can be adduced with higher and lesser-paid members of the staff, and prove conclusively that the Award of the E.P.E.A. is fundamentally sound, just, and well deserved by members of the staff of supply undertakings, a vast majority of whom have worked like niggers for the past 4½ years."

Parliamentary.—Mansfield and District Light Railway Co. is making application to the Light Railway Commissioners for powers to construct light railways in the County of Nottingham.

The E.S.C.A.—From an announcement appearing in our advertisement pages to-day, it will be seen that all members of the clerical staffs of electricity undertakings who are interested in the Electricity Supply Commercial Association are invited to attend a meeting of the Yorkshire Division, which will be held in the Council Chamber of the Leeds Chamber of Commerce on Saturday, April 5th, at 4.30 p.m.

Appointments Vacant.—Electrical engineer and manager, for the Witney U.D.C. Electricity Department; jointer, for the Darlington Borough Electricity Works; shift engineer (94s. 7d.), for the Oldham Corporation Electricity Department; wireless engineer operators (£250 + £50 and war bonus), for the East African Protectorate; principal lecturer in electrical engineering, and lecturer in mechanical engineering (commencing salary for each post, £150 to £240, according to experience, rising to £400), for the University of London—Goldsmiths' College. See our advertisement pages to-day.

Chemical Engineering.—With the object of promoting the interests of chemical engineering and its development on sound and scientific lines, a chemical engineering group has been organised by members of the Society of Chemical Industry. At the inaugural meeting, on Friday last, the announcement was made that already about 1,000 members had been enrolled.—*Daily Telegraph.*

A correspondent of *The Times* points out that the Government still does not recognise the value of the scientific professions in general, and of the chemical profession in particular. The Ministry of Labour is issuing particulars of temporary appointments for highly-trained and proficient chemists in the Government Laboratory at the munificent salary of £100 per annum, plus £15 allowance, plus £60 war bonus. One would expect the Government Laboratory to be the ideal employer as far as the chemical profession is concerned, but apparently it rates the services of its chemists at a value lower than those of a semi-skilled labourer.

The 40-Hour Week.—According to the *Manchester Daily Dispatch*, the Electrical Trades Union ballot for a shorter working week was considered by the full Executive Council in Manchester on Saturday. The ballot shows a large majority in favour of a further reduction in hours, with a national strike, if necessary, to enforce the demand. The actual figures will not be made known until the meeting of the National Conference of Engineering and Shipbuilding Trades, which is to take place shortly, to consider the advisability of a national demand for a further reduction of hours. It is stated that the Manchester district shows a majority in favour of 40 hours.

The Court of Arbitration appointed by the Ministry of Labour has refused applications of the Shipbuilding and the Engineering and Foundry Trade Unions for wage advances.

Engineering Mission to the Rhineland.—With further reference to our note of last week on "Engineering Developments in Occupied Territory," the first weekly issue of the *Bulletin* of the Federation of British Industries states :—"The Federation has been invited to appoint four representatives to accompany a Mission which has been organised by the Government to visit the occupied territory in Germany, in order to examine the development of engineering there during the war. In accordance with the plan of the Government, representatives of the Heavy Engineering, Electrical Engineering, Machine Tool, and Textile Machinery Industries are accordingly being nominated, the matter having been referred direct to the Groups and Sub-Groups concerned."

The I.E.E. and Wireless Telegraphy.—The Council of the Institution of Electrical Engineers has decided to appoint a number of Committees for the purpose of helping in the dissemination of information regarding recent progress in various branches of electrical engineering. The first of these to get to work is the Committee dealing with Wireless Telegraphy. During the war, radiotelegraphy became so very important for military purposes that many new developments had to be kept as secret as possible; at the same time, invention and discovery became very rapid. In consequence, there is a great mass of unpublished information which will become available for the general public at an early date. The Institution is going to offer special facilities through its new Sectional Committee for the publication and discussion of this new knowledge. Apart from the fact that knowledge grows by being circulated, it is especially essential to this country that wireless telegraphy should now be quickly transferred from the service of war to that of peace, and that our manufacturers should all have as much information as possible placed early at their disposal. By starting this section for the organisation of meetings, the Institution hopes to help the non-official public in the overtaking of four years of arrears in the study of wireless telegraphy.

Before the war the Wireless Society of London had come into being, and was doing excellent work on behalf of the amateur. This Society, it is hoped, will resume its work in due course. Besides this, there were at times efforts made to form a new special professional society for dealing with wireless telegraphy, and something resembling the Institute of Radio Engineers of America was projected. It has always been felt, however, that there are very real disadvantages in separating the men devoted to different branches of electrical engineering, and that there are advantages in keeping in touch even such extremes as the men who handle megawatts and those who handle microwatts. In fact, there is a general tendency for societies with a community of interests to amalgamate, and thus if a special society were formed for radiotelegraphy it might only lead, after a few years, to a train of negotiation for absorbing it into the Institution of Electrical Engineers. The advantages offered by the policy now being initiated by the Institution are obvious; for on the one hand the Institution cannot but be strengthened if it attracts the whole body of wireless telegraph engineers into its corporate life, and on the other hand the Institution can give at once to matters affecting the interests of wireless telegraph engineers the weight and prestige of the whole body of electrical engineers generally.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—West Ham electricity department held its annual dinner recently at the Connaught Rooms, with Mr. J. W. Beauchamp, the borough electrical engineer, in the chair. Mr. W. Wyld, borough electrical engineer of Hampstead, proposed the toast of the department, and Mr. Beauchamp responded. The toast "The Visitors," proposed by Mr. G. Bendix (assistant station superintendent), was acknowledged by Mr. J. H. Bowden, of Poplar.

Swindon T.C. has granted Mr. A. DIMMACK, late borough electrical engineer, an honorarium of £75 in respect of the extra work in connection with the electricity works extensions. The Electricity and Tramways Committee has appointed Mr. F. NEWEY electrical and mechanical engineer at £350 per annum, and Mr. T. MEDCALF general manager of the electricity and tramways undertaking at £360 per annum.

Watford U.D.C. has granted increases of salary as under:—Mr. C. D. Greenhalgh, chief assistant at the electricity works, £350; Mr. J. E. Walley, mains superintendent, £300; Mr. C. H. Tritton, shift engineer, £246; Mr. W. J. Appleby, shift engineer, £238; Mr. W. Middleton, shift engineer, £223.

Mr. E. SIDGWICK, rolling stock superintendent, Rochdale Corporation tramways, who has been appointed to a similar position with the Southport Corporation, was last week the recipient of gifts of a solid silver fruit dish and pair of silver vases from the employés at Rochdale. Mr. G. Webster, tramway manager, spoke of Mr. Sidgwick's services during the past 11 years, and Mr. A. Marsden made the presentation.

Mr. J. A. T. CARR, mains engineer at the Barnsley Corporation electricity works, has returned to duty on demobilisation, and his salary has been fixed at £246 a year, including £110 war bonus, as from February 26th.

Manchester City Council last week decided to grant advances in salaries to the electricity supply officials as recommended by the Electricity Committee.

After being chief electrical engineer at Southampton for 18 years, Mr. H. F. STREET has resigned, owing to eye trouble.

The salary of Mr. B. HALL, who has been appointed works manager, engineer, and rolling-stock superintendent under the Wigan Corporation tramways department, is to be £275, rising to £325, not £250, rising to £300, as stated in our last issue.

The directors of the Bognor Gas & Electricity Co. have increased the salary of their electrical engineer, Mr. H. A. HARDING, to £221 per annum.

General.—Mr. E. F. HOLDEN, lately Continental representative of the Morgan Crucible Co., Ltd., Battersea, has joined the British Electric Plant Co., Ltd., of Alloa and Glasgow, as chief sales engineer for Scotland.

We are asked to state that Lieut. GEORGE PREECE, R.E., whose demobilisation and future activities we mentioned in our last issue, is not Lieut. George L. Preece, of Manchester, son of the late Mr. G. E. Preece, and nephew of the late Sir W. H. Preece. Lieut. G. L. Preece was for 15 years with Messrs. W. T. Glover & Co., Ltd., of Trafford Park, and since 1910 he has been Manchester district branch manager for Messrs. Bruce Peebles & Co., Ltd. By a curious coincidence he, too, has just been demobilised, after holding a Lieutenancy in the Lancashire Fusiliers, and seconded for duty for the last two years with the R.E. He has returned to take up his old position with Messrs. Bruce Peebles at 30, Cross Street, Manchester.

LORD EMMOTT has resigned his post as chairman of the Consultative Council on Import Restrictions, and has issued a protest against the appointment on the sub-committees of too many representatives of affected interests.

Mr. ALEXANDER JOHNSTON, general manager of the North British Rubber Co., Ltd., has joined the board of the company as managing director.

Mr. I. T. WILLIAMS has been appointed general manager of the L. & N.-W. Railway, in succession to the late Sir Guy Calthrop.

Sir E. WYLDBORE-SMITH, K.C., has resigned from the Civil Service, and accepted a directorship of the Metropolitan Carriage, Wagon & Finance Co.

The *Times* states that HERR HANS BREDOW, aged 41, of the Telefunken Gesellschaft, who organised the German wireless during the war, has been appointed director of all wireless services in the Berlin Ministry of Posts and Telegraphs.

Capt. W. S. WILSON, R.E., having now been demobilised, has resumed his position as manager of the North-East England branch of Messrs. Johnson & Phillips, Ltd., at Newcastle-on-Tyne.

The King of the Belgians has been graciously pleased to create Mr. PHILIP DAWSON, M.Inst.C.E., M.I.Mech.E., M.I.E.E., Chevalier de l'Ordre de Leopold, in recognition of his services as a member of the Belgian Royal Commission on the electrification of the Belgian State Railways.

Mr. W. A. DE FLORAC, electrical and maintenance engineer to the Norman Thompson Flight Co., Ltd., Bognor, has resigned his position to take up an appointment as manager of Messrs. James Evans & Co.'s electrical department, London.

Mr. PHILIP S. DOHERTY, who will shortly cease his connection with Messrs. Haighs (Oldham), Ltd., has returned to his old offices, 25, Victoria Street, London, S.W. 1, where he will continue his business as pumping engineer, &c., under the title of Philip S. Doherty & Co.

Obituary.—MR. C. P. ELIESON.—We regret to record the death on March 19th, at the age of 70, of Mr. C. P. Elieson, one of the early workers in electric traction, and a man whose genial personality and infectious enthusiasm rendered him welcome and popular with all his electrical confrères. We remember Mr. Elieson first as a colleague of Reckenzaun, when electric propulsion really was in its infancy. In 1885 he devised an electric motor for traction, and in the following year his patent accumulators were used with the motor by the Electric Locomotive & Power Co.; his battery cars ran for many months, and covered many thousands of car-miles, on the North Metropolitan Tramway Co.'s system, and successful demonstrations were also given in the United States. In 1887 the Elieson electric launch was brought out, and in 1888 his battery was most favourably reported on in the United States; but, unfortunately, financial difficulties led to the collapse of his company in 1889. Two years later he invented an electricity meter, and in 1892 a new accumulator; in 1893 his battery traction system was again successfully demonstrated in America. His whole career was intimately associated with experimental work on lead accumulators, and he remained enthusiastic and optimistic to the last. In 1898 he collaborated in the design of the Elieson-Naylor controller for electric vehicles, and in 1916 he formed the Elieson Electric Traction Co. to market an electric invalid chair, a really good thing, which unfortunately was held to be a motor-car "within the meaning of the Act," and was handicapped by the resulting taxation. Mr. Elieson many times deserved success, and often seemed upon the verge of attaining it, but a cruel fate always intervened. His inventions will be developed by Mr. J. Carlier (trustee), who with a few friends is forming "The Rapid Accumulator Co." for that purpose.

Mr. A. Unsworth.—The death has taken place, at Sheffield, at the age of 28 years, of Mr. Arthur Unsworth, assistant manager of the Sheffield branch of the General Electric Co., Ltd.

Mr. F. Best.—The death took place on March 15th, at the age of 46 years, of Mr. Frank Best, partner in the Lift and Hoist Co., of Deptford, S.E.

Mr. W. H. S. Dawson.—The death occurred on Sunday last, at the age of 58 years, of Mr. William H. S. Dawson, Bradford city engineer and surveyor, who had been in ill-health for some time past. He entered the Corporation service at the age of 22, and succeeded Mr. J. H. Cox as city engineer in 1908. He was responsible for the laying of the electric tramway tracks in the city.

NEW COMPANIES REGISTERED.

Fuller's United Electric Works, Ltd. (153,623).—Registered March 13th. Capital, £500,000 in £1 shares (250,000 8 per cent. cum. participating pref.). To take over the business of electrical and general engineers, makers of telegraph, telephone, and electric wires, cables and appliances, and carbon carried on by (*a*) the Fuller Accumulator Co., Ltd., (*b*) John C. Fuller & Son, Ltd., (*c*) Fuller's Wire & Cable Co., and (*d*) Fuller's Carbon & Electrical Co., Ltd., also to carry on the business of rubber manufacturers and workers, engineers, &c. First directors:—G. Fuller, L. Fuller, G. J. A. Fuller, and D. A. Palmer, all of Woodland Works, Chadwell Heath, Essex; J. J. Jarvis, 253, Hackney Road, N.E.; and F. J. Gordon, 72, Curtain Road, E.C. Registered office: Woodland Works, Chadwell Heath, Essex.

Ivor Electrical Co., Ltd. (153,551).—Private company. Registered March 8th. Capital, £2,000 in £1 shares. Electrical and mechanical engineers, manufacturers of agricultural implements and electric motors, wheel and gear cutters, &c. First directors: J. Wood, Lock View, Maidenhead, merchant; W. P. Dunfoy, 10, Ederline Avenue, Norbury, manager. Registered office: 12, Abchurch Lane, E.C. 4.

French & Foxwell, Ltd. (153,533).—Private company. Registered March 7th. Capital, £4,000 in £1 shares. Electric, petrol, and general engineers and contractors, manufacturers of and dealers in tram, electric, and other apparatus, manufacturers of motor vehicles, owners of hangars and garage sheds, &c. Permanent governing directors:—D. G. French, Florenceville, Grove Road, Sutton, Surrey, engineer; H. G. Foxwell, North Lodge, Tadworth, Surrey, engineer. Solicitor: E. M. Gibson, Jun., 3-5, Queen Street, E.C.

Thanet Electric Co., Ltd. (153,742).—Private company. Registered March 20th. Capital, £2,000 in £1 shares. Electrical, motor, mechanical, and general engineers, manufacturers and repairers of electrical or petrol-driven plant, aircraft and accessory manufacturers, &c The first directors are:—H. E. Davis, 262, Northdown Road, Margate; A. L. Adutt, Queen's Gardens, Cliftonville; and J. A. Forde, Templemore, Park Avenue, Broadstairs. Solicitor: S. Shea, 19, Cecil Square, Margate.

Manchester Engineering Agencies, Ltd. (153,738).—Private company. Registered March 20th. Capital, £1,500 in £1 shares. To carry on the business as indicated by the title. The subscribers (each with one share) are:—F. Cornwell, The Grange, North Road, Clayton, Manchester, brassfounder; A. Cornwell, 46, Philips Park Road, Bradford, Manchester, engineer. Table "A" mainly applies. Solicitor: W. H. W. Menzies, 2, Mount Street, Manchester.

National Electric Co. (Birmingham), Ltd. (153,678).—Private company. Registered March 17th. Capital, £10,000 in £1 shares (5,000 pref.). Manufacturers of and dealers in electrically-heated utensils for cooking and other purposes, electrical machinery, fittings and accessories, &c. Permanent directors:—A. C. Jenks, "Woodthorne," Wolverhampton, manufacturer; F. J. Wineberg, "The Chateau," Massfield Road, King's Heath, Birmingham, manufacturer. Registered office: 15, Bath Street, Birmingham.

Electric Equipments, Ltd. (153,765).—Private company. Registered March 21st. Capital, £2,000 in £1 shares. Electrical, mechanical, and general engineers, suppliers of electricity, &c. The subscribers (each with one share) are:—T. M. Reed, 29, Albany Park Road, Tynemouth; W. Crocker, 16, Denwick Terrace, Tynemouth; A. F. Davidson, 75, Howard Street, North Shields. Table "A" mainly applies. Solicitor: P. M. Dodds, Howard Street, North Shields.

The Acetrical Engineering Co., Ltd. (10,257).—Private company. Registered March 10th, in Edinburgh. Capital, £5,000 in £1 shares. To carry on the business of oxy-acetylene and electric-arc cutting and welding of metal and alloys, engineers, boilermakers, chemical workers, shipbuilders, boat and aeroplane builders, &c. The subscribers (each with one share) are:—James Platt, 33, Orr Avenue, Greenock, foreman caulker; William Miller, 10, Ardgowan Street, West Greenock, accountant. First directors: W. Miller, Jun., Clyde View, 113, Eldon Street, Greenock, director of Grangemouth Dockyard; L. M. Miller, 6, Dargarvel Avenue, Dumbreck, Glasgow, engineer; J. G. Robertson, 6, Wellington Street, Greenock, shipyard manager. Solicitor: J. W. Snodgrass. Registered office: 2, Hamilton Street, Greenock.

Grafton Dynamos, Ltd. (10,261).—Private company. Registered March 14th. Capital, £10,000 in £1 shares. To carry on the businesses of manufacturers of and dealers in dynamo-electric machines, accumulators, carburettors, engines, lamps, &c. W. W. Tennent is to receive £250 for procuring subscriptions for £5,000 shares. The subscribers (each with one share) are:—F. Blair, 121, West George Street, Glasgow, officer in H.M Forces; A. Dukinfield-Jones, Kenmore, Scotstounhill, Glasgow, engineer; G. B. Tennent, 5, Kingsgate, Glasgow, wine and spirit merchant; W. Whaley Tennent, 2, Northbank Terrace, Glasgow, engineer; Miss J. M. Maclean, Armadale, Dumbrick, Glasgow. First directors: W Frederick Grafton, F. Blair, A. Dukinfield-Jones, G. Beaconsfield Tennent, W. W. Tennent. Registered office: 44, Robertson Street, Glasgow.

Radio-Communication Co., Ltd. (153,646).—Private company. Registered March 14th. Capital, £200,000 in £1 shares (100,000 pref.). To acquire the benefit of inventions connected with radio-telegraphy and telephony, and other methods of intercommunication, to acquire, make, and supply apparatus for the transmission of signals, sounds, and communications, whether submarine, between ship and ship, between ship and shore, or otherwise, &c. The subscribers (each with one share) are:—A. L. Dunning, Bankside, Eskdale Avenue, Chesham, company secretary; W. Seabrook, 75, Broadway, Chesham, solicitor's clerk. First directors to be appointed by the subscribers. Registered office: Oswaldstre House, Norfolk Street, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Siemens Bros. & Co., Ltd.—Satisfaction in (a) to the extent of £7,000 on January 31st, 1919, of £300,000 debenture stock, covered by trust deed dated June 27th, 1900, and (b) to the extent of £330,000 on February 20th, 1919, of £1,330,000 debenture stock, covered by trust deed dated January 15th, 1918.

Gell Telegraphic Appliances, Ltd.—Satisfaction in full on January 22nd, 1919, of mortgage dated April 29th, 1910, securing £1,600.

Crompton & Co., Ltd.—Satisfaction in full on September 23rd, 1918, of £100,000 debentures secured by deeds of 1895, 1913, and 1914

Silent Electric Clock Co., Ltd.—Satisfaction in full on February 7th, 1919, of debentures dated May 14th, 1913, securing £800.

C. H. Hare & Son, Ltd. (110,911).—Capital, £16,000 in 8,000 pref. and 8,000 ord. shares of £1 each. Return dated December 31st, 1918. 6,200 pref. and 8,000 ord. shares taken up; £6,702 paid on 6,200 pref. and 502 ord.; £7,498 considered as paid on 7,498 ord. Mortgages and charges: Nil.

Dynamic Electrical Co., Ltd. (104,436).—Capital £100,000 in £1 shares. Return dated December 31st, 1918. Seven shares taken up; £7 paid. Mortgages and charges: Nil.

Electrical Contracts & Maintenance Co., Ltd. (101,757).—Capital, £3,000 in £1 shares. Return dated May 15th, 1918. All shares taken up; £1,331 paid; £1,669 considered as paid. Mortgages and charges: £3,000.

Westinghouse Cooper-Hewitt Co., Ltd. (89,947).—Capital, £30,000 in £1 shares. Return dated January 4th, 1919. All shares taken up; 9s. 6d. per share called up; £14,250 paid. Mortgages and charges: Nil.

CITY NOTES.

County of London Electric Supply Co., Ltd.

Mr. J. B. Braithwaite, in his speech at the annual meeting, on March 17th, said that on the whole their results were satisfactory. The gross receipts were increased by £71,975, partly due to the increased business and partly to the advance of 20 per cent. on lighting rates and 25 per cent. on power and heating. The average price charged for all purposes was 2.47d. per unit, against 2.15d. before the war. The increase between 1913 and 1918 was therefore slightly under 15 per cent. The company's relations with the South London Electric Supply Corporation had been drawn very much closer during the year. The generating stations were now interconnected. A further step forward was made by entering into an arrangement with the City of London Co. under which its station at Bankside would be interconnected with this company's mains, and the City Co. would put down for the County Co. a 10,000-kw. set, which would be at the disposal of the County Co. within the next year or two. The new 6,000-kw. turbine set at Wandsworth was approaching completion. The number of consumers had increased to 28,400, and the total units sold to 40,326,263. In view of the fact that the Government and others seemed at last to be awaking to the truth that electric supply was an important factor in industrial life, it might perhaps be hoped that some of the existing restrictions would be removed, in which case he did not doubt London's ability to equal or surpass records shown by other cities. He would perhaps be expected to say something about the pending great development of electric supply foreshadowed by the various departmental reports, and in the Bill to establish a Ministry of Ways and Communications. As a result of developments made by the various electric supply companies, it appeared to be generally realised that a supply of electric power on reasonable terms was vital to industry, and, incidentally, would lead to considerable economy in coal consumption. The report of the Electric Power Supply Committee contained recommendations with many of which he entirely agreed. It recommended that a new body, to be called the Electricity Commissioners, should be set up, to which should be transferred the powers now exercised by the Board of Trade and other Government Departments. If this recommendation were adopted, the electrical supply of the whole country would be controlled by one body, which, in his opinion, was the right course. In the Bill to establish a Ministry of Ways and Communications, however, this recommendation appeared to have been abandoned, as the supply of electricity was tacked on to railways, light railways, tramways, canals, &c., roads, bridges and wharves, harbours, docks and piers, all of which were put under the control of one Minister. If this were carried, obviously the electrical supply would be subordinate to the interests of railways, tramways, &c. The title of this Bill should be "a Bill for the paralysing of private enterprise and of business generally," as the Minister might compulsorily purchase any undertaking of the nature specified the acquisition of which was, in his opinion, expedient, or he might establish any such new undertaking, so that in his own unfettered discretion, subject to no control, the Minister might compulsorily expropriate the private property of any company or individual connected with transport or establish similar concerns in competition. In such a case it would be impossible to induce capitalists to embark in the development of such enterprises. The commanding position of Great Britain in trade and industry was due to private enterprise, and if this were discouraged and penalised, as proposed by the Bill, all incentive to future development would be removed. The example of Government ownership of telephones illustrated the incapacity of Government Departments to undertake ordinary business transactions, and other instances might be quoted indicating what would be the result of bureaucratic control of great commercial undertakings like railways, tramways, &c. Two fallacies pervaded many official representations regarding the supply of cheaper electricity: (1) That this would be promoted by the erection of super-generating stations employing units of plant much larger than those now generally used. and (2) that the erection of these generating stations at the collieries would also tend to economy. While increased economy of generating was obtained by the use of large units, the risk of serious breakdown was shown by experience to be by no means negligible, and a comparatively small increase in economy of generation might be bought too dear; it might in reality increase the risk of serious interruption of supply. Regarding the second point, in his opinion any advantage derived from avoiding the conveyance of coal from colliery to generating station would be more than lost by interest and sinking fund on the cost of transmission lines, the loss of energy in transmission, the cost of constructing and maintaining reservoirs at the collieries, the risk of interruption through damage to transmission lines, or of stoppage of coal supply by an accident or a strike at the colliery at which the generating station was erected. London, with lines of railway and water communication to all parts, might be regarded as the colliery of the world; it could take its pick of coal from any part of the country, and as the freight of water-borne coal in pre-war days was about 3s. to 3s. 6d. per ton, it would be seen that, so far from economy resulting from placing the power-house at the colliery, the effect would be quite the reverse. If the Goveroment would extend the companies' present tenure, which expired in 1931, and remove existing restrictions, it would be possible gradually to give an ample supply of electricity on favourable terms. If the 13 London companies were grouped together, and the 14 local authorities supplying electricity in London were similarly grouped, the London situation would be satisfactorily and fully met, and probably the two groups might inter-connect big power houses as an additional insurance against interruption to the supply. In this way the cheapest supply of electricity to the London area could be secured.

Davis and Timmins, Ltd. Sir Henry Mance, presiding at the annual meeting on March 18th, said that the company had had a strenuous year. The times had been, and still were, anxious. They must regard the returns submitted as exceptional. When they settled down—it was taking longer than expected—doubtless they would still be able to present results as good as those presented before the war. The reserves were used in the business, and had materially assisted in obtaining the satisfactory results. The gross profit was less in consequence of the termination of the war, the increase in the price of metal, and the increase in wages. They might have turned out more work but for the shortage of skilled labour. They had also been seriously interfered with by the influenza. The capacity of the factories for turning out work was equal to that of any factory of the size in the kingdom, but work would not be quite so brisk as during the war. When hostilities ceased a considerable number of war orders were cancelled, and at present orders were not coming in quite so freely, as customers seemed to be hesitating. No doubt the disordered state of the industrial world was the cause of it, and customers were only ordering sufficient for present requirements. In the form of excess profits tax they had been able to contribute more to the expenses of the war than the total capital of the company. If the Labour unrest could be settled on an equitable basis, they hoped, when they got back to normal conditions, to be able to present accounts as satisfactory as before the war. At a later stage in the meeting Mr. Negus, in moving the re-election of Sir Henry Mance as a director, said that from Sir Eric Geddes's speech it was clear that many millions of pounds would be spent in electrical development. Their company would take a share of that in the various products which they made. and would also be able to adjust themselves to the manufacture of new articles. The management was alive to the necessity of keeping pace with the times. and they need have no fear that there would not be plenty of work for their own and kindred enterprises in the future

British Insulated & Helsby Cables, Ltd. Mr. James Taylor, presiding at the annual meeting on Monday, said that the profits for 1918 were lower than for 1917, which was their best year. The reduction in Government requirements for war munitions was partly responsible, but the most important reason was the increased pay of the employés which amounted to £112,958, or 11¼ per cent. on the ordinary capital; further advances had since been made. Such increases could not alwaya be charged to the purchasers of goods, as in many cases the increases of wages were retrospective, and the amount was not known before delivery was given. Further, large and important customers expected and could force delivery at contract price, irrespective of the loss caused to the company. A firm such as theirs, which normally did so large a foreign trade, could not largely increase the price of its manufactures without making it difficult to compete successfully in the open markets of the world. A few weeks ago a London company buying electrical goods for South America, obtained prices from three English and one American firm. The English prices averaged £3,000 and the American was £2,100. If thia country were to lose its foreign trade through high wages and low output it would be disastrous for all concerned. During the war the company had used all its resources to bring victory. As much as 98 per cent. of their output had been to Government orders, and they had delivered goods to the value of over £12,000,000. The value of their stocks and work in process showed an increase of about £200,000, due to the fact that larger stocks of raw materials had to be kept to meet shipping difficulties.

The Vickers-Metropolitan Amalgamation. Meetings of Vickers, Ltd. (at Sheffield) and of the Metropolitan Carriage, Wagon and Finance Co. (at Birmingham) were held on Monday, Mr. Douglas Vickers presiding at the former and Mr. F. Dudley Docker at the latter. The object of the meetings was to consider the scheme of amalgamation referred to here last week. Mr. Vickers, in the course of his speech, said they thought they were offering no menace to the public. They asked for no monopoly. Advantages would be gained by economy of production due to an assured market for their products, economy in selling, finally by their strong finance, and by the great power and influence which their engineering position would give them. The best fields now open to the heavy side of engineering were those connected with transportation and electrification, or both. As to transportation by rail, and general electrification, these were intimately bound together, and the new proposals foreshadowed in the Ministry of Ways and Communications Bill, which, in their (the directors') opinion, were bound to eventuate before long, would be of great magnitude, and would present favourable opportunity for operations. Added to this there was an enormous amount of wear and tear to be made good in this country, also abroad. Abroad, in the war areas, destruction had to be replaced, and in the Dominions and foreign countries which had not suffered directly from the war, railway material had been unobtainable during the war, so that there were large arrears to be made good. As to the European part in this work there was no doubt that, in the past, Germany would have taken a lion's share of it. It was now hoped that this country would take that share, and with the combined firms they were trying to bring together that day, they hoped that those firms would have a large part of that share. The electrification of the country that had also been proposed in the Ministry of Ways and Communications Bill would be the subject of a Bill to be introduced before Parliament some time in the next few days, and would also bring with it a host of minor requirements in addition to the big plants, for they had to remember that for every 100,000 H.P. going with a super-power plant, more than 200,000 H.P. of motors would be required by the users of the current. In addition to these requirements there were vast numbers of accessories which they had to manufacture, required by the user. He meant that the user did not stop at the motor; he required a transformer, switches, and other things. A vast amount of electrical material would be required. Their proposals, if accepted, would unite them with the finest electrical carriage and wagon works in the country, and put them in a uuique position to deal with these problems on the largest scale. The works at Sheffield, the parent works of the firm, would feed the others producing the finished articles. The speaker referred to the interest of the Metropolitan Co. in the British Westinghouse Co., the South Metropolitan Electric Light & Power Co., the West Kent Power Co., and others. Vickers's association with the Metropolitan which led to the present proposals began with the Metropolitan's purchase of these electrical interests. At that time Vickers' were seeking to provide for a large extension of their electrical work, and they welcomed the suggestion from the Metropolitan that they should join with them in acquiring a controlling interest in the British Westinghouse as the best and cheapest way of attaining their objects. The resolution approving the scheme was carried.

At the Metropolitan meeting, Mr. Docker, in covering somewhat similar ground, said that when the Metropolitan Co. bought a controlling interest in the British Westinghouse Co. they took Messrs. Vickers into partnership. They found that Messrs. Vickers also were carrying on an electrical business mixed up in such a manner with other departments in their various works that it had been found impossible to separate it to advantage; consequently, without fusion of the kind now suggested, there must of necessity be confusion. Messrs. Vickers again were associated with the Metropolitan Co. in the South Metropolitan Electric Light & Power Co., of which they had great hopea for the future. In short, they were allied to them in so many ways that complete amalgamation was most desirable.

Automatic Telephone Manufacturing Co., Ltd. Mr. James Taylor presided at the annual meeting on Monday at Liverpool. He said that the profits for the year were £3,044 less than for 1917 owing to the following reasons: (1) the large additions to wages and in many cases the impossibility of adding the extra cost to work in hand; (2) about the middle of the year they were asked to cease production on many Government contracts then in hand on which they were working night and day, and no factory could in this way cease and change over to a new class of manufacture without considerable loss in both time and money; and (3) during 1918 the price being paid by the Government for fuses for shells, of which they made nearly 2,500,000, was considerably lower than was paid during 1917. While the company had been busily employed in delivering munitions it did not neglect the propaganda work necessary for the automatic telephone side of its business after the war. They had gone to a considerable amount of spade work in various foreign territories, and eventually benefits would accrue from this activity. The Leeds Automatic Telephone Exchange, serving 6,800 working subscribers, was opened for public service in May last. The result of the working of the system in Leeds had proved entirely satisfactory. As a result of the good opinions earned by the automatic installation fitted at Simla, India, the company received a contract to supply a similar installation for Lahore, India. This equipment was completed and ready for dispatch. The introduction of other manufactures was continuously before the company, one being the manufacturing of appliances for electric heating and cooking purposes. Recently they had been able to place upon the British market a superior range of such articles, which had been received with considerable approbation, supported by a satisfactory volume of orders. Other branches of their industry were also developing. There was a fair number of orders on the books, which would keep the factory busy for some time, and prospects were favourable but for the fact that they had always hanging over them the persistent demands of all classes of employés for increased remuneration. It was impossible to say what influence this would have upon the business as a whole. They were already feeling the effect of very high wages, and, compared with America, the low output per man in this country was prejudicial where foreign competition had to be met. Several orders had passed the company and been placed in America at lower prices than they could quote, due to low output. This was a very serious and important question both for the company and its employés. They hoped it would be kept well in mind. If foreign competitors were able to quote lower prices, the tendency in the end would be to lose foreign business and cause unemployment.

South London Electric Supply Corpn., Ltd. At the annual meeting, on March 18th, Mr. J. B. Braithwaite said that the County Co. now held more than three-fourths of the entire capital, and a complete amalgamation for all practical purposes had been brought about. The fusion of interests would result in considerable economies. There was an increase in revenue of 12.25 per cent. in spite of the fact that they sold 437,000 units less. The increases in charges had proved to be within £7 of the extra costs incurred. If the demands of the miners were met, resulting in increased cost of coal, it might be necessary to further increase the charges. The coal cost appeared to be less, but it was due to the interconnection with the County Co., and their taking a large amount of energy from that company. The use of the interconnection had been a great convenience. Subject to unforeseen circumstances, the position of the company was such that they would be able to pay an interim dividend in the middle of the year. The turnover in their trading department was the largest they had ever had. When the threat of the engineers to shut down the lighting supply was made a little time ago their whole staff decided to remain at work. If they could only get free from the threatened Labour troubles and settle down to steady work under Peace conditions they would see a very considerable increase in the number of units sold, and have greatly improved prosperity.

Waste Heat & Gas Electrical Generating Stations, Ltd. The profit earned during the year ended January 31st, 1919, after deducting administration expenses, was £38,645, as against £40,731 in the previous year. Of this £12,500 has been transferred to reserve. The balance brought forward was £17,042, making an available profit of £43,187, against £48,142. The dividend is 8 per cent., the same as for the previous year, and £17,587 is to be carried forward. The reserve stands at £100,351, and the redemption funds in respect of plant supplied on hire purchase terms, £37,210.

The constructional work at the power station at Horden has proceeded satisfactorily, and it is hoped that the plant will be put into commercial operation towards the end of this year. The new generating plant at Weardale power station is now practically completed and ready for operation. There have been many unavoidable delays in the final adjustments, which have been to a great extent due to the pressure of war orders in the manufacturers' works. The repairs to the plant at the Teesbridge power station have been completed since the end of the company's financial year, and the station is again in operation.

Capital expenditure during the year amounted to £14,096, mainly in connection with the new power station at Horden. No further investments have been made during the year, and the return from the existing investments has been satisfactory. £2,278 has been expended during the year on the experimental work mentioned in the last report. The units generated at all the power stations, other than Teesbridge, which has been closed throughout the year, show a reduction of about 4 per cent.

Para Electric Railways & Lighting Co., Ltd.—Mr. Follett Holt, who presided at the annual meeting, after referring to his visit to Brazil as a commercial member of the British Special Mission to the S. American Republics, said that the accounts for the year showed that Para had not escaped the effects of the economic depression and disturbances of the war. There had been political strikes when normally they would have earned larger revenues from local celebrations, and the influenza had adversely affected both the tramway and lighting earnings. Shipping and trade restrictions had increased the operating expenses. The available balance was consequently decreased by £8,782, or about 7 per cent. This, however, was temporary, and gave no ground for anxiety; it did not indicate any retrograde movement or stoppage of the steady development of their business. Whilst they would have to face a period of high operating expenses until such time as exports and imports reverted to their previous level and wages adjusted themselves, not only in Brazil but also in those countries from which they drew their supplies, their undertaking in Para had shown such unmistakable signs of intrinsic vitality that the directors looked forward to steady growth in the near future. The rubber trade remained the foundation of economic conditions in the Amazon Valley. The fall in the tonnage exported was really attributable to the general dislocation of shipping.

Hadfields, Ltd.—The report states that £70,000 is to be added to reserve and renewal and £209,100 carried forward. In addition to the interim dividend of 1s. per share, a further 4s. per share is to be paid, together with a bonus of 1s. per share, all free of tax. It is proposed that the reserves and undivided profits to the extent of £800,000 hitherto employed as capital should be capitalised, thus bringing the capital into closer relation to the present value of the assets. This will allow the issue of two fully-paid shares of £1 in respect of each existing ordinary share. Considerable new capital is required to cover large extensions already made, and to adapt the works to post-war conditions, and to provide money for development and extension of various departments. The capital is to be raised to £2,000,000 by the creation of 1,300,000 ordinary shares; 800,000 are required to capitalise the reserves, 400,000 are to be issued at a premium of 10s. each to the ordinary shareholders, and 100,000 are to be left in reserve.

New Issue.—British Electric Transformer Co., Ltd.—According to the *Financier*, this company has been inviting applications at 18s. per share for 62,500 6 per cent. cum. preference shares of £1 each and at 24s. 6d. per share for 62,500 £1 ordinary shares. In order to cope with the increased demand by this and other countries for the company's products additional buildings will be necessary, and the provision of these will involve an expenditure of about £40,000 out of the proceeds of the issue, and it is also proposed to pay off £42,000 borrowed from the bankers to finance the increased turnover. "Although the company has a large volume of work in hand, and the work ahead of it for this country alone appears very great, it is anticipated that when the works extensions are complete the company will also be able to take its share of the foreign and colonial business which was previously carried out by Germany."

It was announced on Tuesday that the issue had been over-subscribed.

Clyde Valley Electrical Power Co.—Profit for 1918 £121,521, plus £21,146 brought forward. After payment of net interest, £8,349; preference interest, £18,000; 5 per cent. for the year on the ordinary shares, £30,000; putting £50,000 to contingency fund for depreciation and £12,984 to special reserve, £23,335 is to be carried forward. The directors' fees have been increased from £1,800 to £2,400, less tax. The item rates and taxes (£41,411) in revenue account includes the amount of excess profits duty as adjusted to December, 1917, and provision for the estimated assessment for 1918. The extensions at Yoker for the installation of a 15,000-KW. turbo-alternator are proceeding, and it is expected that the plant will be put in operation by July, 1919. Orders have been placed for a 15,000-KW. turbo-alternator with equivalent boiler plant and accessories for Clyde's Mill station.

Midland Electric Corporation for Power Distribution, Ltd.—At the recent annual meeting, Mr. James Taylor, the chairman, said that the capital expenditure of the year was £43,296. In order to ensure a successful response to the issue of preference capital it was proposed to advance the rate of dividend from 6 per cent. to 7 per cent. The issue was to be offered to the public generally, but it was underwritten, so that they were able to proceed at once to order the further plant which was absolutely necessary to cope with the demand for power. The net profit for the year fell by £7,021, owing to the awards for increased wages, which were always retrospective, and the higher cost of fuel, &c. None of the increased expenses was immediately passed on to the consumer, therefore the profit was reduced

Scarborough Electric Supply Co., Ltd.—Units supplied during 1918 842,146, an increase of 84,284. Net profit, £1,058. No dividend. Notice has been given to increase the charges for electrical energy.

Mirrlees Watson Co., Ltd.—Dividend 10 per cent., and bonus 2½ per cent., both less tax.

Windsor Electrical Installation Co., Ltd.—Profit for 1918, including £257 brought forward, was £2,915. After paying interest, placing £1,000 to depreciation, renewal, and reserve fund, and paying directors' fees, £338 is carried forward. No dividend is paid on the ordinary shares. The revenue increased by £957 owing to higher prices charged to consumers, but the net revenue decreased by £1,472 owing to increased expenditure. The price has been raised 1d. from January 1st, 1919. The arrangement for the amalgamated working of the company with the Slough & Datchet Electric Supply Co., Ltd., came into operation on January 1st, 1919, and will result in more economical working of the station.

Direct Spanish Telegraph Co., Ltd.—The accounts for 1918, including the balance brought forward, show a balance of £60,686. The preference dividend (10 per cent.) absorbs £3,000; 5 per cent. plus a bonus of 2 per cent. on the ordinary requires £4,526; to reserve £5,000; carried forward, subject to special taxation of profits, £48,160. The dividend and bonus on the ordinary will be paid free of tax. The Bilbao cable became interrupted close to the cable landing in Spain, on March 23rd, and was reopened after repair (cost £1,640) after 15 days' interruption. With this exception the company's lines continued to carry the traffic satisfactorily throughout the year.

Marconi Wireless Co. of America.—The report for 1918 states that the operations show, before allowing for reserves, a net income of $998,358, as compared with $780,592 for 1917. The net profits, after utilising $286,516 for reserves, amounted to $711,841, as against $617,772, or an increase of 15.23 per cent. This amount has been added to the surplus, increasing that account, after payment of $499,975—1918 dividend—to $1,631,415 at December 31st last. A dividend of 5 per cent. per annum was paid August 1st, 1918, and the directors have declared another dividend of 5 per cent. per annum, payable on July 1st next.

Chelsea Electricity Supply Co., Ltd.—Profit for 1918 £26,818, plus £3,479 brought forward and £1,623 for interest. Debenture interest absorbs £5,480; preference dividend, 6 per cent., £1,800; dividend on ordinary shares, 3 per cent., £7,416; to reserve for renewals, depreciation, and contingencies, £16,118; carried forward, £1,106. Lamp connections 339,934, increase 2,801; units sold 4,190,538, or 248,134 less than for 1917. Annual meeting, April 2nd.

Slough & Datchet Electric Supply Co., Ltd.—During 1918 the units sold totalled 1,752,737, an increase of 73,554 units; the revenue was £16,971, against £14,327 for 1917. The total net profit available for distribution is £5,365. £2,000 has been put to depreciation and reserve. After paying a dividend of 5 per cent., less income tax, £827 is carried forward. The main has been laid to Windsor, and additional plant is being installed to give increased bulk supply to the Windsor Co.

Newmarket Electric Light Co., Ltd.—Total connections 33,810, increase during 1918, 873 lamps. Profit £2,156, against £2,020. Debenture interest, £716. Brought forward £379. Dividend, 2½ per cent.; to reserve for plant renewal, £750; carried forward, £412. Mr. W. T. Pressland, a director, has died, and Mr. J. C. Wigham is to be elected in his place.

Galashiels & District Electric Supply Co., Ltd.—The report adopted at the annual meeting in Edinburgh (Mr. A. Fairgrieve presiding) showed a credit of profit and loss account of £2,860. A dividend at the rate of 5 per cent. was declared. £1,000 was put to reserve and £1,150 has been carried forward.

Salisbury Electric Light & Supply Co., Ltd.—Profit for 1918 £5,625, against £5,712 for 1917. Debenture interest £760; excess profits tax for 1917, £97. Including £2,906 brought forward, £7,671 is available. Dividend 6 per cent. for the year; £2,000 to depreciation and reserve; £3,571 carried forward.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

General Electric Co., Ltd.—80,000 additional 6½ per cent. cum. pref. shares of £10 each, fully paid (Nos. 70,001 to 150,000).

P. R. Jackson & Co., Ltd.—Dividend on the ordinary shares for 1918, 10 per cent. per annum. £4,713 is written off the balance of goodwill account, and £3,115 is carried forward.

London United Tramways, Ltd.—A petition for the confirmation of the reduction of the capital from £2,500,000 to £656,250 is to be heard on April 8th.

Tucuman Tramways, Light & Power Co.—After payment of debenture interest there is a loss of £12,258, making a total debit balance of £61,562 to be carried forward.

Robey & Co., Ltd.—Dividend 7½ per cent. on both preference and ordinary shares, carrying forward £68,664, subject to excess profits tax.

Isle of Wight Electric Light & Power Co., Ltd.—After paying debenture charges and placing £500 to the renewal fund, £655 is carried forward.

Alldays & Onions, Ltd.—Interim dividend 2½ per cent., less tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The situation with regard to domestic securities is so much commanded by the Labour position that the effect of this can be traced in securities which appear to be well removed from anything like the area of possible trouble. For instance, Consols and most of the Government loans are lower, and this influences debenture stocks, with other gilt-edged securities of the best-class companies. The Stock Exchange throughout the month has been disposed to take a cautiously optimistic view of the strike outlook, and clients have not attempted to sell with any noticeable freedom. Therefore the deliberations of last week-end were held as being more or less in accordance with expectation. Fairly substantial advances in a good many of the railway stocks occurred, rises which proved to be somewhat too rapid, in that sellers were attracted, and something of a reaction occurred. On balance, however, movements in the railway market are in favour of the stockholders, and the Undergrounds have sympathised with the rest of the list. Underground incomes have been steady throughout the critical weeks. Districts rose to 25½, subsiding to 24½, and Metropolitans reverted to 27 after being 10s. higher.

In the electric lighting market there is not much going on, but the tendency is to let prices slack off a little. City of London ordinary went back 5s. to 12¼, at which price it might be possible to pick up a few shares. Others in the list are also inclined to lean to the lower side, Bromptons, for instance, being easier, with County ordinary and Westminsters. London Electric preference are ⅛ higher at 3⅞. A good deal of interest is aroused in Mr. J. B. Braithwaite's arguments in favour of power stations in London, as opposed to the suggestion that these should be erected at the mouth of the coal pits. Melbourne Electric ordinary at 168 is down 2 points, and of the lower-priced shares, Urban ordinary dropped back to 10s. 6d. Manufacturing shares are, if anything, a trifle harder. Edison "A" came into demand at 19s., and Electric Construction preference advanced to 22s. 6d. General Electric ordinary and preference are better at 17⅝ and 10⅜ respectively. Babcock & Wilcox have rallied to 3 11/16 after their abrupt drop. Telegraph Constructions are now quoted in their new and divided shape, the price being 24½, equivalent to 49 for the old shares. The last price at which the latter were quoted was 54½, which was cum the dividend, so that the current quotation represents a fall on balance. British Insulated shares have gone back to 40s., there being still some disappointment felt with regard to the figures in the report, upon which we commented last week. British Aluminium are also weaker.

It is reported that a new issue of 40,000 7 per cent. preference shares of £5 each at par will shortly be offered by the Midland Electric Corporation for Power Distribution.

Representations have recently been made to the Treasury as to the advisability of restoring to the Stock Exchange lists of prices the market values of securities that were loaned to, or requisitioned by, the Treasury under the mobilisation schemes initiated in the early part of the war. Dealers in the various markets round the House maintain that the time has fully come for restoring the proper values, and the Treasury has just given permission for this to be done. It is of interest to compare the Treasury prices with those now ruling, and a selection of shares and bonds connected with the cable and electrical industry may be set out as follows:—

Security.	Treasury price.	Now.	Rise or fall.
Amer. Tel. and Tel. Cap. ...	105	110½	+5½
Do. 4% Bds.	88½	89	+½
N. Y. Tel. 4½% Bds.	90¾	96	+5¼
Western Union Tel. 4½% Bds....	93½	92	−1½
Con. Gas and Elec. Balt. ...	108⅞	112	+3⅛
Do. 4½% Bds. ...	80⅝	87	+6⅜
Pacific Power and Lt. 5% ...	86⅞	91	+4⅛
Gen. Elec. N. Y. 5% Gold ...	105⅜	105	−⅜
City Service Pref.	83¼	84½	+1¼
Mackay Com.	74⅞	71	−3⅞
Do. Pref.	67	65	−2
Hav. Elec. Rly. 5%	89	91	+2

The foreign list is irregular. Brazilian Tractions stand out as the feature of strength, a further improvement taking the price to 56½. Expectation is growing stronger that the company will soon be in a position to resume its previous dividend of 4 per cent., paid quarterly. The pre-war price was 66, so the current quotation is still 9½ points below the price four and a half years ago. The preferred stand at 90½, compared with 97 in July, 1914. Rio Tramway bonds are being dealt in fairly freely around 95½, and San Paulos stand a little lower. The wild fluctuations in the American exchange, now that the "peg" has been officially removed, have had some effect in attracting attention to bonds the interest on which is paid in dollars, this applying, of course, more particularly to those of the United States companies. Theoretically, a drop in exchange is followed by a rise in bonds, but this has not been invariably the case this week.

Anglo-Argentine Tramways continue to be a weak market, none too much confidence being placed in the news that the strike at the port of Buenos Aires has once more been composed. Mexicans are also dullish, and further falls have taken place in British Columbia preferred and deferred stocks, both of these having fallen to the common level of 41, which means a drop of 3 points in the preferred. The last time the stock changed hands was at 39. The 5 per cent. preference was negotiated some 10 days ago at 60. The 4½ per cent. first debentures stand at 86½, and the 4½ per cent. Vancouver Power debentures at 85½, no business having been recorded in the latter for the past four months. Canadian Generals have advanced to 120, the preferred to 112½. Kaministiqua Fives are better at 89.

Telegraphs and telephones show noticeable steadiness, the only stock in the list to decline being Indo-European, which have fallen 10s. to 57½. American Marconis recovered from 14s. to 14s. 9d. on the issue of the report for the year ended last December. The company made a net profit of $712,900, which is an increase of $94,000. Five per cent. was paid last August, and another 5 per cent. is recommended to be paid on July 1st next. The report mentions that the United States Naval Department recently brought a bill into Congress for taking over all wireless stations by the American Government. Nothing has been done in this connection up to the present, but the prospect of such nationalisation induces caution.

The rubber market is quiet, inclined to be a little better for choice. Vickers have again been sold by holders, who claim that it pays them to do this in order to buy Metropolitan Wagon shares on the fusion arrangements. Copper shares are heavy in consequence of a cut in the dividend on the shares of the Rio Tinto Co., which has caused a fall in the price of nearly £5 a share. The Treasury's removal of restrictions upon new issues of capital for domestic purposes, came as a welcome surprise. Its effect is likely to be seen very shortly in a flood of prospectuses appealing for new capital.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1917.	Dividend 1918.	Price March 25, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	10	8	7½	— ⅛	£6 8 0
Charing Cross Ordinary	4	4	3⅝	—	6 10 4
do. do. do. 4½ Pref.	4½	4½	3⅝	—	6 13 4
Chelsea	5	8	3¾	—	4 1 1
City of London	8	8	12¼	— ¼	6 10 8
do. do. 6 per cent. Pref.	6	6	10½	—	5 18 5
County of London	7	7	10⅞	— ⅛	6 8 9
do. do. 6 per cent. Pref.	6	6	10⅛	—	5 18 5
Kensington Ordinary	7	6	6	—	5 16 8
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	6	6	3⅛	+ ⅛	7 14 10
Metropolitan	4	5	3¼	—	7 13 10
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	9	9	7⅛	—	7 0 4
South London	5	5	8	—	6 13 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6⅝	— ⅛	6 0 9

Telegraphs and Telephones.

	Dividend 1917.	Dividend 1918.	Price March 25, 1919.	Rise or fall.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	99½	+ ½	6 0 7
do. Def.	*1½	83/6	21⅛	—	7 13 0
Chile Telephone	8	8	7½	—	5 6 8
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10¼	—	5 14 8
Great Northern Tel.	22	22	32¼	—	6 16 6
Indo-European	13	13	57½	— ½	5 13 0
Marconi	20	20	$4\frac{11}{16}$	—	4 6 6
Oriental Telephone Ord.	10	15	2⅛	—	4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	1/3	1/3	$1\frac{11}{16}$		*3 15 0
Western Telegraph	8	8	16⅞	—	*4 14 10

Home Rails.

	Dividend 1917.	Dividend 1918.	Price March 25, 1919.	Rise or fall.	Yield p.c.
Central London Ord. Assented	4	4	62½	—1	6 8 0
Metropolitan	1	1¼	27	—	4 12 7
do. District	Nil	Nil	24½	—	Nil
Underground Electric Ordinary	Nil	Nil	3¼	—	Nil
do. do. "A"	Nil	Nil	9/3	—3d.	Nil
do. do. Income	4	5	95	—	*5 5 3

Foreign Trams, &c.

	Dividend 1917.	Dividend 1918.	Price March 25, 1919.	Rise or fall.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	Nil	3⅝	— ⅛	—
do. do. 2nd Pref.	—	—	3⅜	—	—
do. do. 5 Deb.	6	5	67½	—1	7 8 0
Brazil Tractions	—	—	55½	+1	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62	—	8 0 0
do. do. Preferred	Nil	Nil	41	—3	Nil
do. do. Deferred	Nil	Nil	41	—1	Nil
do. do. Deb.	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	61	—1½	Nil
do. 6 per cent. Bonds	Nil	Nil	62	—2	Nil
Mexican Light Common	Nil	Nil	37	—1	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	67	—	—

Manufacturing Companies.

	Dividend 1917.	Dividend 1918.	Price March 25, 1919.	Rise or fall.	Yield p.c.
Babcock & Wilcox	15	15	$3\frac{11}{16}$	+ $\frac{1}{16}$	4 1 4
British Aluminium Ord.	10	10	1[illegible]	—	6 12 6
British Insulated Ord.	25	12½	2	— ⅛	5 17 8
British Westinghouse Pref.	7½	7½	$2\frac{7}{16}$	—	6 3 0
Callenders	25	25	10	— ¼	6 5 0
do. 6½ Pref.	5	6½	5½	—	6 8 10
Castner-Kellner	25	20	$3\frac{7}{16}$	—	6 1 3
Edison-Swan, "A"	—	—	19/3	+ 3d.	7 16 0
do. do. 5 per cent. Deb.	4	5	74½	—	6 14 3
Electric Construction	10	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6½	10⅜	+ ⅛	6 5 4
do. Ord.	10	10	17⅝	+ ⅛	*5 13 4
Henley	25	25	$2\frac{7}{16}$	—	5 8 2
do. 4½ Pref.	4½	4½	4	—	6 12 6
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord.	—	—	6⅛	— $\frac{1}{16}$	*8 2 0
Telegraph Con.	20	20	21⅛	—	4 18 6

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, March 26th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/5	..
a	Ammoniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	"	£78	..
a	Bisulphide of Carbon	"	..	..
a	Borax	"	£43	..
a	Copper Sulphate	"	£47	..
a	Potash, Chlorate	per lb.	1/9	..
a	" Perchlorate	"	1/9	..
a	Shellac	per cwt.	£12 10s.	..
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers	"	£33	..
a	" Lump	"	£25	..
a	Soda, Chlorate	per lb.	11d.	..
a	" Crystals	per ton	170/-	..
a	Sodium Bichromate, casks	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	11⅝d.	1d. dec.
c	" Tubes (solid drawn)	"	1/2¼ to 1/2½	½d. dec.
c	" Wire, basis	"	1/-	..
c	Copper Tubes (solid drawn)	"	1/3¾	½d. dec.
g	" Bars (best selected)	per ton	£114	£4 dec.
g	" Sheet	"	£114	£4 dec.
g	" Rod	"	£114	£4 dec.
d	" (Electrolytic) Bars	"	£82 10s.	80s. inc.
d	" " Sheets	"	£161	..
d	" " Wire Rods	"	£92 10s.	80s. inc.
d	" " H.C. Wire	per lb.	11½d.	½d. inc.
f	Ebonite Rod	"	8/-	..
f	" Sheet	"	2/6	..
n	German Silver Wire	"	2/6	..
h	Gutta-percha, fine	"	11/-	..
h	India-rubber, Para fine	"	2/4¾	½d. inc.
i	Iron Pig (Cleveland warrants)	per ton	Nom.	..
l	" Wire, galv. No. 8, P.O. qual.	"	£40	..
g	Lead, English Pig	"	..	..
g	Mercury	per bot.	Nom.	..
e	Mica (in original cases) small	per lb.	9d. to 4/6	..
e	" " " medium	"	5/- to 10/-	..
e	" " " large	"	12/6 to 25-/& up.	..
d	Silicium Bronze Wire	per lb.	1/4	½d. inc.
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	"	£236 to £238	£12 to £14 inc.
n	" Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Electrical Trades Benevolent Institution.—The annual general meeting of the Benevolent Institution will be held at the Institution of Electrical Engineers, 1, Albemarle Street, W., to-day (Friday) at 2.30 p.m.

The report of the Committee for the year 1918 shows that the number of members has increased from 148 to 176; no Festival has been held for four years, but it is hoped that one will be held in the autumn of this year. An appeal issued by Mr. Hunter, chairman of the general meeting, has brought in up to February 20th, 1919, £1,210, but this does not affect the income for 1918, which was £1,168; the net income was £983, out of which two grants were made, the sum of £963 being carried forward. The total invested fund now amounts to £10,806. Local Advisory Committees were formed during the year, and the Cardiff and District Committee was particularly successful. The number of collectors is increasing, and the amounts collected have risen very considerably.

Electrification of Seed.—The "Wolfryn" electro-chemical process for the treatment of seed grain has been introduced in the Ardee district of Co. Leith.

Mr. W. A. Chamen delivered an interesting lecture before the Cardiff Naturalists' Society, on March 20th, on "Electricity Supply." The lecture was illustrated with limelight views. The lecturer remarked that of the 80 per cent. increase in the cost of the production of electricity which had occurred owing to war conditions, 60 per cent. was attributable to the increased cost of coal, and only 20 per cent. to increased wages and other charges. The firm with which he was associated had been treating a potato field with electricity for the last few years, and last year there was an increased production of from 12 to 15 per cent. in the portion treated compared with the untreated portion. He hoped to be able to show the advantages of electricity as applied to agriculture at the forthcoming Royal Show.

Fatality.—A correspondent reports that James Doig (46), staff attendant, Electrical Power Station, Carron Works, Falkirk, was found dead behind the switchboard. No one saw Doig go behind the switchboard, but he had evidently been endeavouring to couple up a lamp, and in doing so, it is thought, he touched two live wires at 500 volts.

THE PRESENT ELECTRICAL OUTLOOK IN CANADA.

By A. S. L. BARNES, A.M.I.E.E.

In order properly to consider this question, it will be well to ascertain what the electrical trade of Canada was during a few years preceding the war, and also what it has been during the war itself; this information will form a basis upon which assumptions regarding probable future conditions may be made.

A survey of the general trade of Canada showing its extent, together with some details as to Canada's resources, growth of population, and other matters of interest, will be useful in this connection.

Canada is about the same size as the entire Continent of Europe, having a land area of over 3,600,000 sq. miles and a water area of almost 126,000 sq. miles.

Taking the various Provinces, Prince Edward Island, situated in the south of the Gulf of St. Lawrence, is the smallest, with an area of 2,184 sq. miles :—

Nova Scotia has an area of	21,068	sq. miles.
New Brunswick	27,911	,,
Quebec	706,834	,,
Ontario	407,262	,,
Manitoba	251,832	,,
Saskatchewan	251,700	,,
Alberta	255,285	,,
British Columbia...	355,855	,,

The difference between the sum of the foregoing figures, and the total area given previously for the whole of Canada is presumably the area of the North-West territories and the Yukon, which lie north of the 60th parallel of latitude.

These data here quoted, and most of those which follow, are taken from Dominion and Provincial Government reports.

Such a vast territory as that of the Dominion necessarily embraces great differences of climate and great natural resources in agriculture, forestry, minerals, fisheries, water-powers, &c.

In order that such resources may be developed readily, means of communication, both in the country itself, and with the outside world, are a very necessary adjunct.

How is Canada situated in this regard?

It needs but little study of the map to learn that this country is a land of magnificent waterways, since with the aid of a few short canals, boats of several thousand tons burden can sail from the Atlantic to the head of Lake Superior, where the "twin cities," Port Arthur and Fort William are situated; this is a distance of some 2,000 miles or so, and on the route are many large and important towns.

The annual volume of traffic on the canals of Canada has averaged about 32,000,000 tons during the years 1913 to 1916 inclusive.

The next item of means of communication to be considered is railways.

Of steam railways this country had in actual operation a mileage of 37,434 in 1916; the total capitalisation of this mileage was equivalent to about £380,000,000 in that year; nearly 50,000,000 passengers and over 100,000,000 tons of freight were carried during that period.

Of electric railways, including tramways, or, as they are called here, "street railways," the mileage in 1916 was over 1,600, and the number of passengers carried exceeded 580,000,000; the total capital invested was equivalent to about £31,000,000.

Statistics regarding roads do not appear to be readily available, but it may be said that the mileage of fairly good roads is considerable, although for the size of the country it is, of course, insignificant, partly because Canada is a "new" country, and partly on account of its small population. The number of motor vehicles in use has grown from about 70,000 in 1914 to 123,000 in 1916, and has undoubtedly increased a great deal since the latter year.

Aeroplanes are not yet an established means of communication, but, owing to the very large number of men from Canada who have become expert aviators, the several large aeroplane factories which have been established here during the war, and the successful trials of air mail service between Ottawa and Toronto, there is little doubt that advantage will be taken of this method of transportation.

Telegraphs and telephones claim some attention here, since they are indispensable to modern commerce.

In 1916 no less than 10,000,000 land messages, and over 1,000,000 cablegrams, were handled; the wire mileage for telegraphs was nearly 225,000, the line mileage being about 48,000.

There are 50 radio-telegraph coast stations for communication with ships at sea, the most powerful having a range of 3,000 miles—this is the record for 1916.

Telephones in Canada are very much more numerous, proportionally, than in Great Britain. The following figures apply to the year 1916 :—

No. of telephones in use...	548,421
Wire mileage	1,600,564
Persons per telephone	14·6
Capitalisation equivalent to	£15,400,000

Consideration will now be given to some of Canada's sources of wealth, together with figures of the actual values being obtained from those sources at present.

Of the existing means of wealth, which have, so far, been developed, agriculture comes first.

In 1915, in the Western Provinces alone, there were over 22,000,000 acres of land under cultivation; the land area of these three Provinces is 466,000,000 acres, practically the whole of which is said to be suitable for cultivation. The total area in the Dominion in 1916, growing field crops, was about 7¾ million acres, and the value of the crops about £355,000,000.

The forest wealth of Canada is immense, though, unfortunately, it is being yearly reduced on a big scale by disastrous forest fires, in which millions of dollars' worth of timber are ruined. A good deal of such regrettable loss has occurred within the past 10 years, but steps are being taken with a view to reducing the damage annually resulting from fires.

Canada, it is estimated, has between 500 and 600 millions of acres of forests, about half of which area has timber of merchantable size on it. The value of the forest products of the Dominion for 1916 was about £34,000,000, of which pulpwood amounted to £4,000,000 worth.

The fisheries of the country are a very important asset; the total value of the catch for 1915-16 was approximately £900,000, and the resources available for further development are very great.

In mineral wealth, Canada takes a high place in the world, and in two mine products at least, viz., asbestos and nickel, the former coming chiefly from Quebec, and the latter from Ontario, she has almost a world monopoly.

In 1916 the total value of the metal and mineral production was over £35,000,000. The principal mine products are gold, silver, lead, zinc, copper, nickel, iron, coal and asbestos, while in addition may be mentioned limestone, china clay, mica and salt, as well as gas and oil.

The extent of Canadian trade during the past 10 years is shown by the following approximate figures, which are millions of dollars :—

	Total imports.	Total exports.	Merchandise. Imports.	Merchandise. Exports.
1908 ...	$371	$280	$352	$263
1909 ...	310	262	288	260
1910 ...	392	301	370	299
1911 ...	472	297	452	290
1912 ...	559	315	521	308
1913 ...	692	393	671	377
1914 ...	651	479	618	455
1915 ...	629	491	455	461
1916 ...	565	883	508	779
1917 ...	873	1,376	845	1,179

MANUFACTURES.

Exports the Produce of Canada.

	United Kingdom.	U.S.A.	Other countries.	Totals.
1908 ...	$7	$12	$9	$29
1909 ...	8	12	9	29
1910 ...	7	15	10	31
1911 ...	7	17	12	35
1912 ...	7	16	13	36
1913 ...	7	21	15	44
1914 ...	9	30	18	57
1915 ...	25	42	19	86
1916 ...	148	58	35	242
1917 ...	339	92	46	477

Percentages which United Kingdom and U.S.A. trade with Canada forms of the total trade of the Dominion :—

	Imports.		Exports.	
	U.K. Per cent.	U.S.A. Per cent.	U.K. Per cent.	U.S.A. Per cent.
1908	27	58	51	37
1909	25	59	51	35
1910	26	59	50	37
1911	24	61	47	39
1912	22	63	49	37
1913	21	65	47	40
1914	21	64	49	39
1915	20	65	46	40
1916	15	73	59	28
1917	13	79	64	24

Under the heading of "Electric Apparatus," the following are approximately the figures given relating to imports in the official reports :—

	U.K.	Germany.	U.S.A.	Foreign, including U.S.A.
1913 ...	$1,188,000	$107,000	$7,613,000	$7,916,000
1914 ...	952,000	200,000	7,505,000	7,974,000
1915 ...	715,000	79,000	5,137,000	5,320,000
1916 ...	243,000	140	4,640,000	4,653,000
1917 ...	177,000	10	6,149,000	6,166,000

The term electric apparatus apparently includes carbons, electric motors, generators and dynamos, incandescent lamps, &c.

The population of Canada increased as follows during the 40 years ending with 1911 :—

1871	3,689,000	1901	5,371,000
1881	4,325,000	1911	7,207,000
1891	4,833,000		

Up to the year 1914 the population had been steadily increasing, and the general impression was that the figure of 8 millions was being approached ; 10 per cent. of the people are officially classed as foreign born—British born are not included in this category. During the period 1914 to 1917, 653,000 immigrants arrived, of whom very considerable numbers came from the United States.

In an article on the subject of which this one treats, the water-power possibilities must take a prominent place, for, in a country possessing such an abundance as Canada does of water power, it is from this source that most of the electrical energy generated here will be derived.

(*To be continued.*)

SOME NOTES ON THE ELECTRO-CARDIOGRAPH.

By ROBERT S. WHIPPLE, M.I.E.E.

(*Abstract of paper read before a joint meeting of the* Royal Society of Medicine *and the* Institution of Electrical Engineers.)

Prof. A. W. Waller was the first physiologist to show that the electric potentials developed in the heart at each contraction of the organ were sufficiently large to deflect a sensitive galvanometer when the latter is connected to the limbs of the human subject.

Little progress was made from this discovery until the invention of the string galvanometer in 1901 by Prof. W. Einthoven. Largely as a result of Einthoven's work and that of Dr. Thomas Lewis, an important branch of pathology, electro-cardiography, has arisen, which science is dependent on the interpretation of the records obtained with the string galvanometer.

If the extremities of the limbs of a patient are placed in non-polarisable electrodes, and electrical connection is made through the galvanometer, the string is deflected by the current passing through it. The magnitude of this current varies continually during the systole of the heart. In the majority of healthy people the heart passes through a normal cycle and this gives practically the same electrical potential at every stage of the cycle. If, therefore, the position of the galvanometer string is continuously photographed the potential corresponding to any particular heart movement can be determined. During the taking of the record the resistance of the galvanometer string and the body of the patient remain practically constant, and since the period of the string is so small (about 0.04 second) and the motion is nearly aperiodic, the movements recorded are a direct measure of the electromotive force at any instant. The maximum changes in electromotive force throughout the whole of the heart movement rarely exceed 3 millivolts.

A string about 100 mm. long, 0.003 mm. in diameter, and having a resistance of about 3,000 ohms in series with a patient having an approximate resistance of 4,000 ohms, moves through approximately 0.5 mm. when a potential of 3 millivolts is applied to it. A high magnification must therefore be used to study the detailed movements of the string.

The equipment required to obtain an electro-cardiogram is as follows: The galvanometer which receives the electrical impulses of the heart, and camera to record the movements of the string in the galvanometer; a time-marker or mechanism for marking time intervals on the photographic plate; a source of illumination by means of which the photographs are obtained; electrical equipment for making the necessary standardisation and other adjustments; and the electrodes for making electrical connection to the patient.

Since the invention of the string galvanometer by Einthoven several models have been devised, although they all have the same general characteristics and are modifications in detail only. The most successful model is, the author believes, that designed by the late W. Duddell in 1905 for the Cambridge Scientific Instrument Co., Ltd.

The problem of moving a photographic plate or paper at a uniform speed is a difficult one. The range of speed required in clinical electro-cardiograph work is zero to 85 cm. per second, but in many physiological researches speeds as high as 4 metres per second are used.

By means of a device suggested by Dr. Avery Newton any part of the width of the plate may be exposed, and it is now customary to take the photograph from the three leads from the electrodes (fig. 1) upon the same plate. Fig. 3 is a reproduction of such a record. The three cardiograms have been exposed successivly one after the other.

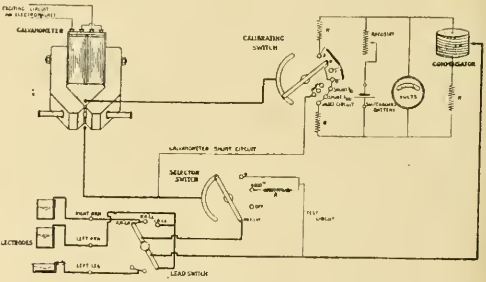

Fig. 1.—Diagram Showing Connections of Switchboard.

An essential condition for the study of, and especially for the comparison of any two records on electro-cardiograms, is an accurate time scale. A vibrating reed in which the vibrations are maintained electrically is frequently employed. The shadow of the reed is projected on the photographic plate and a record similar to fig. 2 is obtained. In all the records in this figure the time-marker is indicating thirtieths of a second. Not infrequently the method is modified by using an electrically-driven tuning-fork to maintain a small Deprez time-marker in motion. This is a convenient arrangement, as the tuning-fork can be placed on a rigid support at a little distance from the galvanometer and camera; the time-marker is placed so as to intercept the light beam.

The most satisfactory source of light—especially if quick records are to be taken—is an arc lamp. A useful model—because the position of the crater remains practically constant—is one in which the positive carbon is mounted horizontally. The carbons are fed together automatically. In clinical work the current required does not generally exceed 6 amperes. It is now impossible to obtain Nernst lamps in this country, and the "Pointolite" made by the Ediswan Co. is from many points of view a better lamp. Not improbably it will become the lamp used in clinical electro-cardiographic work.

Connection is made to the patient by means of non-polarisable electrodes into which the limbs of the patient are placed. Three electro-cardiograms are taken, generally on the same photographic plate, the two arms and the left leg being used. Superimposed on the varying currents due directly to the heart, there is generally a relatively large and fairly steady current due to an electromotive force set up by the glandular activities of the skin and known as "the skin current."

It is necessary that this should be neutralised by the introduction of an equal and opposing potential difference.

In order that the various cardiograms may be comparable with each other, it is essential that the galvanometer from which they are obtained should be standardised to the same sensitivity. All observers have adopted a sensitivity of an excursion 10 mm. on the photographic plate for an applied potential difference of 1 millivolt when the connections are complete through the patient. It is also frequently desirable to know the resistance of the galvanometer and of the patient. The electrical connections to fulfil the above requirements are shown in fig. 1.

The electrodes in which the patient's limbs are placed are connected to the three terminals on the control board, and assuming that it is desired to take a cardiogram of lead I—right arm, left arm—the lead switch is placed as in the diagram. In all preliminary work with the string galvanometer it is advisable to cut the galvanometer out of the circuit by placing the calibrating switch in the "short-circuit" position. The current in the circuit is then adjusted by means of the rheostat until the pointer of the small voltmeter indicates 0.5 volt. When such is the case there is a drop of 1 millivolt and 3 millivolts respectively across the studs of the calibrating switch where marked 1 and 3. The calibrating switch is then moved to the position shunt 1/100, when 1/100th of the current passes through the galvanometer. A deflection on the galvanometer due to the skin current of the patient will then be observed. This is brought to zero or "compensated" by the introduction of a counter electromotive force, the rheostat or "compensator" being turned until there is no deflection of the galvanometer. The switch is then moved to 1/10, which will probably produce another deflection, which must again be neutralised by the rotating compensator. The switch is finally put on to the zero position, and, if necessary, the compensator is again adjusted. The galvanometer will then show the periodic deflections due to the electro-motive force produced by the heart's action.

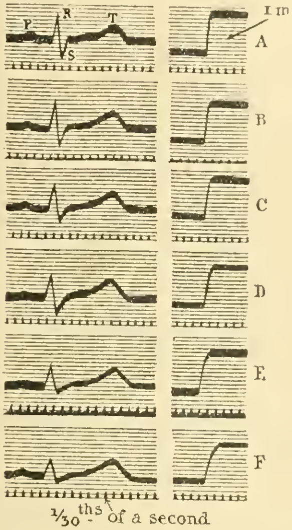

Fig. 2.—Effect of Varying Tension of Galvanometer String.

The galvanometer should now be calibrated and adjusted for sensitivity. It is usual that the image of the fibre should be deflected through 10 mm. for a change in electro-motive force of 1 millivolt. The mean position of the string is carefully observed and the calibrating switch put on to the "1" stud. This introduces 1 millivolt into the circuit, and the shadow of the string will move to a point on the scale depending on the slackness of the fibre. The tension on the string is adjusted by means of the micrometer screw until the correct sensitivity is obtained.

The resistance of the string is readily measured. The calibrating switch is placed on the "short-circuit" position, and the selector switch on the zero position. The compensator is then adjusted until the galvanometer string remains at zero, when the calibrating switch is moved from the "short-circuit" to "0" position (the shunt positions having been used for safety). The galvanometer is adjusted to standard sensitivity for 3 millivolts. The 4,000-ohm resistance is introduced by moving the selector switch, and the deflection in mm. then observed.

The resistance of the fibre =

$$(4{,}000 \times 2\text{nd deflection}) \,/\, (30 - 2\text{nd deflection}).$$

In a newly silvered fibre the resistance varies from 2,000 to 6,000 ohms, and usually slowly increases.

The resistance of the patient may be determined in a similar manner. First compensate for any skin current and calibrate the galvanometer to standard sensibility, viz., 30 mm. deflection for 3 millivolts. The patient is then disconnected by moving the selector switch to the 4,000 position, and the "compensator" adjusted until the string remains at its zero position. The deflection when 3 millivolts are introduced is then noted. Knowing the resistance of the galvanometer string, that of the patient may be determined, the deflections being proportional to the resistance of the galvanometer string and the patient, and the galvanometer string and 4,000 ohms respectively. The resistance includes that of the electrodes.

Many of the heart movements it is desired to study are very rapid, and experience has shown it is essential that the string when adjusted to the working sensitivity of 10 mm. per millivolt should be just aperiodic. Corresponding to this sensitivity a certain tension is required in each string. This gives each string a certain free period; the damping at this period must be such that the motion is aperiodic.

In practice it is found that a silvered glass or quartz fibre about 100 mm. long and 0.003 mm. in diameter well fulfils the conditions and attains practically its full deflection corresponding to the applied voltage in less than 0.02 second. Fig. 2 shows the effect of varying the tension on the string in a striking manner. The curves on the right of the figure were taken with different resistances in circuit and they were all adjusted to a sensibility of 10 mm. per millivolt with different tensions on the string. From above downwards (A to F), the added resistance was increased and the string slackened. A reduction in the tension of the string causes overdamping, and the string cannot follow the changes in potential due to the heart's action with sufficient rapidity and the curves are distorted. This is clearly shown in the records to the left of the figure. The electro-cardiograms of the first two strings are practically alike and correct; distortion is seen in the third record when the deflection time is increased from 0.013 to 0.028 second.

The electrodes used consist of an inner porous vessel which is filled with a 20 per cent. saline solution and an outer stoneware vessel filled with a saturated zinc-sulphate solution and containing an electrode of zinc. Records taken with polarisable electrodes are distorted, and it is inadvisable to use them. Fig. 3 is an electro-cardiogram obtained from the three leads. P, the first phase, is due to the simultaneous contraction of the two auricles. Q, R, S, and T (of which R and T are the most prominent) are the result of simultaneous contraction of the two ventricles.

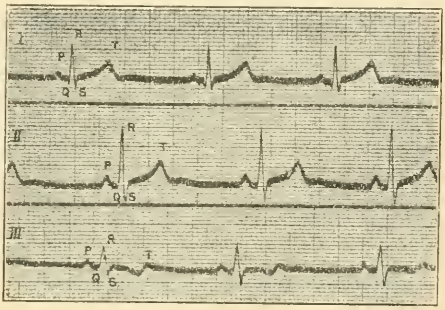

Fig. 3.—Actual Cardiogram.

Dr. Thomas Lewis, in opening the discussion, showed a number of cardiograms, and explained how and why they differed. He outlined the valuable aid the electro-cardiograph had become to diagnosis in clinical medicine, and suggested that electrical men would meet an urgent need could they provide a microphone of a higher natural frequency than the type at present in use. Such an instrument would enable them to arrive at much more important and valuable results than they were able to obtain at present. He referred to the great work the Cambridge Scientific Co., Ltd., had done in developing the apparatus, without which the important results that were now being obtained would not have been possible.

The Belluzzo Steam Turbine.—The results obtained some years ago on the variable-speed reversing steam turbine designed by Prof. Belluzzo were so encouraging that various naval authorities became interested.

An article in *l'Industria*, of December 31st, 1918, describes a turbine of the new type developing some 20,000 H P. at the shaft, as applied to scouting torpedo boats capable of attaining a maximum speed of 40 M P.H. The turbine is formed of a single cast-iron body unit, in which is enclosed the rotating part formed of the various disks and a drum. The drum and disk blades are entirely of the action type. The first disk or wheel has four crowns of blades of the special type invented by Prof. Belluzzo for running in both directions.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "Victory" Bell Push.

We illustrate below, fig. 1, a new mining ironclad bell push which is being put on the market by the patentee, Mr. E. H. March, of Campsall Road, Askern, Doncaster. The fitting is specially designed and manufactured to stand rough usage; it is suitable for use in all exposed positions, such as mines and collieries, as well as chemical and dye works, &c. Amongst the advantages claimed for it are that it is safe and reliable, besides being gas and watertight as well as dust-proof. The "Victory" push is strongly constructed, and has the contacts enclosed in a cast-iron container, in one piece. The cover, which is of steel plate, is screwed on to the back. When the push is fixed in position it cannot be tampered with, there being no exposed covers or screws liable to be removed, and there are no troublesome glands. The leading-in cables are soldered to the contacts, and the intervening space is filled in with solid compound. Full particulars and samples will be supplied by the patentee on request.

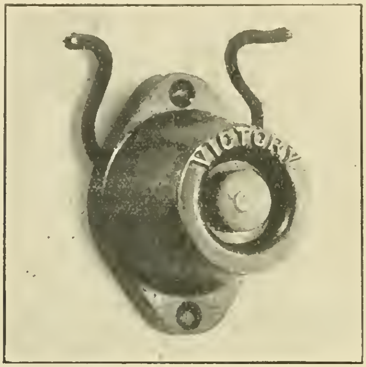

Fig. 1.—"Victory" Ironclad Bell Push.

Scientific Salvage.

The system of Army salvage became one of the essential elements in the conducting of the war—and the problem is one of peace as well. Salving waste materials is clear gain. How the clearing up of the junk pile in a power company's organisation can be made a source of profit rather than an expense is interestingly told in the *Journal of Electricity* by the commercial engineer of the Southern California Edison Co., who has directed the salvage work of that company. The holding of second-hand, idle, and obsolete plant and material soon becomes a burden, and for lack of knowledge the advantages of salvage are too often neglected or overlooked. With the knowledge of how scrap can be used and sold to the best advantage, the matter of salvage can be made one of simple marketing. More profitable avenues for salvage than the junk dealer are to be found. For instance, it was discovered that the obsolete ribbed reflector was put to novel use, by uniting two discarded shades as in fig. 3, as a fruit dish, which when mounted on a suitable base, is both appropriate and beautiful. Clear arc-light globes were redeemed, as in fig. 2, for more than first cost by a wise Japanese, who knew more about hanging gold fish containers than electricity. Frosted and clear globes alike find a fitting use with the nurseryman for the shelter and propagation of delicate plants, while obsolete marble switchboard slabs are indispensable to the confectioner, and extremely handy to the housewife in fancy baking. The man who can achieve these results can afford to pay more for the glassware than can the junk man. These are a few reasons why the common practice of carelessly raking up a pile of so-called waste and dumping it on the scrap-heap should not be countenanced.

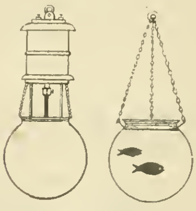

Fig. 2.—Redeemed Arc-Lamp Globe.

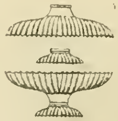

Fig. 3.—Converted Glass Reflector.

The Wild-Barfield Electric Furnace.

The following brief description and illustration refer to the Wild-Barfield electric steel-hardening furnace that is being supplied to the Metallurgical Department of Sheffield University by Messrs. Automatic & Electric Furnaces, Ltd., of 6, Old Queen Street, Westminster, S.W. 1, who, we understand, are about to introduce new ranges to meet the demand that has arisen for larger sizes of furnaces. Referring to the illustration, fig. 4, the overall dimensions of the furnace are 8 in. by 15 in., and the heating chamber is 4 in. bore by 13 in. deep. The power consumption at full load is 1,400 watts at 200 volts A.C., the maximum temperature being 850 deg. C. The furnace has an output of 10 lb. of tools per hour, and it will accommodate an article of a maximum weight of 2 lb. and a maximum length of 8 in. The overall dimensions of the electrically-heated quenching and tempering bath are 12 in. by 15 in., while the inner pot is 8 in. bore by 13 in. deep. The power consumption reaches 600 watts, and the maximum temperature 350/400 deg. C. It will take articles of a maximum weight and length of 4 lb. and 10 in. respectively. An angle-iron working bench, 6 ft. long by 2 ft. 5 in. wide, to accommodate the entire equipment, is supplied with the outfit. Through the courtesy of Prof. J. O. Arnold, arrangements have been made to give practical demonstrations to representatives of engineering firms and others who are interested in the modern heat treatment of steel. Sheffield readers who would care to receive an invitation can do so on application to the makers of the furnace.

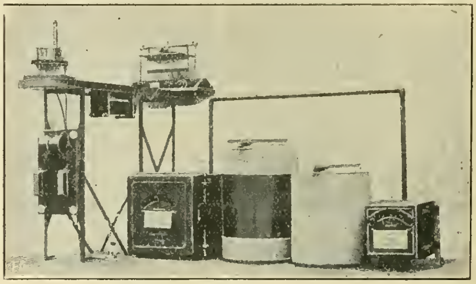

Fig. 4.—Wild-Barfield Electric Furnace.

An Improved Pot for Solder.

Mr. L. V. Snyder, in the *Electrical World*, states that the Westchester Lighting Co., Mount Vernon, N.Y., has adopted a specially designed solder pot of oval shape (fig. 5) which has the advantage that there is space for the solder to fall back into the pot as well as for the lineman to use his ladle freely. The safety lip on the inside of the pot prevents the solder from spilling out of the vessel when it is being raised or lowered on a pole. Another advantage of this design is that the solder cannot be lost out of the pot as easily when it is cold because the lip projects inwards enough to keep it from falling out.

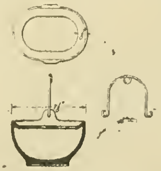

Fig. 5.—Oval Solder Pot with Safety Lips.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Shorter Working Week.

	A.	B.	C.	D.
	Day shift.	Evening shift.	Night shift.	Spare shift.
Sun. .	8 a.m.—4 p.m.	Off duty	4 p.m.—12 mn.	12 a.m.—8 a.m.
Mon. ..	8 a.m —4 p.m.	4 p.m.—12 mn.	Off duty	12 a.m.—8 a.m.
Tues. ..	8 a.m.—4 p.m.	4 p.m.—12 mn.	12 a.m.—8 a.m.	Off duty
Wed. ..	8 a.m.—4 p.m.	4 p.m.—12 mn.	12 a.m.—8 a.m.	Spare duties
Thurs...	8 a.m.—4 p.m.	4 p.m.—12 mn.	12 a m.—8 a.m.	Spare duties
Friday..	8 a.m.—12 noon	4 p.m.—12 mn.	12 a.m.—8 a.m.	Spare duties and 12 noon—4 p.m.
Sat. ..	Off duty	4 p.m.—12 mn.	12 a.m.—8 a.m.	8 a.m.—4 p.m.
	44 hours	48 hours	48 hours	48 hours

In the above shifts, A would go off on Friday at noon, and then come on evening shift on Monday at 4 p m.

This makes three weeks of 48 hours each, and one of 44 hours, or a 47 hours week over the four.

If 48 hours is the number agreed on, then A would have to remain on until 4 p.m. on Friday, which would make 48 hours each week.

I may state that these shifts are being worked in a local undertaking, and are being found very satisfactory to all concerned.

March 21*st*, 1919. **Scottish Engineer.**

Overtime for Shift Engineers.

I understand that an attempt is being made to introduce a 48-hour week by the E.P.E.A. In bringing this matter forward, has any stipulation been made as regards overtime? There are many cases in which through sickness, or when a man leaves, or in case of breakdown, engineers-in-charge have to work many hours over the maximum 48.

There seems to be a feeling among certain men that it is *infra dig* to receive overtime. I have in some cases worked 48 hours in four days; the remaining two, or three, days, as the case may be, have been worked for no payment at all. The only way to enforce a 48-hour week will be to insist that overtime is paid at time and a half. As long as hours are worked for which no payment is made the 48-hour week will exist, in many cases, in name only. You cannot stop a supply because a man has completed his 48 hours and no other man is available, therefore when 48 hours have come into force let a clause be added stating that all time over 48 hours shall carry time and a half. **Max. Demand.**

The Control of Electricity.

With regard to the proposed change in the method of controlling the electrical industry, there is one point to which I think it is necessary to call immediate attention. Unless care is taken it may be found that the Bill has gone through Parliament, and before long we may find that everything connected with electricity has become an official secret.

It may be quite as impossible in the future for us to discuss a design of a joint-box or to criticise any system of supply as it is for men in the Post Office or other Government Departments to give voice to their opinions. For instance, a man in the Post Office who wrote to the Press criticising an installation of automatic telephone apparatus, and pointing out its defects, would immediately lose his position. This official secrecy is the cause of an enormous amount of inefficiency in Government Departments. It results largely from the desire of rather inefficient managers to shield themselves from wholesome and much-needed criticism. Furthermore, the introduction of the official secret method into electricity supply would mean the immediate closing down of the electrical Press so far as electricity is concerned. All our progressive tendencies would be slowed down, and we should be put in the position of waiting to see what other countries did before we adopted any big development. For instance, the automatic telephone could, no doubt, have been invented in this country had there been opportunity for the men of the Telephone Department to use their brains. As it was, we had to introduce it from abroad.

The obstacle under Government control is this: A man has an idea. He puts it before the heads of departments. They offer to take it up provided that he will prove that it is satisfactory. He, on his part, is unable to test the apparatus himself as he has no facilities, and probably no money. As a result, the Department waits for the inventor to develop it, and the inventor waits for the Department to give facilities, and in the end nothing is done. Incidentally, as the I.E.E. Report has shown, Government Departments think it a good plan to let a man spend all his own money, and a lot of other people's money, in developing an idea, and then to take it from him without payment. In this way the inventive faculty of the nation has been largely sterilised, and we are squandering millions of money yearly by using means which are inefficient, when we might have had efficiency had we encouraged our inventors. How are we to meet the situation? Three methods of dealing with it are obvious:—

First of all we must maintain our rights to free discussion, free criticism, and free investigation. This is a hard task, but not impossible. We must also with it maintain our free Press, without which the industry would lose its life and become like a bird in a museum, dusty and dead and a source of disgust to the onlookers.

Secondly, we must introduce a research department on a big scale, whose business it will be to investigate new ideas and to develop them where profitable. To make such a research department workable, it should be divided under at least three different managements, and competition should be introduced between them as to which will produce the greatest number of successful results in a year. This will prevent the research departments from degenerating into routine methods under which the managers pride themselves on their power of detecting the nigger in every new idea.

The third item, which is of overwhelming importance to the industry, is that some means must be introduced whereby the industry may make its voice heard in the Board of Control. This could be done by arranging that the Board of Control shall have a number of representatives voted on it, very much as members are voted on the I.E.E. and I.M.E.A. Councils. These members should be elected for a strictly limited period, and continual rotation should be enforced, so that it will not be possible to have the same people on the Board year after year. By this means fresh blood will be introduced into the governing department every year which will help to prevent it getting unduly tied up with red tape.

Many of us fear that the new control will mean the introduction of red tape, but a little care now may do much to reduce the strangling power of that all-too-prevalent suppressor of energy. **E. M. F.**

March 20th, 1919.

The Re-settlement of Officers.

While thanking you for your generous appreciation of the work of the young officers in the war, will you kindly allow me to add a few words to yours with regard to the letter of "Fed-up" published in your issue of March 14th? The correspondent's grievance, under cover of which he vents his feelings upon those under whom he has served, arises from a lack of knowledge of the subject on which he writes. The Ministry of Labour, in its booklet on "The Re-settlement of Officers" (Reconstruction Problems 12), clearly states that the term "officer" is therein used in a broad sense to denote not only commissioned officers, but also men serving in the ranks of like educational qualifications, and that any man who has, or considers he has, high educational or technical qualifications is at liberty to fill and forward the same form as used by officers (A.F. Z15), and will receive the same opportunities for civil employment as an officer.

All officers are familiar with the man in the ranks who, unable to obtain his commanding officer's nomination for a commission, usually for the best of reasons, becomes a man with a grievance and a stirrer-up of discontent and discord amongst his fellows. The assertion that commissions were less easily obtained in the early stages of the war than latterly is without foundation; in fact, the reverse is the case. During the past three years a candidate, even after nomination by his commanding officer, only obtained his commission after some months' hard training in an Officer Cadet Battalion, followed by a stiff oral and written examination, whilst in the first few months of the war many men obtained commissions direct with little or no previous military experience.

While admitting that most officers have at one time or another received credit for work carried out by those under them, two years' experience of a more active Front than Alexandria has taught me that an officer who always leans on those under him will fare badly. There is also no doubt who bears the responsibility for bad work or work left undone. **R.E. Subaltern.**

France, *March 17th*, 1919.

The Importance of the Home Market.

With reference to your report of the speech of Sir Arthur Steel-Maitland at the Leeds Luncheon Club, I note he stated that it was clear that if we do not manufacture for other countries there will be nothing for us to do but starve; but surely he has been mis-reported? What about manufacturing for ourselves, and where is the advantage of manufacturing for the market of others in preference to our own?

Surely, it is undeniable that as goods are paid for by goods, for everything we export we import something, and that a larger market for one manufacturer exporting is offset by a small market for another manufacturer who might have made what we imported. No nation can therefore have a larger market than its own, and its total market is exactly equal to its own production. Therefore, we shall starve if we do not produce, but a nation can lose by export as well as gain, and it only gains by export when its cost of production for the exported article is less than would have been that for the imported article.

Further, the economists have failed to realise, and the Government apparently also, that the cost of production is merely the necessaries of life of the workers, so that the fewer workers necessary to produce a given value the better. A nation which exports the products of unskilled labour, that is a large number of workers, and receives in exchange the products of skilled labour, or a smaller number of workers, loses on every transaction.

Engineering & Arc Lamps, Ltd.
J. S. Hecht, *Director*

St. Albans, *March 21st*, 1919.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

5,012. "Switches or apparatus for controlling electric batteries." Accles and Shelvoke & H. F. Steventon February 28th.

5,030. "Contact-breakers for ignition devices." G. P. Thompson. February 28th.

5,047. "Radio communication." Connecticut Telephone & Electric Co. February 28th. (U.S.A., March 23rd, 1918.)

5,057. "Portable electric lamps." Chloride Electrical Storage Co. and H. Dean. February 28th.

5,061. "Disinfectant mouthpiece for telephones." G. Flinck. February 28th.

5,119. "Electrically heating metal rings or bands." H. S. Binns. March 1st.

5,130. "Collector for electrical machines" F. Bolton. March 1st.

5,156. "Starting mechanism for internal-combustion engines." Soc. Officine Elletro-Meccaniche. March 1st.

5,173. "Electric door-opener." S. A Stammwitz. March 3rd

5,185. "Apparatus for cutting and welding metals by the electric arc" C. G. Conradi. March 3rd.

5,187. "Apparatus for the deaf and attachment to telephone circuits." C Kahn. March 3rd.

5,196. "Electric lampholder and switch combined." A. E. Alexander. March 3rd.

5,210. "Electric lampholders." G. Oesch & K. Stirnemann. March 3rd.

5,212. "Electric furnaces." G. Marriott. March 3rd.

5,216. "Connectors for electrically-operated or heated devices." G. H. Collins, H. F. Collins & C. Pitcher. March 3rd

5,235. "Electrical apparatus." A. R. Angus. March 3rd.

5,257. "Electric signalling on railways." A. Spooner. March 3rd.

5,270. "Railway traffic-controlling systems" McKenzie, Holland & Westinghouse Power Signal Co. March 3rd. (U.S.A., March 4th, 1918.)

5,308. "Light intensifier for metal-filament electric lamps." E. F. R. Roberts. March 4th.

5,317. "Attachment for pocket lamp cases to indicate condition of battery." G. Rathbone. March 4th.

5,325. "Multiple electrical conductor for internal wiring of buildings." D. S. Munro. March 4th.

5,382. "Electrically-controlled, &c., brakes for railway vehicles." E. R. Smith. March 4th.

5,387. "Ignition devices for explosion motors." G. Calliano. March 4th.

5,389. "Frequency transformer." M. D. Dimitrievitch. March 4th.

5,394. "Heating and ventilating apparatus." E. Hancock (R. Hancock). March 4th.

5,395. "Ignition control for internal-combustion engines." Light Steelworks, Ltd., & F. Wyatt. March 4th.

5,396. "Holders for incandescent electric lamps." F. O. Monkhouse and G. E. Tate. March 4th.

5,412. "Magneto coupling." C. F. Beer & W. J. Brown. March 5th.

5,413. "Dynamos." J. Glazebrook. March 5th.

5,438. "Matrix for manufacture of plates by electro-deposition." S. O. Cowper-Coles. March 5th.

5,461. "Electric contact device." A. C. E. Hojgaard. March 5th. (Germany, March 9th, 1918.)

5,463. "Dynamo-electric machines." J. J. Linebaugh. March 5th. (U.S.A., March 6th, 1918.)

5,464. "Dynamo-electric machines." J. L. Burnham. March 5th. (U.S.A., March 6th, 1918.)

5,465. "Electric furnace control apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 5th.

5,494. "Electric switches for lighting, &c." Benjamin Electric, Ltd., & G. Campbell. March 5th.

5,502. "Sparking plugs." G. Signorini. March 5th.

5,504. "Magneto motor." D. Suchostawer. March 5th.

5,505. "Electric motors." Etablissements H. Crochat. March 5th. (France, November 19th, 1918.)

5,507. "Disinfecting devices for telephones, speaking tubes, &c." L. Levison & M. de Young. March 5th.

5,524. "Electric hand lamp." M. J. Railing & T. Taylor. March 6th

5,526. "Electric motors." W. S. Dennett. March 6th.

5,559. "Spark plugs." E. M. Johnson. March 6th.

5,573. "Electric smelting furnaces." I. Hole. March 6th. (Norway, April 11th, 1918.)

5,574. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 6th.

5,575. "Electric motor-control systems." British Thomson-Houston Co (General Electric Co., U.S.A.) March 6th.

5,611. "Relay oscillograph, telegraph, telephone, automatic current or tension regulator, &c." F. A. Johnsen & K. Rahbek. March 6th.

5,617. "Electrically-operated engine starters for self-propelled vehicles, &c." F. J. Gill. March 6th.

5,621. "Electric light fittings." E. Rawcliffe. March 6th.

5,624. "Means for controlling or regulating dynamo-electric machines." Powell & Hanmer, W. A. Shepherd & F. E. Wilson. March 6th.

5,625. "Electrical machines for starting, lighting, and ignition of motor vehicles." Powell & Hanmer, W. A. Shepherd & F. E. Wilson. March 6th.

5,627. "Switch or cut-out for electric starters of motor vehicles." Powell and Hanmer, W. A. Shepherd & F. E. Wilson. March 6th.

5,630. "Portable electric lamp." J. Canning. March 6th.

5,633. "Method of localising faults on electric mains and switching on of street lamps." E. J. Walsh. March 7th.

5,639. "Electric magnetic rings, bracelets, thimbles, &c., and manufacture of same." R. C. Roden. March 7th.

5,650. "Sparking plugs for internal-combustion engines." B. Carter & J. Suckling. March 7th.

5,667. "Wireless telegraphy, &c., control systems." M. Compare & Comparri Wireless Control Syndicate. March 7th.

5,679. "Incandescent electric lamps, &c." W. E. Corrigall. March 7th.

5,698. "Electrolysers." G. C. Hepburn. March 7th.

5,700. "Ignition magnetos for internal-combustion engines." J. H. Chambers & H. Lucas. March 7th.

5,706. "Electric storage cells." C. J. V. Fery. March 7th. (France, April 30th, 1917.)

5,708. "Sparking plugs." G. Redini. March 7th. (Italy, March 7th, 1918.)

5,710. "Electric impulse motor." M. E. A. Baule. March 7th. (France, May 16th, 1917.)

5,736. "Electric printing telegraph machines." Western Electric Co. (Western Electric Co., U.S.A.) March 7th

5,764. "Manufacture of carbon electrodes." C H. Thompson. March 8th.

5,765. "Heating or cooking by electric energy" O. A. Grimnes. March 8th. (Norway, March 9th, 1918.)

5,766. "Sparking plugs for internal-combustion engines." H. F. Holsworthy. March 8th.

5,782. "Sparking plugs." H. Coley. March 8th.

5,783. "Process for production of zinc battery elements." S. O. Cowper-Coles. March 8th.

5,789. "Hygienic devices for mouth- or earpieces of telephones, speaking tubes, &c." J Clay. March 8th.

5,810. "Earth connection for dissipating electric charges." E. Isherwood. March 8th.

5,819. "Incandescent electric lamps." G. Hookham. March 8th.

5,826. "Electric lamp fittings." F. W. Evans & T. W. Greaves. March 8th.

5,841. "Direct-current motors and generators." G. Stirk & J. G. Stirk. March 10th.

5,851. "Method of actuating automatic electric brakes for talking-machines." J. S. Lester. March 10th.

5,856. "Miners' electric safety lamps." B. Totty. March 10th.

5,863. "Portable electric lamps." J. Tweedie. March 10th.

5,883. "Electric igniter." W. W. Partington. March 10th.

5,894 "Electric furnaces." F.I.A.T. Soc. Anon. March 10th (Italy, November 2nd, 1918.)

5,910. "Method of collecting current in high-speed electrical machinery." E. N. Pink. March 10th.

5,911. "Rotors for disk-type homopolar or acyclic generator." E. N. Pink. March 10th.

5,925. "Telephonograph." H. Ullmann. March 10th.

5,929. "Electric switches." Benjamin Electric, Ltd. March 10th. (U.S.A., July 3rd, 1918.)

5,931. "Electric furnace for heating, annealing, or melting metallic materials." Stabilimenti Biak-Ing. A. Pouchain. March 10th. (Italy, March 9th, 1918.)

5,955. "Sparking plugs." L. S. Clark. March 11th.

5,964. "Electric lamps for motor vehicles, &c." G. A. Edman. March 11th.

5,998. "High-speed interrupter for induction apparatus." A. E. Dean. March 11th.

6,001. "Transmission gear and bracket for magnetos of motor vehicles." E. R. R. Chilcott. March 11th.

6,004. "Electric adapter switch." T. W. Bennett. March 11th.

6,016. "Telephonic intercommunication systems." M. S. Conner & A. R. Kahl. March 11th.

6,024. "Step-by-step mechanism for electric motor starters." C. C. Garrard, A. H. Railing & W. Wilson. March 11th.

6,038. "Magneto converting cam." H. Rothwell. March 11th.

6,040. "Dynamometer." W. W. Smith. March 11th.

6,051. "Electric soldering irons." O. O. Kring & O. Stalhane. March 11th.

6,055 "Contact makers, circuit breakers, &c." Schneider et Cie. March 11th. (France, April 12th, 1918.)

6,067. "X-ray apparatus." M. B. Rodriguez. March 11th.

6,075. "Audible warning or signalling devices of the vibratory-diaphragm type." E. T. Cook & J. F. Monnot. March 11th.

6,076. "Protection of electric cables in distribution systems." A. V. Downton. March 11th.

6,079. "Lock switch or circuit-breaker for magneto." L. Felton. March 11th.

6,097. "Multiplex electrical signalling systems." Western Electric Co. (Western Electric Co., U.S.A.) March 11th.

6,105. "Electrical transmitted microphones." B. A. Pilkington. March 11th.

6,108. "Apparatus for locking electric glow lamps to holders." W. J. Bodell & T. Williams. March 12th.

6,112. "Method of fitting electric lamps to lamp cases." T. M. Cox Walker. March 12th.

6,124. "Electric lamps for cycles, &c." H. G. Farrell & M. H. Goldstone. March 12th.

6,125. "Magneto generators." H. O. Farrell & M. H. Goldstone. March 12th.

6,140. "Electrically-heated irons." W. Cross & Sons and J. I. Kirby. March 12th.

6,174. "Sparking plugs." I. L. Slawter. March 12th.

6,189. "Method of making electrical condensers." W. Dubilier. March 12th. (U.S.A., October 30th, 1918.)

6,195. "Electric heating units, and methods of manufacturing same." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 12th.

6,237. "Incandescent electric lamps." W. H. Aish. March 13th.

6,307. "Cord grips for electric light fittings." C. G. Bennett & H. Garde. March 13th.

6,308. "Sparking plugs." L. M. J. S. Bour. March 13th. (France, June 29th, 1918.)

6,339. "Electric switches." N. C. Francis & R. Hutchinson. March 13th.

6,342. "Pressure-operated electrical cutouts." H. Frost & Co. & W. H. Welch. March 13th.

6,343. "Electrical cutouts." H. Frost & Co. & W. H. Welch. March 13th.

6,353. "Telephones." E. T. Jones. March 14th.

6,364. "Lighting or starting sets of automobiles, &c." P. C. Samuel and C. E. Skinner. March 14th.

6,366. "Electric driving and controlling gear for planing machines." Electromotors, Ltd., E. Greenhalg & B. Longbottom. March 14th.

6,424. "Telephone sound-intensifier and microbe shield." A. A. Pepperell and A. Veness. March 14th.

6,450. "Divers', &c., electric lamps." G. Oldham & J. Oldham. March 14th.

6,457. "High-tension insulators." R. M. Johnston. March 14th.

6,489. "Electric loom for motor vehicles." H. J. Butterfield & Hill, Upton & Co. March 15th.

6,511. "Controllers for electric motors, &c." R. Amberton. March 15th.

6,527. "Interlocking mechanism for electric switches, &c." C. J. Baker and V. G. Middleton. March 15th.

6,535. "Control of electric currents." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 15th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1917.

8,724.—Electric motors. L. R. McDonald. June 16th, 1916. (107,382.)

16,194. Starting devices for internal-combustion engines. J. Gray (C. H. Reyoolds & A. L. M. Ayers). November 6th, 1917. (123,342.)

17,673. Electromagnetic devices and apparatus. G. Plaisant. November 29th, 1917. (123,346.)

1918.

2,953. Electric gas lighters. A. MacKeozie (legal representative of J. W. MacKenzie) (Safety Gas Lighter Corporation). February 19th, 1918. (123,386.)

3,056. Dynamo-electric machinery of variable pole number. F. Creedy. February 20th, 1918. (123,395.)

3,213. Electric heating apparatus. Naamlooze Vennootschap Fabriek van Instrumenten en Electrische Apparaten Inventum. February 23rd, 1917 (113,623.)

3,344. Automatic control for electric generators. H. A. Scott. February 25th, 1918. (123,411.)

3,584. X-ray tube stands. C. E. S. Phillips. February 28th, 1918. (123,417.)

3,837. Mine signalling apparatus. C. King & W. Smith. March 5th, 1918 (123,420.)

3,952. X-ray tube stands. E. C. R. Marks (A. D. Reid, U.S.A.). March 6th, 1918. (123,424.)

4,026 Electrically-heated gloves. C. O. Bastian. March 7th, 1918. (123,427.)

5,771. Tee or branch joints or armoured electric cables. C. J. Beaver and E. A. Claremont. April 4th, 1918. (123,440.)

6,043. Electrical operation of liquid recording and reproducing instruments. L. Williams. April 9th, 1918. (Cognate application No. 16,217/18.) (123,220.)

6,418 Magnetic friction clutches. W. Langdon-Davies & A. Soames. April 16th, 1918. (123,446.)

THE
ELECTRICAL REVIEW.

VOL. LXXXIV. APRIL 4, 1919. No. 2,158.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4. LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £[illegible] 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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MILAN. Fratelli Treves.
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TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers: Gordon and Gotch 132, Bay Street
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

WAR INDEMNITY IN ELECTRICAL MACHINERY.

IT is highly probable that the war indemnity which Germany will be required by the Treaty of Peace to pay to the Allies will consist partly of money, with payments extended over a number of years, and partly of goods or manufactures or constructions in some form or other. It has to be borne in mind, however, that if Germany can obtain the necessary raw materials, any orders given to that country for manufactures will tend to assist in the industrial reconstruction of the nation: and this assumption also applies to the requisitions which will be made for the delivery of goods as partial liquidation of the indemnity. It should, therefore, be in the interest of the Allies to demand payment in money as far as possible, distributed over a series of years, and to accept manufactures to a minimum extent, except in so far as they can be, mainly or exclusively, produced from raw materials existing in the country—or, better still, to require the surrender of the raw materials themselves, which the Allies could transform into finished products. On the other hand, the Allies control, directly or indirectly, various raw materials which are necessary for the rehabilitation of German industries: and it is, therefore, desirable that the tonnage of these allotted to Germany should not unduly exceed the quantities needed for the production of those manufactures which that country will be called upon to supply as part of the indemnity, leaving to the discretion of the Allies the question of future supplies after the delivery of the manufactures, which will be specified, has been completed. It is by no means the duty of the Allies to assist Germany beyond the stage represented by the satisfaction in full of the claims which will soon be set forth in concrete form.

We feel constrained to make the preceding remarks by reason of the fact that an influential French contemporary, in the course of numerous articles dealing with the war indemnity, demands the delivery of enormous quantities of coal, potash, iron and steel, railway permanent-way material and rolling stock, ships, electrical machinery and apparatus, mechanical equipment, chemical products, motor-cars, &c. It is pointed out that Germany exported electrical machinery and plant in 1913, of the then value of the equivalent of £14,500,000, of which generators, motors, transformers, &c., represented £2,800,000; cables, £1,950,000; telephones, £450,000; apparatus for lighting, electrolysis, and the transmission of power, £3,700,000; and measuring instruments, £1,200,000; whilst the balance was constituted by other plant. Under these circumstances it is suggested that the German electrical industry would be able to deliver to France the machinery necessary for the equipment of those waterfalls which are not yet utilised, for new generating stations, and for the multiplication of the tramways and the conversion of the railways to electric traction. The hydro-electric works in France prior to hostilities only represented 750,000 H.P., which has scarcely been doubled during the war, whereas it is contended that the water-power used for electrical purposes really ought to amount to 10,000,000 H.P. It is, therefore, argued that the indemnity in electrical machinery, plant, and apparatus, should reach hundreds of millions of francs, if not milliards of francs.

It is certainly desirable for the Allies to secure full and adequate compensation, and although a considerable tonnage of coal and iron and steel is already being procured from Germany, it is advisable for the reasons given for the Allies not to accept any manufactures other than those which are absolutely essential for their purpose. By all means let us have what is necessary in manufactures, but we should refrain from any steps which would facilitate the industrial regeneration of the enemy and pave the way for the war of revenge which the industry-controlling classes are said already to cherish either on the account of Germany alone, or in conjunction with Russia in the future.

Since the preceding observations were written it has transpired that Germany is to be permitted to export certain classes of goods as a result of the further agreement which was reached at Brussels on March 14th. This agreement applies only to the period of the Armistice, and the financial proceeds derived from the exports will be devoted to the payment for the food products which the Allied Governments have undertaken to supply to Germany. According to the official statement on the question issued by the Supreme Economic Council at Paris, the permissive exports concerned under the agreement include coal, dye stuffs, certain classes of iron and steel and electrical and certain other types of machinery. The Allied Governments have the option of purchasing two-thirds of the quantity or value of the merchandise or manufactures to be exported, whilst the remainder can be disposed of as Germany may desire. In both cases, however, the values or credits receivable will be, as already mentioned, applied to the liquidation of the account for food supplied. It is understood that the prices to be paid in the case of Allied purchasers will be arranged between representatives of the Allies and those of Germany at Cologne. We have carefully perused the last issues of an influential French contemporary in order to ascertain, if possible, whether any additional light could be thrown upon the question of electrical and other machinery comprised within the list of permissive exports, but have seen no further information on the problem; nor have we found any statement dealing with the subject in the German newspapers, down to the present time.

Electricity v. Gas.

The perennial discussions as to the relative merits of gas and electricity remind us of the ancient problem: Why does a tub full of water not overflow when a live fish is put into it? This remarkable phenomenon was gravely argued by the sages until some highly practical but unsophisticated fellow tried the experiment.

In very much the same way we are solemnly informed from time to time that, according to calculations, covering sheets of foolscap, electricity is so unsuitable a medium for lighting, heating, and cooking, that it stands no chance whatever in comparison with gas.

We do not wish to make invidious comparisons; we are not in the least concerned to decry the merits of gas—in these days we are all out for harmonious co-operation, not for conflict—but we cannot be expected to stand aside when an unprovoked onslaught is made upon our industry. Such an attack was made by Sir Dugald Clerk, as briefly reported in our last issue, and he was backed up by Lord Moulton, who even went so far as to advocate the use of small gas engines for domestic purposes—the limit of hardihood. The amazing thing is that, like the sages of old, these gentlemen gave no heed to realities, but limited their mental vision to abstractions. *What are the facts?*

There is no need, in this case, to go away and try experiments—the facts are clamant, obtrusive, inexorable. Above all, they are reflected *in the quarterly accounts*—the most convincing of all arguments. Where electric lighting is substituted for gas lighting, the cost is less, and the service better; where electric cooking is substituted for gas cooking, the cost is about the same, and the cooking far better done; where electric heating is used, the cost is certainly greater than with gas, but nothing like as much as calculations would show, and as Col. Crompton pointed out, the benefits are far greater. The reason is that in each case the work is done by electricity far more *efficiently* than with gas—much less electricity is used than paper calculations indicate. It is a matter in which experience proves the case in the face of the most elaborate arguments and computations.

But what about motive power? Sir Dugald wisely touched upon this lightly—his case for gas would have been ruined if he had done otherwise. We make bold to say that electrical motive power was one of the chief factors in winning the war. Let those who would question this statement go to Sheffield, Birmingham, Manchester—any industrial town; or to the Ministry of Munitions: and ask "What did Electricity do in the Great War?" The enormous increase in the output of electrical energy in itself tells the story, which moreover is put into the plainest language by the three official reports on the Electrical Trades after the War, and Electric Power Supply. It is much too late in the day to try to depose electricity from its position of unquestionable superiority.

The weak point of the electrical case is the waste of by-products, including heat, with which it is at present almost always associated, and here is the point at which the electrical and gas interests should collaborate. Each has its proper place and appropriate uses; there is nothing to be gained by internecine warfare—let peace and co-operation prevail here also, for the good of the State, and let us have done with misleading academic disputations.

Removing the Shackles on Trade.

It was scarcely to be expected that anything absolutely definite would be forthcoming from the questions put and the statements made in Parliament concerning the future regulation of this country's exports and imports. This remark is not made wholly in a spirit of adverse criticism. We are not going to revive the talk of "Dilly and Dally." One problem which the authorities have to face is what goods, raw or semi-manufactured, needed in our industries, should be allowed free entry immediately, and what goods, semi-manufactured or wholly-manufactured, likely to compete with a struggling British industry, should be kept out, at any rate, until the industry is firmly established. Electrical manufacturers will realise probably more vividly than any others the complicated nature of this problem. It is encouraging to learn that the President of the Board of Trade has now decided that the Advisory Council, which was set up some time ago at the War Trade Department, to advise him on import and export restrictions, should be formed into a sort of Commission, and be reinforced by the addition of representatives of all interests. This step has been taken none too early, seeing that the Armistice was signed more than four months ago. However, Mr. Bridgeman hoped the Commission would sit "continuously," and we believe, in fact, that the Committees into which it has formed itself are sitting almost daily, reviewing all the imports now restricted, as well as the other imports into the United Kingdom, with a view to recommending a percentage of the normal which is to be admitted. We trust that the results of these recommendations will soon be made public, so that manufacturers and merchants may know how they are likely to be placed during the transitional period. In the meantime, they have to be content with the promise that no import restrictions shall be, or shall continue to be, imposed on goods coming from any part of the Empire without the special consent of the Cabinet, that raw materials required for our industries shall now be admitted, free of restriction, and that semi-manufactured articles which are necessary as material for the manufactures of this country are to be admitted free from restrictions, except so far as they are produced by industries which it is essential to foster in this country, and which require shielding, in which case they will be restricted; and, finally, that manufactured articles shall be subject to restriction when not necessary for consumption in this country. As regards the period of any restriction which may be in operation, Sir A. Geddes has stated that this is not to be extended beyond September 1st without further review. Such, then, is as much as we know about the import problem.

As regards exports, we welcome the relaxations of prohibitions which are announced almost daily, and we acclaim Mr. Bridgeman's statement that the Board of Trade is at present considering how it is possible to reduce the prohibited list to the lowest possible dimensions. We have seen no good case made out—other than Blockade reasons—for retaining control over exports, and let us hope that means will be arrived at in Paris, without delay, for removing all hindrance on export trade.

Wireless Telegraphy after the War.

The value of the services rendered to the cause of civilisation by wireless telegraphy during the war can hardly be exaggerated. What position will it hold in the future? and what part will the amateur be permitted to play in its development and use?

Before the war a system of licensing and inspection by the Post Office authorities was in force, which allowed to amateurs a reasonable degree of freedom, whilst maintaining a very necessary surveillance over their operations. As Mr. Marconi recently pointed out, not only was wireless telegraphy in great part created by amateur workers, but also the latter, when war broke out, were able to place at the disposal of the Admiralty and the War Office a body of experience and enthusiasm which was of the greatest value to the nation. Obviously steps should be taken to ensure that if, unfortunately, such another emergency should arise, a similar reserve of skilled operators would be available; it costs nothing to the State, while it is constantly in readiness for immediate utilisation. We very gladly, therefore, support an appeal which was published in the March issue of the *Wireless World*, urging that the restrictions which at present absolutely bar the amateur worker from riding his hobby shall be removed at the earliest possible moment. As our contemporary points out, the number of persons interested in the subject has immensely increased since 1914: if their enthusiasm can be kept alive, it will constitute a priceless asset—and the only way by which this can be accomplished is by according them liberty to experiment, of course, under suitable regulations.

In this connection we were very pleased to publish, last week, the announcement that the Institution of Electrical Engineers had taken active steps to provide full opportunity within its organisation for discussion of the subject and for the dissemination of the greatly extended knowledge which has been gained during the war. It is admitted that in wireless telegraphy—despite the poisonous interference of the politicians—this country has always led the world; no means should be left unutilised, not only to maintain that position, but also to increase our advantage; and the first step to be taken is undoubtedly to enlist the interest and activities of the amateur in wireless research.

Trade Union Amenities.

The decision of Mr. Justice Astbury, in the recent case of Valentine *v.* Hyde and Howard (see the *Times* Law Reports, Vol. XXXV, p. 301), ought to encourage employers not to submit tamely to the dictates of a Trade Union. His Lordship held that where members of a Trade Union threaten a fellow-employé, who is a member of another Trade Union, that they will obtain his discharge unless he joins a Trade Union different from the one to which he belongs, and where they exercise moral intimidation, undue influence, and coercive pressure upon the employer to attain that object, such threats are an unlawful interference with the rights of the employer, and the pressure exercised on the employer amounts to an unlawful interference with the rights of his employé which is actionable at common law and is not protected by Sec. 3 of the Trades Disputes Act, 1906.

The evidence showed that the defendants, in their capacity of secretaries of some unions, both wrote to the plaintiff's employer, and called upon him with reference to his further employment of the plaintiff. No threat or warning was uttered, but following on the visit the plaintiff's employer informed him that if he and some other workmen did not join the defendants' Union, he would dismiss them. As the plaintiff refused to join, he was, in fact, dismissed, but the dismissal was suspended pending the result of the application for an injunction, which, as we have seen, was granted by the Judge.

It is to be observed that the litigation in this case was between a workman and a Trade Union—not between an employer and a Trade Union. Suppose that the defendants had said: "Unless you dismiss him (the plaintiff) we shall call your other men out." Would an action have lain against the Union? Upon the authority of Mr. Justice Astbury's judgment, it would certainly lie at the suit of the workman; but would it lie at the suit of the *employer*? That is where the Trades Disputes Act, 1906, seems to come in. Were he to bring an action to prevent his men being called out, that would be an attempt to obtain redress for something done in furtherance of a trade dispute which (to use the words of Sec. 3 of that amazing piece of legislation) "is not actionable on the ground only that it induces some other person to break a contract of employment or that it is an interference with the trade, business, or employment of some other person or with the right of some other person to dispose of his capital or labour as he wills." So the Trade Unions were declared to be above the law in 1906; and it is the exercise of these powers thus accorded to them which is responsible for many of our present-day labour difficulties. Instance a case which has recently come to our ears. A contract was secured to erect certain works in the country. After his tender had been accepted, the builder was confronted with a resolution of the Bricklayers' Union to the effect that no bricklayer should lay more than 500 bricks a day. Realising that, apart from expense, this spelt delay, the contractor summoned the men. "Look here," he said, "if any of you will lay 1,000 bricks in a day, or more for that matter, I'll pay at the rate of a day's pay for each 500!" Several volunteered, and proved themselves well able to earn several days' pay in one day. But it may be supposed there was too much "free trade in ability" about this to please the ca' canny party. In two or three days the employer had a letter from London to say that unless he dismissed the energetic workers the slackers would be called out! And he was compelled to submit.

And yet this is a free country, in which we are often heard to boast of "the rule of law." It would be exceedingly interesting to hear of an action being brought by an employer in the circumstances we have mentioned.

ELECTRICITY SUPPLY AT SMETHWICK.

There are few spheres, we should think, in which more remarkable progress has been made during the last few years than in that of public electricity supply. The phenomenal expansion of electricity supply undertakings has been truly remarkable, and, therefore, no excuse is necessary in presenting the following review of the most important changes that have taken place in yet another undertaking—namely, the Shropshire, Worcestershire, and Staffordshire Electric Power Co., which supplies the Smethwick and Dudley districts, and of which Mr. G. T. H. Legge is chief engineer.

Prior to the war the expansion of the undertaking was normal, the plant capacity at the outbreak of war standing at 12,475 kw. The company, however, was no exception to the general rule, and as the load grew, additional plant had to be installed to meet the constantly-increasing demand. During the war, plant with a capacity of 24,250 kw. has been installed at the Smethwick and Dudley stations (which two stations operate in parallel), and thus (allowing for the removal of an old 400-kw. d.c. set at the latter station) the total capacity to date is brought up to 36,325 kw. The consulting engineer in connection with the large extensions which have been made during the last four years has been Mr. C. W. G. Little.

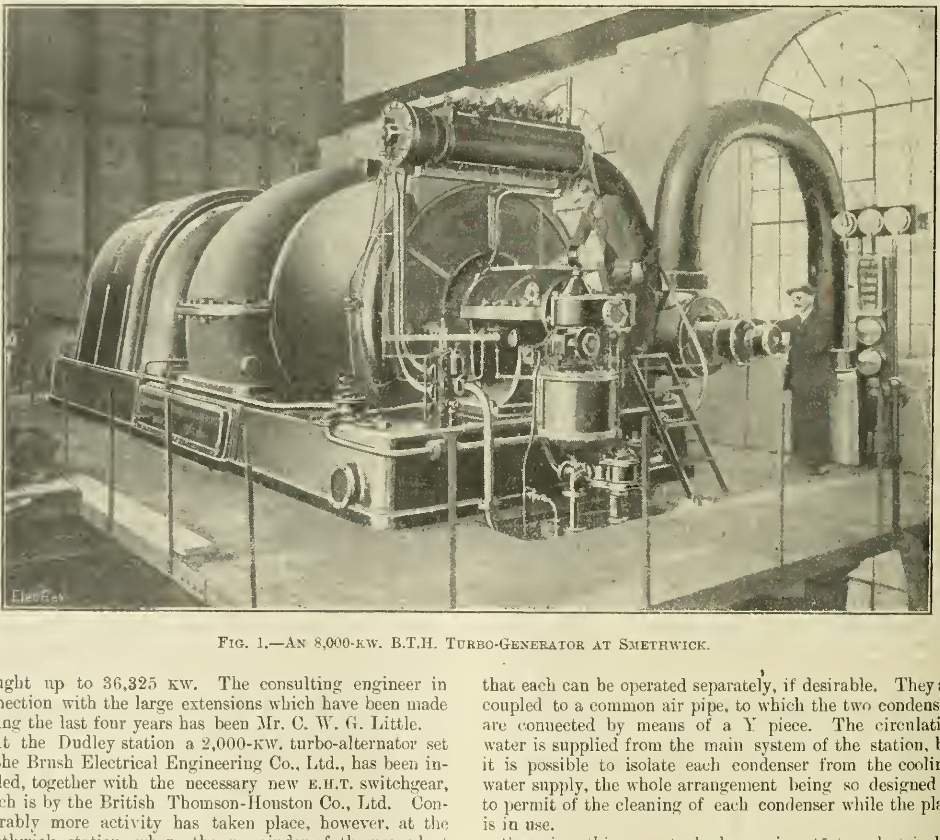


Fig. 1.—An 8,000-kw. B.T.H. Turbo-Generator at Smethwick.

At the Dudley station a 2,000-kw. turbo-alternator set by the Brush Electrical Engineering Co., Ltd., has been installed, together with the necessary new e.h.t. switchgear, which is by the British Thomson-Houston Co., Ltd. Considerably more activity has taken place, however, at the Smethwick station, where the remainder of the new plant has been installed. In this station the original plant was supplied by the Brush Co., but is, however, of the Brush-Parsons design and many years old. In addition to the plant at Dudley, this company has recently supplied a considerable number of transformers for use in connection with this system.

At the Smethwick station a new turbo-house has been built, in which two 8,000-kw. turbo-alternators by the British Thomson-Houston Co., Ltd., have been installed—one in 1917 and the other in 1918. These two sets are duplicates, and each is capable of an output of 10,000 kw. for two hours. One of these sets is shown in fig. 1. They are carried above the condensers, which are on the ground level. Each machine is remote-controlled from the main switchboard in the old turbo-house, a complete set of telegraphs and indicating instruments being provided for each machine.

Each turbine exhausts into two condensers, coupled to the turbine by means of a special breeches piece, thus permitting either condenser to be cleaned while the turbine is operating on one half of the total condenser surface. The condensers, supplied by Messrs. Willans & Robinson, Ltd., have cast-iron shells, and represent ordinary modern standard practice; each has a surface of 8,000 sq. ft., the tubes being ¾ in. in external diameter. The condensate is withdrawn by means of two-stage, motor-driven centrifugal pumps, arranged in such a manner that either condenser can be shut off from the condensate pumps, or either pump can be shut down. The air is extracted from the condensers by means of stationary water jets, the water supply to which is coupled up from the main circulating-water inlet pipe. There are two water nozzles arranged in parallel in such a manner that each can be operated separately, if desirable. They are coupled to a common air pipe, to which the two condensers are connected by means of a Y piece. The circulating water is supplied from the main system of the station, but it is possible to isolate each condenser from the cooling-water supply, the whole arrangement being so designed as to permit of the cleaning of each condenser while the plant is in use.

Spanning this new turbo-house is a 45-ton electrically-driven crane, supplied by Messrs. Holt & Willetts, of Cradley Heath. The old 20-ton hand-operated crane by Messrs. Vaughan & Son, of Manchester, in the old turbo-room is being converted to electric drive, and its lifting capacity increased to 30 tons.

At the outbreak of war, the plant, all in the old turbo-room, an interior view of which is shown in fig. 2, consisted of three 500-kw. B.T.H. alternators, direct coupled to Brush reciprocating engines. One of these sets is now being removed to make room, and the other two will be dispensed with as required. There were also three turbo-alternator sets by the Brush Electrical Engineering Co., Ltd., two being rated at 1,000 kw. each, and the third at 2,000 kw., while a 4,375-kw. turbo-alternator set, by the British Thomson-Houston Co., Ltd., was put to work just prior to the outbreak of hostilities. A complete surface condensing installation in connection with this set was supplied by Messrs. Worthington-Simpson, Ltd., capable of dealing with 68,500 lb. of steam per hour on the basis of a vacuum of 27·5 in., with the barometer at 30 in. and with cooling water at 80°. The plant, complete with connections, piping, valves, and instruments, consists of one cylindrical steel-shell condenser, having 9,500 sq. ft. of cooling surface; one vertical triplex "Edwards" air pump, size 20 in. by 12 in., running at 130 r.p.m., and having one 8 in. by 10 in. vertical single-acting attached lift pump, and a 27-b.h.p. motor running at 720 r.p.m.; and one twin centrifugal condensate pump, size 16 in., delivering at the rate of 8,000 gallons per minute, against a total frictional and static head of 60 ft. The pump is driven by a 185-b.h.p. motor, at a speed of 720 r.p.m., the efficiency of the machine being 79 per cent.

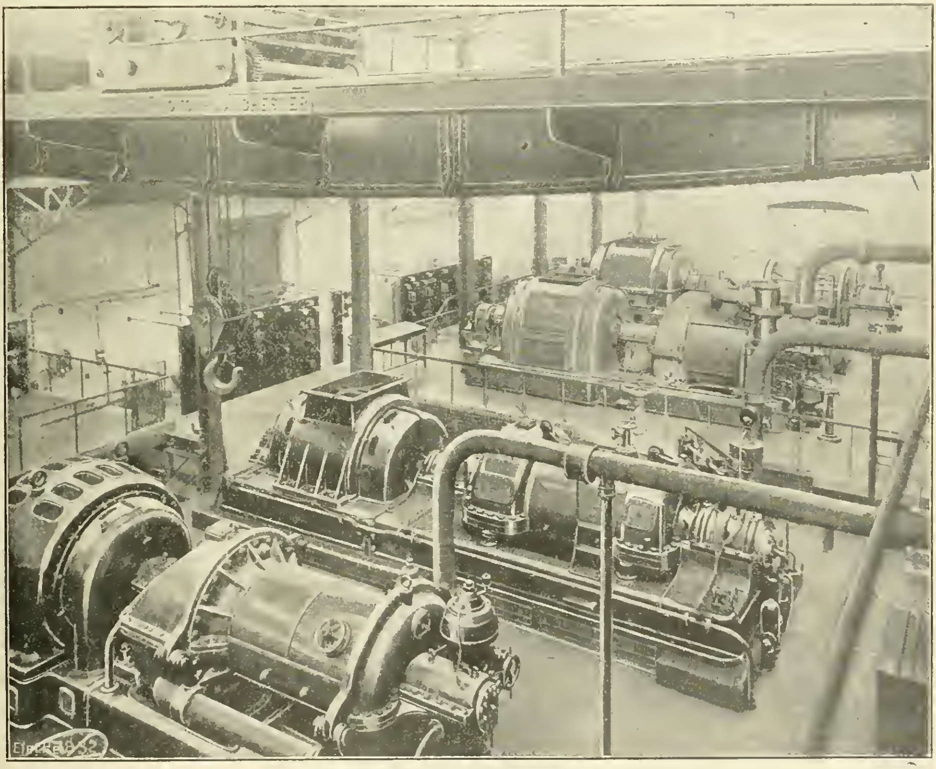


Fig. 2.—Interior of Old Turbo-Room at Smethwick.

The third large set installed in this station since 1914 consisted, in the first place, of a Brush - Dick, Kerr set. Trouble was experienced with this machine, the turbine stripping itself, and as the set could not be done without, a B.T.H. turbine, which happened to be available at the time, was substituted for the Brush machine. The alternator, by Messrs. Dick, Kerr & Co., Ltd., is rated at 5,555 k.v.a., or 5,000 kw. at 0·9 power factor: it is a three-phase, 25-cycle machine at 5,500 volts pressure, and running at 1,500 r.p.m. A direct-coupled exciter is provided, and the efficiency figures are as follows:—At half-load, 91·5 per cent.; three-quarter load, 94 per cent.; full load, 95 per cent.; and five-fourth load, 95·5 per cent.

The local traction load is supplied by two 300-kw. rotary converters, while the whole of the station auxiliary plant is gradually being changed over from d.c. to a.c., bringing it into line with the new plant. A sub-station is being built on to the end of the turbine house to accommodate a 1,000-kw. bank of transformers to supply the station auxiliaries. Each transformer will be placed in a separate brick cubicle on the ground floor, so that in case of fire any one transformer may be entirely isolated from the rest. On the top floor of the sub-station a new air filter and fan for the 6,250-k.w. B.T.H.-Dick, Kerr set is to be installed.

An exterior view of the station at Smethwick is given in fig. 3, which also shows the cooling towers and telphers.

With the increasing capacity of the station, additional switchgear has naturally had to be provided, and the whole of the e.h.t. switchgear has been remodelled and considerably extended. This work has been carried out by the British Thomson-Houston Co., Ltd., and consists of moulded stone cells containing the high-tension apparatus and oil switches, the latter being mechanically remote-controlled from the control panels mounted on the gallery above the basement in which the cells are located. The switches themselves are of the B.T.H. heavy-tank type. The bus-bars are sectionalised through reactances, the latter being of the cast-in-concrete type, also supplied by the B.T.H. Co. Electrical surge arresters are provided on two sections of the bus-bars.

Turning to the boiler house, which is situated between and parallel with the two turbo-houses, 10 new boilers have been installed during the war, bringing the total up to 24. Of the B. & W. boilers, two are rated at 17,000 lb. per hour and six at 21,000 lb. per hour, while the remaining two are by Messrs. Clarke, Chapman & Co., Ltd. These are water-tube boilers having a heating surface of 8,800 sq. ft., and are each capable of evaporating 40,000 lb. of water, actual, per hour. They are fitted with the firm's "Woodeson" patent superheaters, forming integral parts of the boilers, and with "Bennis" inclined chain-grate stokers.

Six of the boilers supplied by Messrs. Babcock & Wilcox, Ltd., are of the patent water-tube land type, each having 6,182 sq. ft. of heating surface; each boiler is fitted with an integral superheater, and two 5 ft. by 14 ft. mechanical chain-grate stokers. The working pressure is 200 lb. per sq. in., and the steam is superheated 200° F. At the back of each boiler on the ground level, an economiser, having 200 pipes, by Messrs. E. Green & Son, Ltd., is fitted. To work in conjunction with each pair of boilers, independent draught plant is provided, comprising a motor-driven centrifugal cased fan, and a short steel-stayed chimney 60 ft. high. The "Sirocco" fans are arranged with up-cast discharge, and the chimneys are supported on gantries immediately over the fan-discharge connections.

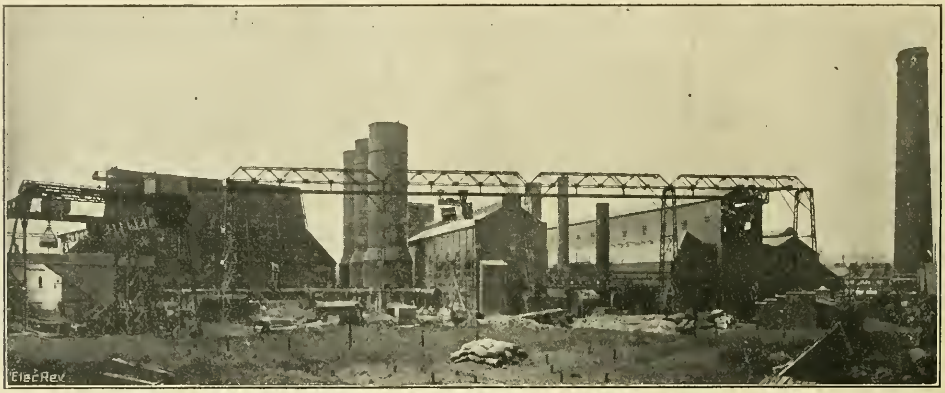


Fig. 3.—Exterior View of Power Station at Smethwick.

The boilers and economisers are set in brickwork, and to deal with the ashes there is provided an underground ash tunnel, the ashes being discharged into hoppers, which, in their turn, discharge into trucks running on rails in the tunnel. This arrangement is to be abandoned in favour of suction ash-handling plant, by Messrs. Edward Bennis & Co., Ltd., which is in course of erection.

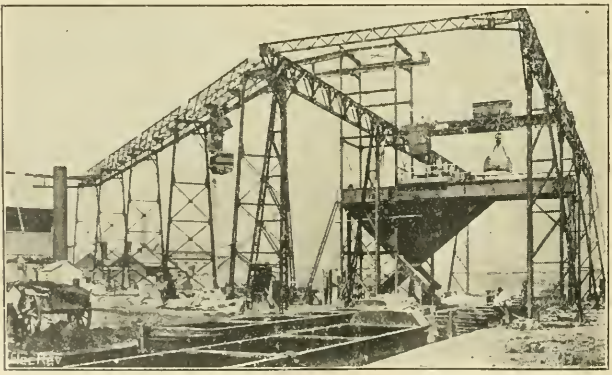


Fig. 4.—Coal-Handling Plant at Smethwick.

The stokers are suitably arranged for the application of balanced draught, and Messrs. Babcock & Wilcox, Ltd., have supplied two centrifugal cased fans, discharging the air into ducts, built of brickwork and running underneath the firing floor, from which branch connections are taken to the stokers under each boiler. Each boiler, when working in conjunction with its stoker, economiser, and induced-draught plant, is capable of evaporating 25,000 lb. of water per hour when burning good-quality coal, without balanced draught, the balanced undergrate draught being only brought into operation when burning low-grade fuel. The firing floor is on the ground level, the 10 new boilers being ranged on one side and the 14 original ones on the other side of the boiler house. These latter have flues at each end, with the damper in the middle. At the base of each stack, an economiser, by Messrs. Green & Son, Ltd., is provided, which consists of 320 tubes, arranged in two separate units of 160 tubes each, the vertical tubes being 11½ ft. in length. The economisers are arranged 10 tubes in width, and are suitable for a boiler pressure of 200 lb. per sq. in. The scrapers are driven by an electric motor with worm reducing gear. A new induced-draught fan is to be installed to correspond with the one provided at the opposite end.

Water softening plant, capable of dealing with 3,600 gallons of water, is provided, whilst the additions to the pump room comprise a five-stage boiler feed-pump of a normal capacity of 200 gallons per minute, against a total head of 500 ft., by Messrs. Mather & Platt, Ltd. It is driven by a 52-b.h.p. wound-rotor motor through a flexible coupling. Besides a 3,000-gallon reciprocating and two 7,000-gallon turbo feed pumps, Messrs. G. & J. Weir, Ltd., have supplied two rotary feed pumps. The first, a turbo-driven rotary, is capable of delivering 16,000 gallons of water per hour, against a pressure of 220 lb. per sq. in., when supplied with steam at a pressure of 155 lb. per sq. in., the steam being superheated 125° F. The second pump is capable of delivering 8,000 gallons per hour under the same conditions as the first. Hydrokineter nozzle heaters were supplied with both these pumps.

To deal with the cooling water two "Premier" wooden natural-draught chimney cooling towers were erected. Both towers are 70 ft. high; one occupies a ground space of 40 ft. by 144 ft., and will deal with 480,000 gallons of water per hour, cooling the same from 100° F. down to 80° F., with an air temperature of 55° F., and humidity of 75 per cent. The second tower occupies a ground space of 40 ft. by 122 ft., and can deal with 372,000 gallons per hour, cooling from 95° F. down to 80° F. These are in addition to the three natural-draught steel cooling towers supplied complete and erected by Worthington-Simpson, Ltd.; each tower having a shell 28 ft. 8 in. in diameter, chimney 22 ft. 8 in. in diameter, and an annular shell 6 ft. in diameter, with a total height above ground level of 98 ft. The latter three combined are capable of dealing with 500,000 gallons of water per hour, reducing the temperature from 100° F. to 80° F. based upon a wet bulb reading of 50° F. An idea of the cooling towers can be gained from fig. 3.

At Smethwick, during the busy war period, the amount of coal that was handled per day, reached something like 400 to 500 tons. With the increased capacity of the station, additional coaling plant had to be provided, and the extensions, including bunkers of 3,000 tons capacity over the boilers, now enable 40 tons of coal per hour to be dealt with. The coal-handling plant is shown in fig. 4. Two electrically-driven cranes by Messrs. Thos. Broadbent & Sons, of Huddersfield, and Holt & Willetts, of Cradley Heath, now span the canal, and by means of 15-cwt. grabs are capable of unloading one 30-ton barge per hour. From the barges the coal is discharged into an overhead bunker, which automatically feeds the electric telphers supplied by Messrs. Strachan & Henshaw, Ltd., of Bristol, and Priestman Bros., Ltd., of Hull. The telphers run in at one end of the boiler house, and have an extension out at the further end, so that, if required, coal may be fed into the bunkers from both ends of the boiler house at the same time.

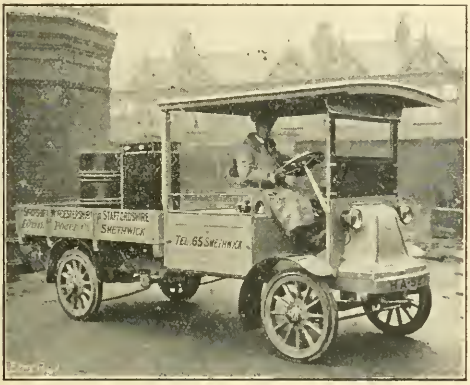


Fig. 5.—Electric Truck.

In fig. 5 is illustrated the central station use of electric trucks, or, in other words, practising what it preaches, such usage being prompted, and justified, by efficient, economic, and dependable operation—not sentiment.

In conclusion, we have to thank Mr. G. T. H. Legge, chief engineer, for permission to publish the above particulars and photographs, and the station superintendent at Smethwick, for affording facilities to gather the data at the time of our visit.

ELECTRICITY IN MINES.

We are glad to see from the report of the Chief Inspector of Mines for the year 1917, that the use of electricity is rapidly extending. The following table is interesting as showing the extent of the increase :—

	1916.	1917.
Surface.—Horse-power	368,446	391,744
Per cent. increase on preceding year ...	9·63	6·32
Underground.—Horse-power	482,216	521.896
Per cent. increase on preceding year ...	2·90	8·23
Total.—Horse-power	850,662	913.640
Per cent. increase on preceding year ...	5·71	7·40

whilst the table below shows the aggregate horse-power in the different Inspection Divisions :—

Division.	Surface.	Underground.	Total.
Scotland...	38.463	135,668	174,131
Northern	103,507	110,469	213,976
York. & North Midland	91,393	75,788	167,181
Lancashire, North Wales, and Ireland	20.376	29,502	49,878
South Wales	121,587	123,175	244,762
Midland and Southern	16.418	47.294	63,712
Total	391,744	521,896	913,640

The number of electrically-driven coal-cutting machines in use at the end of 1917 was 1,739, an increase of 149 over the preceding year.

There were six fatal accidents due to the use of electricity, four of which took place on the surface and two underground. However unfortunate these accidents are, it is satisfactory to note that, so far as underground accidents are concerned, they appear to be decreasing, as the following figures, which give the number of fatal accidents since 1907, show :—1907, 10 ; 1908, 12 ; 1909, 13 ; 1910, 15 ; 1911, 9 ; 1912, 7 : 1913, 13 ; 1914, 4 ; 1915, 8 ; 1916, 4 ; 1917, 2.

As regards the accidents themselves, the particulars are set out below.

It is somewhat difficult to comment on these accidents, as one can always be wise after the event, but they show, as has been pointed out in these columns so frequently how careful everyone should be when working with electrical plant, and again they show the absolute necessity of paying particular attention to the "earth" wire.

In regard to coal-cutting machinery, there were 678 collieries where coal-cutting machines were at work in 1917, as against 660 in 1916. The total number of machines was 3,799, as against 3,459 in 1916. 1,739 were worked by electricity, and 2,060 by compressed air. The total amount of coal won by these machines was 28,196,486 tons, this being an increase of 1,391,088 tons over the preceding year. 50 per cent. of the total number of machines are in two divisions, namely, Scotland and the York. and North Midland.

The following table shows the number of machines at work in the different divisions, and the quantity of coal obtained :—

Division.	No. of collieries where machines are at work.	No. of machines.	Worked by		Mineral obtained.	No. of conveyors at coal face.
			Electricity.	Compressed air.		
					Tons.	
Scotland... ...	234	1,039	893	146	9,841,098	102
Northern ...	89	750	145	605	3,784,051	75
York. and North Midland ...	132	879	425	454	8,354,159	138
Lanc., N. Wales and Ireland ...	98	620	55	565	2,796,388	45
South Wales ...	55	159	69	90	718,314	205
Mid. and Southern	70	352	152	200	2,702,476	38
Total in 1917 ...	678	3,799	1,739	2,060	28,196,486	603
Total in preceding year ...	660	3.459	1,590	1,869	26.805,398	491

whilst the next table shows the type of machine, and the number in use at work in the different divisions. It will be noticed that of the compressed air machines more than half were of the "percussive" type.

Kind of machine.	Scotland.	Northern.	York. and North Midland.	Lancashire, N. Wales, and Ireland.	South Wales.	Midland and Southern.	Total.
Driven by electricity :—							
Disk	590	46	157	10	3	36	842
Bar	261	25	90	24	30	26	456
Chain	36	72	171	21	36	90	426
Percussive	2	—	1	—	—	—	3
Rotary heading	4	2	6	—	—	—	12
Total	893	145	425	55	69	152	1,739
Driven by compressed air :—							
Disk	97	40	130	116	2	14	399
Bar	7	17	49	54	18	5	150
Chain	2	26	123	48	40	57	296
Percussive	39	522	150	345	30	120	1,206
Rotary heading	1	—	2	2	—	4	9
Total	146	605	454	565	90	200	2,060
Total in 1917	1,039	750	879	620	159	352	3,799
Total in preceding year	987	671	802	569	136	294	3,459

The table below is interesting, inasmuch as it shows the quantity of mineral cut by the machinery in the various inspection divisions.

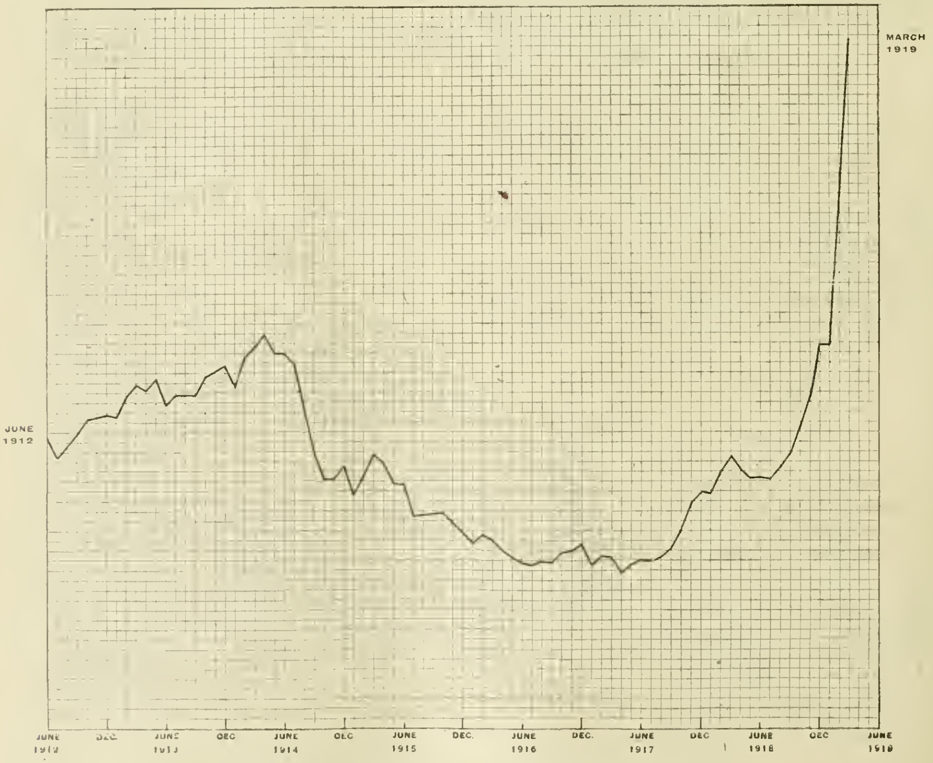
In regard to safety lamps, the report says :—It is worthy of note that the increase in the use of electric safety lamps is very marked, thus :—The numbers in use were in 1911, 4,298 ; 1912, 10,727 ; 1913, 37,823 ; 1914, 75,707 : 1915, 95,167 ; 1916, 126,784 ; 1917, 146,651. The total number of oil safety lamps in use in 1917 was 600,919, the total in 1916 being 610,821 ; so that the electric lamp would appear to be displacing the oil lamp to some extent. The majority of the electric lamps were used in the York. and North Midland and South Wales Divisions, there being 65,285 in the former and 58,630 in the latter.

Division.	Statute tons cut by electricity.					Statute tons cut by compressed air.					Total quantity of mineral cut by machinery.
	Coal.	Fire clay.	Iron stone.	Oil shale.	Total.	Coal.	Fire clay.	Ganister.	Iron stone.	Total.	
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
Scotland	8,861,385	29,689	84,835	6,549	8,982.458	842,173	210		16,257	858,640	9,841,098
Northern	1,152,047	—	—	—	1,152,047	2,631,105	899	—	—	2.632,004	3,784.051
York. and North Midland	4,184,359	—	—	—	4,184,359	4,145,198	23,769	533	—	4,169,800	8,354,159
Lancashire, North Wales, Ireland ...	386,206	—	—	—	386,206	2,410,182	—	—	—	2,410,182	2,796,388
South Wales... ...	305,474	—	—	—	305,474	412.840	—	—	—	412,840	718,314
Midland & Southern	1,191,563	26	372,177	—	1,563,766	1,103,466	1,620		33,624	1,138,710	2,702,476
Total in 1917 ...	16,081,031	29.715	457,012	6,549	16,574,310	11.515.264	26,498	533	49,818	11,622.176	28,196,486
Total in preceding year	15,507.311	3,924	403,272	8,096	15,922,603	10,795,799	25,142	13,547	48,307	10,882,795	26,805,398

THE "ELECTRICAL REVIEW" AND THE WAR.

"How did the war affect your business ?"—The question is a familiar one to very many of our readers, as it is to ourselves ; and we think that a few particulars of our experiences during the great upheaval may be of interest.

Naturally, the first effect of the outbreak of war was to put the brake on business generally, and on the manufacturing industries in particular ; the technical Press is very sensitive to fluctuations in trade, and whereas up to that time the circulation of the Electrical Review had been steadily advancing, a marked drop occurred during the first three months of the war. We give herewith a diagram showing the monthly averages of the "paid circulation" of the Review during the past six years—that is, the net paid circulation, exclusive of all exchanges, voucher copies, &c.—which shows this sudden drop, as well as other interesting features ; it will be noticed that in



Progress Curve of the "Electrical Review," 1912—1919.
The curve is drawn to scale, but the lower portion of the diagram is omitted.

normal times there is a rapid rise during the autumn and winter, and a slight decline during the summer months, which in 1914 was greatly magnified by the disaster which then overtook the nation. In the early months of 1915 there was the usual recovery, but the failure of the Allies to turn the tide of battle was reflected in the almost continuous decline throughout the remainder of that year, and in 1916 almost the lowest ebb was reached, though the total was still comparatively high for a technical journal of its class. That year, however, was marked by the Battle of Jutland, the Battle of the Somme, and successful efforts on the part of all the chief Allied Armies—it was the year of the turn of the tide, and though the usual valleys occurred in the progress curve of the Electrical Review, the upward trend was plainly shown in the autumn and winter of 1916 and 1917. From the summer of 1917, in fact, we have never looked back; the customary fall in the summer of 1918—increased hardly at all by the spring offensive of the enemy—was stayed in June and reversed in August, when the fortune of War had definitely changed in favour of the Allies. From July, 1918, to the present time the rise in our paid circulation, undoubtedly reflecting the confidence of the electrical industry in the future course of events, has been phenomenal; it is interesting to note that our steady point in that year was identical with our lowest point in 1914, and in January this year we had practically equalled our highest point in 1914. The extraordinary steepness of the curve in 1919 is very striking, and, to our mind, is indicative of the coming boom in the electrical industries; it is embarrassing, also, for until lately the stringency in the paper market has been a heavy handicap upon our aims. However, the situation is improving, though it is still very far from pre-war price conditions, which are not likely to return.

Of the staff of the Electrical Review, 25 took an active part in the war, of whom Riflemen H. Allen and W. H. Beck gave their lives for their country, while six, of whom several were severely wounded, were invalided out of the Army; others have been welcomed back to their old posts, but some are still on active service.

While the aerial bombardments of the City fortunately failed to find the editorial, publishing, or composing rooms of the Electrical Review, in 1917 the works of our printers were struck by a bomb, and for a time the production of the journal was seriously jeopardised.

During the war we have had pleasure in supplying the Electrical Review, free of charge, to all technical men on active service who chose to avail themselves of our offer, and we are very glad to know, as letters that we have published have shown, that this service has been keenly appreciated by the recipients and their comrades. We have also been consulted on very many occasions by Government Departments in need of information on technical, commercial, topographical, and other matters, and we have been happy to place at their disposal all the resources at our command. On the other hand, we have been subject to restrictions with regard to the publication of items of news and technical articles, which at times have been exceedingly irksome, especially because we were not permitted to inform our readers why these items did not appear in our pages, although they were practically common knowledge. In fact, some articles which we submitted for censorship were denied publication in our pages, although they were published by contemporary journals which did not submit them to the censor. We were informed that whether others published such information or not, it was particularly desirable that they should not appear in the Electrical Review, which was closely scanned by the agents of our enemies.

Oil from Cannel Coal.—A Committee, appointed by the Council of the Institution of Petroleum Technologists, to investigate the production of oil from cannel coal and allied minerals, issued an interim report last summer recommending that an experimental station should be established for tests on retorts and material; as an outcome of the report, the Midland Coal Products Co., Ltd., has been formed, with a subscribed capital of £100,000, for the production of oil and the manufacture of fuel, &c. A site has been acquired in the centre of the Midland coalfield, with excellent facilities for obtaining coal and establishing the industry on a sound commercial basis.

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION.

Annual Report and Meeting.

The annual general meeting of this Association was held at the offices, 36, Kingsway, London, W.C. 2, on March 20th, Mr. F. R. Davenport, Chairman of the Council, presiding.

Mr. Davenport, in moving the adoption of the annual report (referred to below) reviewed the war period generally, recalling the heavy sacrifices, personal as well as financial, which were made in order to secure a permanent peace. He dealt with the many transition questions which would continue to confront the electrical and allied industries before a resumption of normal business could be expected, of which the chief were labour, the export trade, and the much-debated question of the future fiscal policy of the Government.

The accounts and report were adopted.

The Chairman announced the result of the election to the five vacancies on the Council as follows:—British Westinghouse Electric & Manufacturing Co., Ltd., D.P. Battery Co., Ltd., Electromotors, Ltd., Lancashire Dynamo & Motor Co., Ltd., and Nalder Bros. & Thompson, Ltd.

Messrs. Price, Waterhouse & Co. were re-elected auditors of the Association for the year.

During the course of the proceedings the Chairman said that it was with great personal regret that he judged it necessary to resign the office of chairman, which, owing entirely to their goodwill, it has been his privilege to hold for five consecutive years. He was led to that resolve solely by the fact that he had held the chairmanship so long, and by the expediency, in most undertakings, after such a period, for making way for someone else. He had the great satisfaction of knowing that his successor, whoever he might be, would find himself in charge of a real live organisation with a loyal and energetic staff equal to any call made upon them. There was no reason to anticipate anything but greater successes still for the Association in the future, and he hoped to continue in close touch with all its work. In conclusion, he thanked the members for their courtesy to him on all occasions and the staff for their loyal service. His relations with everyone had been, he was happy to say, of the most cordial kind.

Mr. C. P. Martin (C. A. Parsons & Co., Ltd.) and Mr. John Taylor, O.B.E. (Mather & Platt, Ltd.), in respectively proposing and seconding a vote of thanks to the Chairman for presiding, spoke of the great regret with which they had all heard of his determination to vacate the chair. He had been in every way an ideal chairman, doing a tremendous amount of work, and extending to all comers the greatest consideration and courtesy.

The vote of thanks having been passed with acclamation, the proceedings terminated.

At the subsequent meeting of the Council of the Association, Mr. W. O. Smith, managing director of Elliott Bros. (London), Ltd., was unanimously elected chairman for the year 1919.

The report of the Council covered the financial year ended September 30th, 1918. After four years of war, and in the eighth year of its operations under the title of the B.E.A.M.A., the Association was found to be firmly established as the representative of the electrical and allied industries.

The prospect, when once the problems of reconstruction had been overcome, were distinctly promising in view of the increasing importance with which electrical power as an aid to industrial development was now regarded; the immense amount of future work connected with reparation; and the developments which had been held up during the last four years.

The one matter that appeared to give rise to anxiety now was how to secure that full use was now made of the capacity which was created and thoroughly tested during the war—how to secure full workshops, especially for export trade. Much of the recent work done by the Export Committee arose directly out of war conditions. Rations of metals were obtained by the Association in quarterly instalments for a variety of manufactures, thus permitting members not only to keep in touch with their overseas connections, but to enter markets which were very largely in the hands of Germans in pre-war days. The signing of the Armistice was followed by the gradual relaxation of export and import restrictions, but it was still necessary for members to take into consideration contracts in hand which bear priority classification, and to quote deliveries subject to non-interference by priority. This placed the foreign manufacturer in a position of advantage; but the recent conference with the Standing Council for Post-War Priority would, it was believed, have the effect of shortly removing all such restrictions tending to retard home and overseas trade.

The lack of status of H.M. Trade Commissioners in the Dominions, after being the subject of correspondence with the Government Departments concerned, was now the subject of a vigorous protest by the Council to the Chairman of the War Cabinet, from which results were expected

Advantage had been taken of visits of members of Overseas Committees, *e.g.*, South Africa and the Argentine, to discuss with them not only the work of their respective committees, but also to post them with information as to the activities and method of working of the Association at home. Reports since received from the Overseas Committees showed that these conferences had been advantageous. The South Africa Committee had, in important contracts, been able to bring into agreement on conditions not only British tenderers, but also those representing important Swiss firms.

Useful reports had been received from the Argentine Committee, which had not been so much affected by the war as those in Africa and India, many members of which had been engaged on Government service arising out of the war. This Committee had been active in reporting as to enemy firms; arising out of which the Department of Overseas Trade had recently increased the number of Commercial Attachés and representatives in South America, and a further increase was now under consideration.

The Australian Overseas Committee had been active in the matter of import duties, and at important interviews it was strongly urged that the basis of assessment should be altered from *ad valorem* to weight in the case of dynamos and motors, and to a unit basis in the case of incandescent lamps, and that, particularly in the case of heavy machinery which required time for its manufacture, the duty should be based on the cost at the time of contract rather than at the time of shipment. This Committee had also under consideration the adoption of a standard declaration form for use in the Dominions. They had, further, secured amendment of Government conditions of contract in favour of British manufacturers. Practically all the Overseas Committees, more particularly those in overseas Dominions, had reported on certain practices of Japanese manufacturers with regard to British trade marks and labels. These matters had been taken up with the Board of Trade. Acting on the suggestion of the Department of Overseas Trade, all members of the Association were warned to make careful inquiry before sending information to certain Swiss inquiries, many of these being either recently naturalised Germans or seekers of information in the interests of German or Austrian houses. The Association had published an interesting report on the electrical trade of Brazil by Mr. John Glen, the representative in Rio de Janeiro of Messrs. Mather & Platt, Ltd., and the Association's correspondent for Brazil, in collaboration with the Argentine Overseas Committee.

The director of the Association recently visited the Scandinavian countries with a view to studying the commercial and industrial conditions at present subsisting there.

The staff of the Association had been strengthened as from January 1st, 1919, by the engagement of Mr. I. V. Robinson, for many years a leading member of the staff of Messrs. Richardsons, Westgarth & Co., Ltd.

The proposed new Trade Classification of Imports and Exports was deferred by the Board of Trade while the war was in progress. The Association's Committee had recently had a conference with the Statistical Department of the Board, and there was now a promise of rapid progress.

The Council was in communication with the Restriction of Imports Department of the Board of Trade as to the necessity for continuing the war import restrictions on a variety of electrical apparatus, *e.g.*, instruments, accessories heating and cooking apparatus, and dry batteries. The Council takes the view that none of the existing restrictions should be removed at present, but that each application for permission to import should be considered, as heretofore, on its merits, leave not to be granted without the fullest inquiry. The Association has for some time exercised a Government licence controlling the import of supplies of essential accessories, and it is possible that the present negotiations will result in the Association's becoming the general licensing authority for the whole trade, thus reasonably controlling imports in accordance with proved necessity.

It is believed that the report of the Ministry of Reconstruction Engineering Trades (New Industries) Committee will be a weighty factor in shaping the future industrial and fiscal policy of the country.

In regard to the super-power stations scheme, whilst agreeing generally with the recommendations embodied in the Board of Trade Report, the Council expressed the opinion that the Commissioners proposed to be appointed should act in the first instance as an advisory body without compulsory powers; and that it was of the highest importance that pressures, periodicities, and methods of supply generally should be standardised and everything practicable done to improve the economy of generation and distribution, and to free the industry from all legislative restrictions which retard its development, make it unattractive to investors, and adversely affect the other industries which depend for their development on a cheap supply of power.

By request, the Council agreed to send representation to the Salvage Department of the Ministry of Munitions to consider as to the best means of disposing of those portions of unconsumed war stores which are of interest to members.

The Ministry of Munitions adopted a proposal of the Council that for the better adjustment of contract prices, necessitated by Government wages awards, there should be a general percentage basis for all contracts (instead of innumerable individual settlements on the merits of each case). The system adopted was put into force during the year, worked well, and was, later, adopted by the Air Ministry. The Admiralty, still later, adopted it, but with its usual reservations. The Post Office has accepted settlements on the same basis. The Council was in active argument during the year with the Admiralty over its arbitrary methods of determining the price to be paid for apparatus. A promise of amendment was extracted, but little improvement has been noticed, and, as a result, certain Sections of the Association resolved not to quote to Admiralty inquiries until the promise was fulfilled.

A movement was set on foot by the Institution of Electrical Engineers during the war for combining in one association all electrical interests for the purpose, mainly, of educating the public in the uses of electricity by the widest publicity. The Council has promised support to the movement, subject to its winning from the other public bodies interested support corresponding to the aims of the association which it is proposed to incorporate under the title of the Electrical Development Association.

The Council sent representatives to the Joint Committee set up by the Institution of Electrical Engineers to consider and report as to the creation of a national proving house for the electrical industry. The Committee has not yet found itself able to make recommendations.

The Council accepted from the Board of Agriculture a seat on the Electroculture Committee set up for the purpose of study and experiment in the best methods of equipping farms for electroculture.

The report contains brief reference to national kitchens, the Electricity Supply Order, 1918, the F.B.I. Railway Bill, education, and progress made with research for the improvement of, and the preparation of standard specifications for, insulating materials, viz., ebonite, composite materials (vulcanised and unvulcanised), magneto distributor material, mica, insulating papers, varnished cloth, and enamelled wire; also other departments of research activity.

Representation has been established on the Technical Co-operation Committees of the Institution of Electrical Engineers, and in the conferences arranged by that Institution, to discuss the metric system and the proposals for a national proving house.

The Industrial Solicitor reports that purchasers on the whole are now found willing to accept the text of the I.E.E. General Conditions. A special set of conditions, governing contracts including erection, was settled between the Council and the Port of London Authority, and members were instructed to tender to the Authority upon that set. For P.L.A. contracts without erection, Conditions of Sale (A) are still in force. The Revising Committee prepared a new edition (third) of the home Conditions of Sale known as (A) and (B), which was issued during the year.

The texts of the Association's export Conditions of Sale known as (AE), (BE) and (AEC) have been revised during the year, and their translation into French, Spanish, and Russian directed.

The Council considered it expedient to become a member of the Association of Great Britain and France (president, Lord Denbigh), the main object of which is to constitute a permanent link between the industrial communities of the two countries.

The following new Sections were constituted during the year: The Portable Accumulator, the Primary Battery, the Insulations, and the Centrifugal Pump Sections.

The question of finding larger accommodation for the rapidly increasing business and staff of the Association has once more been before the Council during the Session, and it is hoped shortly to make an announcement to members.

The number of members on the register at the end of the year (December 31st) was 216. Forty-five firms were admitted to membership during the year, and three resigned.

The system of tendering embodied in cross-tendering agreements continues to find favour among members, but has not been extended during the year. The Association has in operation the following such agreements: (1) Steam engine builders and dynamo makers; (2) Diesel-engine builders and dynamo-makers; (3) condenser makers, steam-engine builders, and turbine makers.

A 60,000-kw. Transformer.—A static transformer of this capacity has been supplied by a German firm to a Rhineland electricity works. The pressure is stepped up to 110,000 volts from four 6,250-volt primary coils. The complete transformer weighs 116 tons, the core 66 tons, the casing 15 tons, and the insulating oil 35 tons. The overall height is 17 ft. 3 in., and the floor space occupied 18 ft. × 8 ft. 4 in. The four L.T. coils at 6,250 volts are normally connected in parallel, but may be placed in series to work at a primary pressure of 25,000 volts. The transformer is insulated with material specially manufactured by the makers for H.T. purposes. Tests showed a loss of 126 KW. in the iron core, and 434 KW. by radiation from the aluminium coil: a total loss of 560 KW., which corresponds to an overall efficiency of 99·07 per cent. A second transformer of the same size is nearly completed, and will, together with the first one, be connected to two turbo-generator sets, each of 50,000 KW.—*Zeitschrift des Vereines Deutscher Ingenieure.*

LEGAL.

Meagher & Hayes v. City of Cork Tramway and Electric Lighting Co., Ltd.

At the Cork Spring Assizes, on Saturday last, before Lord Justice O'Connor and a jury, this action was heard, in which plaintiffs claimed £109 for overcharges by the defendant company in the supply of electric power to plaintiffs' works at Crosse's Green, Cork. The defendant company's case was that the circumstances entitled them to make the charges, and that these charges were regular.

Plaintiffs' case was that they were charged for electrical energy supplied by the defendant company at 1½d. per unit for the first 1,000 units, 1¼d. for the second, and 1d. for the third. They claimed to be entitled to a flat rate of 1d. per unit, at which rate energy was supplied by the defendant company to a neighbouring sawmill owned by a Mr. Harte. They maintained that there were no special clauses in the agreement between the defendant company and Harte to justify any special tariff, but that the supply was for the same purpose—a sawmill—and during the same hours, and that their consumption and that by Harte was approximately the same.

The defendant company contended that plaintiffs were builders and contractors, and that the sawmill they had erected for war work was only an auxiliary business. The problem the defendant company had to solve was to keep consumers off "the peak of the load." It was then quite economical for the defendant company, and advantageous to give special tariffs to consumers who would accept current at hours off the peak. Mr. Harte was supplied on such terms, and the defendant company had the option of cutting off his supply without notice during those hours.

Mr. Nalder, manager of the defendant company, said that plaintiffs could have had the same terms as Mr. Harte on the same conditions without any question. The arrangement with Harte was not the result of an offer by the defendant company; it was negotiated on Harte's behalf.

Mr. FitzGibbon: You wrote a letter in answer to the plaintiffs' claim for the 1d. rate that "current at 1d. per unit is only given to consumers consuming at least twice as much as you do." Is that correct?—I think so.

The statement in the letter is a lie. It is not true?—I would not say that.

The **Judge**: Have you in existence a single written agreement undertaking to supply current at 1d. per unit to persons willing to have it closed down during "the peak of the load" hours? That is an agreement similar to the one you have with Harte?—We have. I could not give names off-hand.

The **Judge** intimated that a list of the kind should be prepared for the jury.

Mr. FitzGibbon (to Witness): Did you go to Mr. Harte on January 9th last and tell him that he should sign an agreement?—He never signed an agreement.

Witness was then cross-examined as to accounts supplied to plaintiffs, which showed charges of 1d. per unit, which counsel suggested were made after the issue of the writ in the present action, and charges of 2d. per unit to plaintiffs' premises in Travers Street. Witness objected to be examined on accounts, as he was not conversant with them.

The **Judge** questioned witness as to the offer made to the plaintiffs, and pointed out that the agreement mentioned was much more stringent than the terms which Harte had.

Witness: We never had it in mind to give them any other than the terms given Harte—the right to cut off during "the peak of the load" hours. It was not a case of picking out one or two special customers, and making hole-and-corner agreements.

The **Judge** thought that the case might be settled. If the jury came to the conclusion that there were hole-and-corner agreements they should find for the plaintiffs.

The Court adjourned for half an hour, and on its reassembling **Mr. Serjeant Sullivan** said that Mr. Nalder had the information asked for by the Judge.

Mr. Nalder stated the special terms which they gave customers, and produced the figures.

Mr. Serjt. Sullivan then said that the parties in the action had consented to a dismiss. Certainly there was a misunderstanding in the letter written to the plaintiffs, who had not, apparently, a fair chance of considering whether or not they would come in on these special terms. The defendant company had undertaken to pay a certain sum for costs; the plaintiffs would come in on the penny rate, and the accounts would be settled on that basis.

The **Judge** said that the arrangement was very satisfactory. In agreeing to pay certain costs of plaintiffs, the defendant company had acted handsomely. Plaintiffs, through the incorrect phrasing of a letter, did not get an opportunity they might have availed themselves of.

The action was accordingly dismissed.

Summer Time.—An amendment to repeal the Daylight aving Act was attached to another Bill, which was not passed y Congress before the adjournment early last month. The daylight-saving law, therefore, remains in force in the U.S.A.

Through an error in the announcements in the daily Press, which as not corrected in time for our last issue, we were misled as to e date of the change in this country. We trust that our readers ffered no inconvenience through the mistake.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Re-Settlement of Officers.

Your article under the above heading, published January 24th, and the following correspondence, has been of great interest to me. Although in accordance with the views expressed in their supplementary article of March 14th by Eds. Elec. Rev., I must also admit to a sneaking admiration for "Fed-Up's" spirited criticism of the whole affair.

What, may I ask, is being done for the man who, although not one of the "wealthy men or men of position," has, by virtue of his personal determination and ambition, raised his general educational standard and knowledge of his profession, to a level not attained by many of the "officer type"?

Has he no right, after doing his share of the fighting, to the benefits of further tuition, &c., which this scheme offers, because, for a variety of reasons, he does not hold the King's Commission?

Or must he, while his share in taxation for expenses incurred by the Resettlement Committee is being paid, have again to rely on his sorely tried determination to "get there"?

Belgium, *March 26th*, 1919. **Gunner.**

[Once more we point out that this scheme, though explained in a pamphlet *entitled* "The Re-settlement of Officers," is explicitly, clearly, and unmistakably provided for *all* men, whether officers or in the ranks, whose educational qualifications justify their being trained for responsible posts in civil employment. *This scheme is not confined to officers at all.* As we said in our issue of March 14th, it is for men of the "*officer type*," not for *officers only*; for "a large proportion of the N.C.O.'s and men." "Gunner" has nothing to grouse about; he should simply write to the "Appointments Board, Ministry of Labour, London, S.W.," for Army Form Z15—his actual rank is immaterial.—Eds. Elec. Rev.]

In sympathy with "Ex-Sapper" and "Fed-Up," may I state that I strongly object to the remarks of him who was "Proud to hold a Commission"?

In the brigade section in which I served there were six fully-qualified engineers under the control of a non-technical clerk.

To do this section officer justice—he was a transfer from the infantry—he did put forward applications for commissions to Divisional H.Q. The O.C., however, was a schoolmaster, I believe, and was attached R.E. Applications had very little, if any, chance of passing his hands. The result was that one man who was a sergeant was allowed home for training after 18 months' waiting, while a sapper was granted an immediate commission on the strength of representations of his civil employers—a railway company.

Though many preferred certainty of a first-class sapper to possibility of a third rate commissioned rank, the choice was not always there.

March 25th, 1919. **E. W. A.**

The Association of Officers and Staff Members of Electricity Companies (A.O.E.C.).

It has come to the knowledge of the Executive Committee that some misapprehension exists as to the reasons which led to the formation of this association.

There are a large number of men whose long and honourable service with the electricity (power and supply) companies constitutes an asset which is to them of great value. They see the prospect of amalgamation or absorption of the companies in the near future, whether under the scheme drawn up by the Board of Trade Committee or otherwise, and they fear that in the changes in organisation and readjustments of staffs which will probably take place the value of this asset may be reduced or even lost. This association has, therefore, been formed with the object of securing by concerted action the right to compensation for any one whose interests may be adversely affected—a right which in the case of the London water and dock companies was definitely assured by clauses in the Acts of Parliament authorising the formation of the Metropolitan Water Board and the Port of London Authority. Membership of the association is limited to those of not less than ten years' service, and it is very desirable that it shall be of the strongest representative character. It is not intended to compete with other associations having other interests, but in its object it invites the support of all grades of officers and staff members of the companies.

I would add that the Executive Committee has already placed the views of the association before the Board of Trade in connection with the Government Bill shortly to be brought before Parliament.

Oswald M. Andrews,
Hon. Secretary.

London, W., *March 29th*, 1919.

War Bonus Awards.

I shall esteem it a favour if you will allow me a little space to point out that the bonus of 20 per cent. on salaries, plus £90, is a decidedly better rate than the £1 8s. 6d., plus 12½ per cent. over bonus and wages. There is no point where these two rates become equal. The E.P.E.A. award leads all the way and all the while—no matter whether the wages or salaries be 30s. a week or whether they be £5 a week. If our trade union friends care to reckon out a dozen cases they will realise the truth of my statement.

John Vincent,
National Amalgamated Union of Enginemen, Firemen, &c.

Rotherham, *March 26th*, 1919.

Rotor Currents of Slip-ring Motors.

At one of the meetings of the I.E.E., held some time ago, a suggestion or ruling was passed to the effect that manufacturers of A.C. motors should state on the nameplate of the motor the full-load value of the rotor current (this, of course, applies to slip-ring rotors). So far, I have not come across any motor where this suggestion has been carried out, and I think that if the manufacturers would comply with this request a good deal of trouble would be saved in the way of burning-out of cables connected between the rotor and rotor starting switch. Very often the electrician simply installs cables for both stator and rotor of the same size, and if the size agreed on is large enough for the full stator current, but too small for the rotor current, the result is obvious. I have come across mistakes of this sort which could have been avoided by the rotor current being given on the name-plate.

If you will kindly bring this matter to the attention of manufacturers by inserting this letter in your valued paper, I shall be obliged.

Rotor.

March 29th, 1919.

Electricity Supply Commercial Association.

I should like to draw the attention of your readers to the advertisement which appears upon another page giving notice of a mass meeting of the above Association to be held at Caxton Hall, Westminster, on Thursday, April 10th, at 7 p.m. In addition to present members, a cordial invitation is extended to all those interested and eligible for membership of the Association. Your readers will doubtless be glad to know that widespread interest is now being taken in this Association, and following my previous letters published in the Review, hundreds of new members have joined. The Association affords a splendid opportunity for the commercial staffs of electricity supply undertakings to co-operate in an association of their own, which has amongst its objects, in addition to providing means for expression and exchange of opinion, such important matters as representation, protection, and consideration of Bills before Parliament so far as they may affect the interest of members. Those in the Greater London area who wish to avail themselves of this opportunity to associate and co-operate with their colleagues in electricity supply undertakings in all parts of the country should endeavour to be present at the meeting mentioned above. Members of provincial staffs interested should communicate with the following divisional branch secretaries:—

Midland (West): Headquarters, Birmingham; hon secretary, Mr. H. C. Taylor, City of Birmingham Electricity Department, 14, Dale End, Birmingham.

West Yorkshire: Headquarters, Dewsbury; hon secretary, Mr. C. B. Tresh, Yorkshire Electric Power Co., Wellington Road, Dewsbury.

Scottish: Headquarters, Edinburgh; hon secretary, Mr. J. Beveridge, 10, Henderson Row, Edinburgh.

North-Eastern: Headquarters, Newcastle-on-Tyne; hon. secretary, Mr. E. S. Pattison, Newcastle-on-Tyne Electricity Supply Co., Ltd., 11, Sydenham Terrace, Whitley Bay.

Lancashire: Headquarters, Liverpool; hon. secretary, Mr. H. G. Quillam, 29, Salisbury Road, Wavertree, Liverpool.

Midland (East): Headquarters, Derby; hon. secretary, H. R. Kinnerley, Electricity Works, 9, Iron Gate, Derby; or direct to me for further information.

G. R. Smith,
Acting Hon. General Secretary

39, Leghorn Road, Plumstead, S.E.18,
April 1st, 1919.

The Transport Bill.—A White Paper has been issued summarising the powers and functions under statute which may be transferred from other departments to the Ministry of Ways and Communications. They include the powers of the Board of Trade with regard to tramways and light railways, those of the Light Railway Commissioners and the Development Commissioners, those of the Board of Trade with regard to electrical undertakings, and the functions of the Local Government Board with regard to loans for electricity works for the supply of electricity for traction.

BUSINESS NOTES.

Our Letters from the Forces.—A correspondent just demobilised from the R.A.F. writes:—

"I should like to express my very sincere thanks for the gift of the Electrical Review for such a long period. It will always be a pleasant memory to recall the practical way in which you kept the far-scattered electrical *personnel* in touch with everything affecting their interests at home. Many times I have known those not essentially electrical take an absorbing interest in the "leaders" of your journal, because they suited their case also. It is, perhaps, difficult to judge all at once of things at home on return after a lengthy period away, but it is to be hoped that some of the spade work you have been doing so long and so well will bring forth its just harvest. I have in mind 'The Export Vision' as one instance. Do the workers realise? Will they ever? For the sake of all that has been sacrificed during the war, let's hope they will realise, and, at the same time, learn to discriminate between leaders and fanatics. . . . .

"Wishing every success to your paper, which has been more than valuable over a long, long period, and once more—many thanks."

Another writer, also recently demobilised, says:

"Thank you most heartily for the copies of the Electrical Review which you have so kindly sent to me while I have been in France. I have enjoyed it particularly during the past few months, when work has been anything but pressing."

British Orders for British Works.—The Executive of the Federation of British Industries, on March 26th, passed the following resolution:—

> That every effort should be made by the Government to deal with purely British firms in preference to firms of alien origin; and that, in pursuance of the Government's policy, it is not sufficient for the Government to close down firms which are technically of enemy origin, but that it must set an example by placing its contracts exclusively with firms owned and controlled by British subjects.

Reconstruction Pamphlets.—The Ministry of Reconstruction has issued two more pamphlets. No. 18 describes the Whitley Scheme for Industrial Councils, and reviews the work that been accomplished in that connection. No. 19 deals with the State regulation of wages.

Auction Sale.—By order of the Disposal Board, Messrs. Simmons & Sons will sell by auction, on April 9th, at the Newbury Inspection Depot 1,605, near Newbury Racecourse, a quantity of electrical material. For particulars see advertisement pages to-day.

Plant for Disposal.—Stoke-on-Trent Electricity Department invites offers for one 300-kw. D.C. Belliss & Morcom steam engine with E.C.C. dynamo, and three Babcock water-tube boilers.

Sheffield Corporation Tramways Department will have for disposal, in August or September next, 10 four-wheeled single-deck tramcars. See our advertisement pages to-day.

Profit-Sharing in Principle, but No Profits to Share.—At a commemoration held in the Krupp's Friedrichshalle on Sunday, February 23rd, the present director of the works, Herr Krupp von Bohlen, pointed out in a speech to the assembled guests that the external defeat and internal commotions had involved the Krupp undertaking in incalculable dangers. The disaster thus hanging over a great concern had, more than any other occurrence, made it clear to all that it was not so much the personal interest of the individual that was at stake as the existence and prosperity of the undertaking, with whose future continuance the fate of all its members was bound up. There was much talk nowadays of socialisation and profit-sharing. The idea of sharing profits among the officials and workers had, however, been for years realised at Krupp's under many forms. The speaker went on to say that the management, in grateful remembrance of the great efforts of the employés, had elaborated a plan that large sections of clerks, minor officials and workers should participate more directly than hitherto in the balance-sheets of the company. The present complexion of affairs, which could hardly indicate a prosperous balance, had put an end to this idea. The economic position would determine how far it was possible to return to the idea. The speaker hoped that Germany would justify her existence in the eyes of the world, and that German labour would once more enjoy its ancient prestige.—*D.A.Z.*, February 24th.

Cold-Blast Pig-Iron.—The Minister of Munitions gives notice that in consequence of an arrangement with the manufacturers, whereby certain existing subsidies payable on cold-blast pig iron have been, or are to be withdrawn, he has authorised an advance of 11s. per ton in the maximum price, to take effect as from April 1st, 1919. This advance, added to the increase of 15s. which took effect on January 1st, raises the maximum price for home sales to £10 8s. 6d. per ton f.o.t. makers' works. The export price remains unchanged at £11 12s. 6d. per ton, but the export drawback is reduced by the amount of the increase in the home price.

Calendar Competition.—The Sun Electrical Co., Ltd., is offering a number of prizes, ranging from £5 5s. down to 5s., for sets of phrases suitable for the Sun desk memo calendars. Anybody interested can obtain a copy of the rules by applying to the company's Publicity Department at 57-59, Neal Street, Long Acre, W.C. 2.

B.T.H. Whist Drives.—By four whist drives the staff of the B.T.H. Co., at Rugby, have raised £60 for the B.T.H. Relief Fund and St. Dunstan's Hostel.

British Firms Only.—Southwark Board of Guardians has decided that in future no tenders be considered from other than British firms, and that all firms tendering be requested to state the names of the principals.

Exports to China.—The *London Gazette* for March 28th contains a further list of persons and bodies in China to whom exports may be consigned.

New French Company.—A new company has lately been formed in Paris with a capital of £40,000, and the title La Société d'Appareils de Transports et de Manutentions Electriques.

B.E.A.—The British Engineers' Association (Inc.) has issued pamphlet M 152 (24 pp.), containing particulars of its various trade groups and sections. E 1 class covers electrical plant, machinery and accessories : I 1, internal combustion engines : R 1, railway and tramway plant and material ; S 1, scientific and industrial instruments ; S 4, steam engines, turbines, and condensing plant : W 5, wire.

Industrial Housing.—A memorandum has been issued by the Local Government Board, which gives in detail the terms of financial assistance offered by the Government to public utility societies for housing purposes. The Housing Bill which has just been introduced, contains provisions for the necessary Parliamentary authority for the payment of assistance. Any *bonâ fide* public utility society whose objects include the provision of houses for the working classes, and which complies with the conditions laid down, may receive the Government assistance in respect of approved housing schemes. It is hoped that organised bodies of workpeople will join in the promotion of public utility societies on which their members will be duly represented. The Government's offer is expected also to appeal to employers of labour in town and country, who have a direct interest in seeing that persons employed by them are well housed near their work. The Local Government Board and their Housing Commissioners will be prepared to give any necessary advice in regard to the formation of a public utility society.

War Trade Department.—In accordance with an arrangement made some weeks ago, Lord Emmott and Sir Nathaniel Highmore, K.C.B., who have since its inception in February, 1915, been respectively Director and Secretary of the War Trade Department, have now resigned their posts. The Board of Trade is taking over the War Trade Department, and has appointed Sir Alexander King, K.C.B. (the former Secretary to the G.P.O.), as Controller.

44 Hours' Ballot.—The Federation of Engineering and Shipbuilding Trades, at a Conference held in London, last week, resolved to take a pooled ballot vote of the members of all the Societies in the Federation on the question of applying for a 44-hour week. Women workers in the engineering trade have asked for an alteration of hours of female labour in the engineering workshops from the present 48 to 54 hours to 47 hours.

Electrical Supplies to South Africa. — The *S.A. Mining and Engineering Journal* for February 15th stated that during the preceding week there was no alteration in prices of electrical goods, although plenty of materials were arriving from England, America, and Japan. "Contractors are, in a measure, being held up by the building strike, but outside of that there is quite a lot of work in evidence. One distributing house has been doing quite a good business in C.O.D. railway orders, thus showing an improvement in country orders. The mines are also purchasing rather freely of lamps, wiring, and other materials, as they are not interfered with by the strike. When the latter is fixed up, a lot of activity is anticipated in the electrical business. In the meantime, stocks are accumulating, thus enabling contractors to have a better assortment of all requisites."

American Government Sales of Copper.—It is reported in a Press dispatch from Washington that the War Department announces that an agreement has been come to with copper producers by which approximately 100,000,000 lb. of copper owned by the War Department will be sold in the next 15 months at market prices. In the first 10 months the Metal Selling Co. will dispose of 5,000,000 lb. monthly, and in the succeeding five months 10,000,000 lb. monthly.

Export Trade Commissioners.—In the *Bulletin* of the Federation of British Industries, it is stated that the Overseas Trade Committee has appointed a sub-committee to supervise the Federation's Trade Commissioner Service. The sub-committee will be charged with the duties of considering the qualifications of candidates, and making appointments to Commissionerships, drawing up the necessary regulations governing the service, and making recommendations regarding overseas trade policy. The sub-committee will have power to co-opt, and will generally sit fortnightly. It is expected that the delegation of Brazilian business men will arrive here on June 15th for their tour of industrial Britain.

High-Speed Tool Steel and Scrap.—With reference to the Steel Supplies (Partial Suspension) Order, 1919, the Ministry of Munitions gives notice that after the date of that Order all dealings in high-speed tool steel and scrap therefrom are unrestricted, and consequently the maximum prices applicable to these materials cease to be operative.

Catalogues, Calendars, &c.—THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., of Trafford Park, Manchester, have favoured us with one of their wall calendars for the year ending March, 1920. The monthly date slips appear beneath a study which cannot fail to be an attraction on any office wall.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, London, S.E. 7. In the form of a folder, the company has issued a map of the United Kingdom, effectively showing the very large number of collieries where J.P. electrical plant and cables have been installed. A 32-page catalogue has also been published, entitled "Main Cables," in which a good deal of information is given respecting their power cables. A general specification is followed by notes concerning cable-laying and jointing, vulcanised bitumen insulated cables, low-tension cables, high-tension cables, three-core high-tension cables, three-core E.H.T. cables with earth shield, special cables, split conductor cables, paper-insulated bitumen sheathed cables, rubber-insulated cables, and telephone cables. These are all illustrated with excellent half-tone sectional views, and pictures appear of the paper cable works, and of various cable-laying operations. The company has specialised in cable manufacture for a very long period, in fact its works were established at Charlton in 1875.

MESSRS. HIGGS BROS., Sand Pits, Birmingham. Stock price list of shunt-wound interpole motors from ·25 to 25 H.P.

Export Prohibitions.—A further list of alterations in export prohibitions appears in the *London Gazette* for March 28th.

Book Notices.—*Electrolysis and Its Mitigation.* Technologic Paper of the Bureau of Standards, U.S.A., No. 52. By E. B. Rosa and B. McCollum. 2nd Edition. Washington, D.C., U.S.A. : The Bureau.—This report relates principally to the prevention of electrolysis in metallic structures, including gas and water systems and lead-covered cables. In America no regulations exist imposing limits on voltage drop in the negative return of tramway supply systems, and consequently electrolysis has given rise to serious troubles on pipes, cable sheaths, &c. "It is probable that more trouble from this source is now being experienced in this country [United States] than anywhere else in the world." Voltage drops of 5 or 6 volts in a few hundred feet are common. The subject is very fully treated, and abundant data are given derived from actual experience. Wide use is now being made of insulating joints in pipes, attempts to protect the pipes with paint, &c., having proved ineffective. The best method, however, is to reduce stray currents to the minimum. A new feature of the revised edition is a section on the three-wire system of railway power distribution, of which several examples exist in the United States.

The March issue of the Industrial League *Journal* includes a 12-page supplement reporting an address by Mr. G. N. Barnes, M.P., to managers and foremen on "Industrial Matters." Mr. H. E. Blain, of the London Underground Railways, contributes an article on "Industrial Honour." There are contributions from Sir Woodman Burbridge, Sir Eric Geddes, Mr. R. Yonng, M.P., Mr. G. H. Roberts, M.P., Prof. Kirkaldy, Mr. W. C. Bridgemau, M.P., Sir William Bull, M.P., Mr. G. J. Wardle, M.P., and Mr. Tom Shaw, M.P. An article on "League of Nations and Industrial Unity" is contributed by Major the Hon. Waldorf Astor, M.P. There is also a full account of the donation of £20,000 by Colonel Sir William Dupree towards creating industrial harmony.

Trade Announcements.—MR. C. H. CAMPION (Campion and Ryan, of New York) is at present in London (6, Old Queen Street, S.W.) representing a number of American manufacturers for the purpose of appointing wholesale factors and distributors of various electrical products. He is also here to complete arrangements for representing British interests in America.

The address of MESSRS. AUTOMATIC AND ELECTRIC FURNACES, LTD., has now been changed to 281-283, Gray's Inn Road, London, W.C. 1 (telephone, Holborn 1295 ; telegrams, "Elecfurn, Kincross, London"), where larger premises for offices and works have been secured.

THE POWER SPECIALTY CO., of New York, have opened an office at 315-17, Oxford Street, London, W. 1, to deal with all European business in "Foster" superheaters, the agency for which has until recently been in the hands of Messrs. Heenan & Froude, of Worcester. We have received a copy of the company's fully-illustrated catalogue of 56 pages describing the Foster superheaters.

Mr. J. F. Carr, late Trench Warfare Engineer, West of Scotland, and Mr. T. T. D. Geesin, late of the British Thomson-Houston Co., Ltd., Rugby, and Lt. R.N.V.R., have entered into partnership as CARR, GEESIN & CO., electrical and mechanical engineers, at 1, Montagne Street, W.C. 1. Telephone : "Museum 3413."

Liquidations and Dissolutions.—PEARSONS (ELECTRICIANS), LTD.—Winding-up voluntarily. A meeting of creditors was called for yesterday at 15, Fountain Street, Manchester. Liquidators, W. Eaves and A. Yearsley, 27, Brazennose Street, Manchester.

CEDES ELECTRIC TRACTION, LTD.—Last day for claims April 15th Controller, Mr. H. E. Burgess, O.R., 33, Carey Street, London, W.C. 2.

NATIONAL PROVINCIAL ELECTRICITY CORPORATION, LTD.—A meeting is called for May 2nd at Balfonr House, London, E.C., to hear an account of the winding up from the liquidator, Mr. S. Gillatt.

PNEUMATIC TOOL CO., LTD.—Winding up voluntarily, with Mr. H. L. Williams, 70, Queen Victoria Street, London, E.C., as liquidator.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for March 28th and April 1st.

Wages of Women Engineers.—An Arbitration Court has awarded all women employés in the engineering and allied industries, whether time or piece workers, another 3s. a week, girls under 18 to receive 2s. 6d. The women's Unions had asked for "an increase of 25s. 6d. a week, with an additional advance of 5s. a week." Under the Wages (Temporary Regulation) Act the Labour Ministry has issued an order compelling all employers who have women workers in engineering or boiler shops and foundries to obey the award.—*Daily Mail*

German Industrial Notes.—The German Babcock and Wilcox steam boiler works have purchased large plots of land in Altstaden for the erection of new premises.—*Weltwirtschafts-Zeitung*, February 28th.

The Accumulators Manufacturing Co. in Berlin and the Th. Goldschmidt Co. in Essen have amalgamated their rail-welding departments in the Electro-Thermit Co., Ltd., their methods having been found to be supplementary to each other.—*Kolnische Zeitung*, February 26th.

The Co-operative Electricity Companies attached to the Saxon-Anhalt Electricity Works have combined in a company entitled the Provincial Electricity Co., Ltd., at Halle.—*Kolnische Zeitung*, February 13th.

Nationalisation.—The Council of the F.B.I. recognises that the Federation, which is the largest manufacturers' organisation in the country, cannot remain silent with regard to the policy of nationalisation now being pressed upon the country. On the motion of Mr. W. P. Rylands, a strong committee has been appointed to consider the report of the Royal Commission on the Coal Industry, and to continue to consider the various interim reports of that Commission as they appear; to consider the report of the National Industrial Conference; to take evidence from the various trades with regard to nationalisation: and to report back to the Council.

Parliamentary Question re U.S. Export Plans.—In the House of Commons, on Monday, Mr. Higham asked whether, in view of the fact that the Government of the United States intended to lend to American exporters £200,000,000 of Government money to permit those exporters to sell on credit in Allied and neutral markets, he would state what amount of money His Majesty's Government proposed to set aside for that purpose in order that British traders might be in no less advantageous a position. The reply of Mr. Bridgman, according to the *Times* report, was:—"The hon. member must bear in mind that the war has taxed the financial resources of the British Government more severely than those of the Government of the United States. The Government are fully alive to the importance of the question of credit facilities, which, in the case of some markets, is at present perhaps the chief problem to be solved in connection with export trade. But the solution cannot be a matter either wholly or mainly for the Government."

LIGHTING AND POWER NOTES.

Accrington.—Proposed Extensions.—The Electricity Committee has approved a proposal for the expenditure of £70,000 on additional plant at the electricity works. A report on the scheme has been prepared by Mr. R. Blackmore, of the Stalybridge, Mossley, Hyde, and Dukinfield Electricity Board. The steam-raising and gas-producing plant is inadequate for the present load, and the prospective load will add considerably to the demand. Bulk supplies from neighbouring authorities, or from the contemplated national power stations, are not considered practicable. The capital charges on the new expenditure would be about £7,000 per annum, but it is estimated that the shutting down of the gas-driven plant would save £5,600 a year. The opinion is expressed that if the station is run under steam conditions there would be a substantial reduction in fuel charges, and the total credit is set down at £11,600, leaving a net financial gain of £4,600 a year.

Australia.—E.L. Schemes.—The Corowa (N.S.W.) Shire Council is considering the extension of its E.L. undertaking, at a cost of £4,000. The Yeronga (Q.) Lighting Committee is urging the Stephens Shire Council to install an E.L. scheme. The Erina (N.S.W.) Shire Council is considering an E.L. installation for the town of Gosford.

Tasmania.—The Premier has intimated that if the Mount Lyell Mining Co. does not proceed with the King River hydro-electric scheme, the Government will go on with it.—*Tenders.*

Bandon.—E.L. Scheme.—The Cork C.C. has assented to the proposal of Mr. J. Brennan, a local mill owner, to install an E.L. scheme at Bandon. Energy is to be generated by water power at the site of the mill.

Birmingham.—L.G.B. Inquiry.—Colonel T. C. Ekin held an inquiry on Tuesday, last week, into the application of the T.C. for sanction to borrow £1,126,140 for the purposes of the electricity undertaking. The money is required towards the cost of the new permanent generating station at Nechells, upon the construction of the foundations of which work has been commenced. The Electricity Supply Committee has satisfied the Ministry of Munitions and the Treasury as to the necessity for the work. The initial capacity will be 30,000 kw., and two turbo-alternators, each of 15,000 kw., are to be installed. The mains between Nechells and Smethwick are to be linked-up.

Burnley.—Electricity in Mining.—New electrical pumping plant at Messrs. Hargreaves's Mountain Mine was inaugurated on March 26th. Burnley Corporation is supplying the power at 6,600 volts. The new pump is of the multi-stage turbine type supplied by Messrs. Mather & Platt Ltd., of Manchester. This supersession of steam for electricity has proved so successful that a second electrical instalment is shortly to be made at Arley Colliery, Burnley.

New Services.—The Corporation has received so many applications for power that it has instructed a deputation to consult an expert as to steps required to expedite Government sanction for urgently required extensions.

Colne.—Proposed Loan.—The Electricity Committee has applied to the L.G.B. for a loan of £36,283, for the extension of the generating plant and mains.

Continental.—Sweden.—Among the new companies formed in Sweden in connection with the utilisation of water power for electricity supply, are the Toarps Elektriska Aktiebolag, of Dalsgofors; the Odeshogs Elektriska Aktiebolag, of Odeshog; and the Gotbergs Kraft Aktiebolag, of Gothenburg.

Dundalk.—Price Increase.—The U.D.C. has decided to increase the charges for electricity by a further 12½ per cent. for six months.

Edinburgh.—Bulk Supply.—The agreement between the Edinburgh T.C. and the Leith T.C. for the supply in bulk of additional electricity from the Dewar Place power station has been adjusted on the lines suggested by the B. of T.

Egham.—Proposed Price Increase.—The U.D.C. has objected to the application of the electricity company for consent to increase the price of electricity from 8d. to 1s. per unit.

Glasgow.—National Electricity Supply.—The Glasgow T.C. has decided to oppose the proposal to put the future control of electricity supply in the hands of a Ministry of Ways and Communications. In a report on the subject, Mr. W. W. Lackie, the chief engineer, states that he is of opinion that the supply of electricity warrants the appointment of a special minister or board, and electricity should certainly not be tacked on to the Ministry of Ways and Communications, as a minor item. He regards the power to let on lease any undertaking acquired by the Ministry as dangerous, as any undertaking might be taken from a public body and let to a private company.

Haslingden.—Price Increase.—The Corporation has decided to advance the price of electricity for lighting to 6d. per unit, and for heating and power by 25 per cent., making a total increase of 50 per cent. on the original charges.

Proposed Bulk Supply.—The electrical engineers of the Accrington, Haslingden and Rawtenstall Corporations have held a conference regarding the supply of electricity in bulk, and a further conference is shortly to be held.

Hatfield.—E.L. Scheme.—The R.D.C. has asked the North Metropolitan E.P.S. Co. to supply electricity within its area.

Herne Bay.—E.L. Scheme.—The U.D.C. has decided, owing to the inability of the Gas Co. to supply electricity, to relieve the company of its obligations, on condition that it does not oppose Mr. Hunt supplying energy in the district.

Hornsey.—Price Increase Disapproved.—The Middlesex C.C. has disapproved the application of the B.C. for permission to increase the charges for electricity from 8d. to 10d. per unit.

Ilford.—Price Increase.—From the end of June, the Electricity Committee recommends that the charges for electricity be increased as follows: Lighting, 7d. per unit: residential premises, 12½ per cent. on rateable value, plus 1½d. per unit, plus 75 per cent.: maximum demand, 8d. and 5d.: slot meters, 7½d.; power, maximum demand, 5d. and 3d.; or up to 500 units per quarter, 5d. per unit, next 1,000, 4d., next 1,000, 3d., over 2,500, 2¾d.; heating, 3d.; cinemas, vehicle charging, &c., an addition of 25 per cent., making a total increase of 100 per cent.

India.—Generating Costs.—With a generating plant capacity of 20,800 kw., the Calcutta Electric Supply Corporation has the largest steam plant in India, its power costs being 0·751d. per unit. The Bombay Electric Supply and Traction Co. is able to supply power at a cost per unit of 0·722d., while the Tata Hydro-Electric Power Supply Co. has reduced the generating costs to 0·1d. per unit.

Lancaster.—Proposed Expert Advice.—The chairman of the Electricity Committee has recommended that an expert be called in to report on the present position of the electricity undertaking.

London.—Electricity Loans.—The L.C.C. has been informed by H.M. Treasury that, while it cannot give general authority to allow all electricity loans, it is prepared to favourably consider applications made through the Council where such loans are urgently needed for industrial purposes or housing schemes, and not merely for domestic purposes.

Battersea.—Price Increase.—The Electricity Committee has recommended that the charges for electricity for lighting be increased from 4d. per unit, plus 10 per cent., to 5d., plus 10 per cent., and for power from 1¼d. to 1¾d. per unit net, from the next reading of the meters.

Southwark.—Proposed Price Increase.—The B. of T. having refused the application of the B.C. to increase its charges for electricity for lighting purposes from 8d. to 1s. per unit, the Electricity Committee has now recommended the Council to apply for sanction for an increase to 9d. per unit.

Lambeth.—Electricity Charges.—The B.C. has refused an application of the South London E.S. Corporation for permission to increase its charges for lighting from 6d. to 7d. per unit.

Middlesbrough.—Garden City Lighting.—The Sanitary Committee has decided to light the new garden city at Acklam with electricity.

Peterborough.—Wages.—On the ground that the cost of living is decreasing, it is stated that the Electricity Committee has refused to give its employés the 5s. per week bonus granted by the Committee on Production last November.

Portstewart.—Proposed Municipal Control.—The U.D.C. has decided to ask the Irish L.G.B. for permission to take over the electric lighting plant.

Ripon.—E.L. Scheme.—The T.C. has appointed Mr. A. Redfern, of Darlington, to be consulting engineer in connection with the proposed E.L. scheme for the town.

Rugby. — Municipal Contracting. — The Master Builders' Association has protested against the proposal of the U.D.C. to open showrooms and carry out electrical work within its area. The Electricity Committee has stated that it does not intend to run the department for profit, and has declined to take any action with regard to the protest.

Salford.—Bulk Supply.—The Electricity Committee has renewed its agreement with the Lancashire E.P. Co., for a bulk supply of electricity for a further 12 months.

Stand-by Charges.—The Committee has decided to charge a minimum of £2 per kw. in cases where it furnishes a stand-by to a private installation, irrespective of the amount used.

South Africa.—Mossel Bay (Cape Province).—The T.C. has decided to embark on an electric lighting scheme, at an approximate cost of £20,000. An engineer is to be engaged at once, in order to revise previous plans and specifications.

Elliott (Cape Province).—The municipality proposes to raise a loan of £1,800 for the purpose of an electric lighting scheme.

St. Helens. — Proposed Extensions. — The borough electrical engineer has been instructed to prepare a scheme to meet the increased demand for electricity.

Stockton.—Price Increase.—The Corporation has increased the charges for electricity for lighting and power by 5 per cent., as from April 1st.

Thurles (Co. Tipperary).—E.L. Scheme.—The U.D.C. proposes to spend £7,000 on providing an electric light scheme.

Wages.—The court of arbitration to which we referred last week in these columns, has refused the application of the Electrical Trades Union for an advance of 15s. per week for its members employed in electricity undertakings in London and district. The court stated that the men concerned were receiving a total war bonus of 28s. 6d. per week, plus 12½ per cent. in the case of time workers, and 7½ per cent. in the case of piece workers, and that the circumstances did not justify any further general alteration of wages.

Warminster.—Extension of Time.—The B. of T. has extended the time authorised under the Warminster E.L. Order, 1914, for six months from January last.

TRAMWAY AND RAILWAY NOTES.

Blackpool.—Tramways Purchase.—With regard to the proposed purchase by the Corporation of the Blackpool and Fleetwood Tramroad Co.'s undertaking, the House of Lords Committee appointed to consider the matter has been informed that the Blackpool and Fleetwood Corporations have come to an agreement by which the Blackpool Corporation will acquire and work the whole undertaking, and the Fleetwood Corporation will have an option to purchase that portion of the system which is within its area within a certain period.

Burnley.—48 Hours' Week.—The working hours of the Corporation tramway workers have been reduced from 54 to 48 per week, the wages remaining the same, which will entail a cost of £10,000 per annum.

Chile.—Proposed Railway Electrification.—The State Railway Authorities contemplate the electrification of the line from Valparaiso to Santiago, 116 miles. Two prominent engineers, Rafael Edwardes and Ricardo Solar, will arrive soon to continue their investigations of the problem.—*Railway Review.*

Duty of a Conductor.—The duty of a tramway-car conductor was the subject of comment by the Deputy Coroner for North Worcestershire at an inquest near Birmingham, last week, on a man who was knocked down and killed as he was alighting from a tramway-car. The conductor said the car had not stopped when the man got off, and added that conductors were not supposed to hold back people who attempted to jump off. The Coroner said that when a man 74 years of age was allowed to get off a car before it had stopped, the conductor was neglecting his duty. In returning a verdict of "Accidental death," the Coroner said no blame attached to anyone; the whole duty of a conductor, however, was not to collect fares only—he must exercise discretion and look after passengers.

Liverpool.—Year's Working.—The income of the Corporation tramway department for the year 1918 amounted to £989,505, against £845,646 in the previous year; working expenses totalled £715,979, interest absorbed £50,969, sinking fund £52,734, reserve and depreciation fund £29,322, and £140,000 was contributed to the relief of the rates. The cost of electricity was £138,426, or 2·74d. per car-mile, against 2·584d. in 1917. The receipts per car-mile were 18·91d., against 15·56d.; the average fare per passenger was 1·184d., against 1·137d.; the total charges were 16·12d., against 12·89d.; and the operating cost was 14·082d., against 10·931d. The length of track in operation was 124 miles; the capital expenditure at the end of the year was £2,068,395; 195,082,609 passengers were carried, an increase of £22,240,115, and 12,210,763 car-miles were run. Of the total staff of 3,000, 2,300 left to join the Forces. The Committee has decided to purchase 100 motor-omnibuses in order to relieve the traffic congestion, as it was found that these could be delivered earlier than new tramcars. As soon as possible 100 new tramcars are to be purchased. During the war the Committee placed the Lambeth Road works, and the services of the general manager and his technical staff, at the disposal of the Government, and over two million shells passed through the factory: 300 aeroplanes were completely manufactured there, and 200 were in course of construction when the Armistice was signed. The reserve and renewals fund now totals £916,354, and £1,062,899 has been contributed to the rates.

London.—L.C.C.—Year's Working.—For the year ended March 31st, 1918, the total income of the tramway department amounted to £2,932,140, compared with £2,552,204 in the previous year, while the working expenses were £2,128,686. Of the gross surplus of £803,455, interest absorbed £293,569; and debt redemption, £428,320; after allowing for recoverable charges there was a net surplus of £95,559, which has been transferred to the renewals fund. Passengers carried during the year totalled 593,516,141, against 586,127,976, and 49,189,866 car-miles were run, against 49,478,973. The total revenue averaged 14·3d. per car-mile, against 12·38d.; the average fare per passenger was 1·16d., against 1·01d.; working expenses were 10·38d. per car-mile, against 8·82d., including ·62d. in respect of war-service allowances and other special charges. The average number of cars in use was 1,269, compared with 1,825 in stock. The net capital expenditure during the year was £89,470, and the total capital expenditure to the end of the year was £13,659,589, of which £5,015,789 had been paid off out of revenue. The total track mileage was 149, of which 122 were on the conduit system and 22½ overhead; 4·6 miles of horse tramways, not yet electrified, were not worked. The renewals fund stood at £324,451, and the general reserve fund at £74,667. During the year, £119,432 was paid in respect of employés with the Forces. The cost of war wages and bonuses was £321,125. The amount paid to local authorities as rates on the permanent way was £65,180. Altogether it is estimated that the saving to local authorities in connection with the maintenance of track, street improvements, and rates was £285,220.

The L.C.C. has applied for Parliamentary powers for the construction of new, and the reconstruction of existing, tramways.

The concession of the 44 hours' week to tramway workers will cost £360,000 per annum. Steps are being considered to secure the additional revenue necessary, a further increase of fares being expected.

Collision. A collision occurred on Wednesday morning, last week, just outside Waterloo Station, at a spot where a number of tracks converge, the trains involved being the 8.10 a.m. outgoing electric and an incoming steam train. The rear coach of the electric train fouled the points, and became detached; it was struck by the incoming steam train. The steam locomotive and several coaches were derailed, one of the latter being smashed. Only one passenger was slightly injured. The mishap caused considerable dislocation of traffic, and as each incoming train was stopped in its section, passengers left the carriages and walked along the track to Waterloo and Vauxhall. Some trains were got through on the Windsor line, and about 2 p.m. traffic began to settle down.

L.U.T. Service Curtailment.—Commencing Monday last, the early morning services on the L.U.T. system were slightly curtailed, the first cars leaving all termini later than hitherto.

Extension of Time.—The City and S. London Railway Co. has notified the L.C.C. of its intention to apply for an extension of time for the reconstruction of its system and the construction of subways at Stockwell and Clapham Common.

Marylebone.—The Borough Council has refused to approve the L.C.C. Bill for constructing a tramway along Tottenham Court Road.

Improved Tube Services.—The number of trains in operation on the Piccadilly Railway, between the hours of 10 a.m. and 5 p.m., has been increased from 18 to 24 per hour.

Wood Green District Council is calling a conference of local authorities in North Middlesex to demand an extension of the Piccadilly Tube from Finsbury Park to Enfield. An old agreement between the Government and the G.N. Railway Co. forbids an extension, but the Council takes the view that circumstances have changed.

An additional turbo-generator of 15,000-KW. capacity, with all auxiliary plant, has been ordered for the Metropolitan District Co.'s power station at Lots Road. Its cost will be slightly more than double that of a similar alternator installed before the war.

UNDERGROUND FARES REVISION.—Certain fares on the District, Bakerloo, Piccadilly, Hampstead, Central London, and City and South London Railways are to be increased on April 6th, and season ticket rates will be revised at a later date.

Maidstone.—FARE REVISION.—The T.C. has decided to increase the tramway fares by 25 per cent., and, conjointly with other local authorities, to apply to the B. of T. for permission to increase the fares by 100 per cent.

Mansfield.—PROPOSED LIGHT RAILWAYS.—The Mansfield and District Light Railway Co. has applied to the Light Railway Commissioners for powers to construct five lines of railways in the district.

Reading.—HOURS OF LABOUR.—The T.C. has intimated that it does not intend to accept the agreement for a 48-hour week for tramway employés; it is expected that a conference will be held on the matter.

Stoke-on-Trent.—PROPOSED MUNICIPAL PURCHASE.—The T.C. is negotiating for the purchase of the tramway system within its area.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Telephones.—According to the *Daily Mail*, the Postmaster-General is preparing for the introduction of automatic telephones throughout the Greater London telephone area. A report which has recently been prepared shows that the necessary alteration of exchanges and instruments would take about three years. The cost would be £5,000,000, and it is estimated that the saving in the cost of working would just balance the cost of this capital outlay. The necessary work in London cannot be begun for some time. Orders have been given for the immediate installation of automatic telephones at Sheffield and Dundee. To improve the telegraph and telephone services between London and the Midlands, work has been begun on a new underground cable system between London, Leicester, Leeds, Nottingham, Manchester, and Liverpool.

Cable Delays.—Attention is again called to the delay in cable messages by a suggestion from the Hong-Kong Chamber of Commerce that the naval high-power wireless station there should be used for commercial purposes. It is pointed out that there is an absolute necessity of linking-up Hong-Kong and London by relays of wireless stations, and it is urged that provision be made at the earliest possible moment for direct communication with Calcutta. Telegrams from Egypt, S. Africa, Australia, the Far and Near East received in London during the last month have been subject to delay varying from 4 to 40 days. Of 35 examples cited, 19 have been subject to 10 or more days' delay.—*The Times.*

Mr. Pike Pease states that it has not been possible to do much in the direction of laying new cables for general telegraph service during the war, but steps are now being taken to provide additional lines as quickly as possible.

Colombia.—The Government has granted to the Marconi Wireless Telegraph Co. of America the exclusive privilege for a period of ten years of manufacturing, using, selling, or exploiting in the Republic its wireless telegraph improvements and processes. —*T. and T. Age.*

France.—The staff of the Central Telegraph Office at Paris, says the *Petit Parisien*, ceased work from 6 to 7 p.m. on Wednesday and from 11 to 11.30 on Thursday, last week, as a protest against delay in granting a dear-living allowance and a weekly holiday.

Germany.—Herr Bredow, well known in England as the managing director of the German Telefunken (Wireless) Co., has been made director of wireless in the German G.P.O., says the *Daily Mail*. It is the intention of the German Government to make wireless henceforth an extensive and integral part of the postal system, especially for commercial and Press traffic.

Post Office Record Year.—According to the Accountant-General's report issued last week, the Post Office completed during the year ended March 31st last its best 12 months on record. The profits on the working of the undertaking were:—Postal service £6,848,285 and telephone service £355,468. There was, however, a loss of £556,330 on the telegraphs, reducing the net profit to £6,647,423. The loss on the telegraphs during the previous five years was:—1912-13, £1,175,347; 1913-14, £1,211,742; 1914-15, £1,232,955; 1915-16, £520,047; 1916-17, £529,639.

United States.—The Moon Bill to extend Government control over telephone and telegraph systems was not passed by Congress before the adjournment early in March.

The Postmaster-General has ordered internal telegraph rates to be advanced 20 per cent. as from April 1st, to meet the added costs of the service due to recent increases of wages.

Mr. Lansing states that the United States will soon have its own cables across the Atlantic and the Pacific and to the Far East.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Australia.—BRISBANE.—May 15th. Department of the Treasury, H.T. switchboard, storage battery and motor-generator set for the electric power house, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

MELBOURNE. May 14th. Victorian Railway Commissioners. Cells, renewals, caustic soda and mineral oil for caustic soda batteries. (Contract No. 32,194.)

SYDNEY.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

Bedford.—Corporation Electricity Department. Geared turbine to drive an existing alternator. (March 21st.)

Birmingham.—April 12th. B. of G. Rewiring internal telephone installation, call bells, &c., at the 2/1st Southern General Hospital, Dudley Road. (March 28th.)

Eastbourne.—April 16th. Electricity Department. One water-tube boiler, with superheater and travelling-grate mechanical stoker. (See this issue.)

Grimsby.—April 10th. Corporation Electricity Department. One 3,000-KW. steam turbine, 6,000/6,600-volt, 3-phase alternator, condenser, pumps, &c.; two water-tube boilers, stokers, superheaters, fans, steel chimney, &c.; cooling tower, &c. (March 21st.)

London.—H.M. Office of Works. Two 10-ton, three-motor type, 450-volt, D.C. travelling cranes, 42-ft. span and 60-ft. span. (March 28th.)

Pudsey.—Electric light installation for Unitarian Church. Specification from Rev. R. Newell, 35, Crawshaw Street.

Sale.—U.D.C. Electricity Department. 200/250-KW., 460-volt, Diesel engine and generator, switchboard panel, &c. (March 28th.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Australia.—P.M.G.'s Department, N.S.W. Material for automatic telephone exchanges in Sydney. £861. Automatic Telephones (Aust.), Ltd.—*Tenders.*

Glasgow.—Tramways Committee. Accepted:—

(1) Copper.—Charles Henderson & Co., Ltd.
(2) Gear cases for 49B motors.—The British Westinghouse E. & M. Co., Ltd.

Ilford.—Recommended:—

One Fraser & Chalmers turbine, direct coupled to Siemens alternator £12,569; Worthington-Simpson condensing plant, £4,961; one 1,000-KW rotary converter and starting panel, £5,705; 2,100/6,600-volt step-up transformers, £2,292; switchboard, 5-cubical, 6,600-volt, £1,072; 1,000-KW., D.C. switch-panel, £275.—General Electric Co., Ltd.

One 60-in. Sirocco induced-draught fan, &c., £454; one 65-H.P. motor and starting panel, &c., £489.—Davidson & Co., Ltd.

St. Helens.—Electricity Committee. Accepted:—

Cable.—B. I. & Helsby Cables, Ltd.
Spare armature for motor. British Thomson-Houston Co., Ltd.

Worthing.—T.C. Tenders accepted on Tuesday:—

Mirrlees, Bickerton & Day, Ltd.—500-B.H.P. Diesel engine, £8,792.
General Electric Co., Ltd.—Sub-contractors to above. 345-KW. dynamo, £1,652.
Bruce Peebles & Co., Ltd.—Balancing transformer and switchgear, £270.

The electrical engineer (Mr. G. Porter) and the Chairman of the Electricity Committee interviewed Admiralty Officials with reference to an offer of certain second-hand plant available for disposal, but they could not recommend the Committee to accept it.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, April 4th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Modern Methods of Water Treatment," by Mr. J. P. O. Callaghan.

London Association of Foremen Engineers.—Saturday, April 5th. At 7 p.m. At Cannon Street Hotel, London, E.C. Paper on "The Science of Fine Measurements," by Mr. V. Williams.

Salford Technical and Engineering Association.—Saturday, April 5th. At the Royal Technical Institute. At 7 p.m. Lecture on "Pig Iron: its Source, Manufacture, and Use," by Mr. W. Rawlinson.

Royal Institution of Great Britain.—Saturday, April 5th. At 8 p.m. At Albemarle Street, W. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Friday, April 11th. At 5.30 p.m. At Albemarle Street, W. Lecture on "Piezo-Electricity and its Applications," by Sir J. J. Thomson, F.R.S.

Society of Engineers (Inc.).—Monday, April 7th. At 5 p.m. At Burlington House, W. Lecture on "Modern Explosives," by Prof. J. Young.

Illuminating Engineering Society.—Tuesday, April 8th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 8 p.m. Discussion on "Light and Colour in Relation to Stage Production," to be introduced by Mr. J. B. Fagan.

Institution of Civil Engineers.—Tuesday, April 8th. At 5.30 p.m. At Gt. George Street, S.W. Paper on "The Electrical and Mechanical Equipment of the all-metal Cars of the Manchester-Bury Section L. & Y. Railway," by Mr. G. Hughes, and paper on "All-metal Passengers' Cars for British Railways," by Mr. F. E. Gobey.

Association of Engineers-in-Charge.—Wednesday, April 9th. At 7.30 p.m. At St. Bride's Institute, Bride Lane, E.C. Paper on "The Relationship Between Wages, Output and Improved Standards of Living from a Practical Point of View," by Sir Wilfred Stokes, K.B.E.

Institution of Electrical Engineers.—Thursday, April 10th. At the Institution of Civil Engineers, Great George Street, S.W. At 6 p.m. Paper on "Notes on Surface Condensing Plant, with Special Reference to the Requirements of Large Power Stations," by Mr. R. J. Kaula.

(**North-Eastern Centre**).—Friday, April 4th. Annual dinner.

(**North-Western Centre.**)—Tuesday, April 8th. At the Engineers' Club, Albert Square, Manchester. At 7 p.m. Annual general meeting and discussion on the President's Address to the Territorial Centres.

(**Scottish Centre**).—Tuesday, April 8th. At 207, Bath Street, Glasgow. At 7.30 p.m. Annual general meeting. Lecture on "The Navigational (Magnetic) Compass as an Instrument of Precision," by Mr. M. B. Field, O.B.E.

(**North Midland Centre**).—Tuesday, April 8th. At the Metropole, King Street, Leeds. At 7 p.m. Paper on "The Determination of the Efficiency of the Turbo-alternator," by Dr. S. F. Barclay and Dr. S. P. Smith.

Belfast Association of Engineers.—Thursday, April 10th. At 7.45 p.m. At the Municipal Technical Institute. Annual general meeting.

Chief Technical Assistants' Association.—Friday, April 11th. At 7 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Problems of Linking-up."

National Foremen's Association of Engineering, Shipbuilding and Allied Trades (West London Branch).—Saturday, April 12th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

Royal Society of Medicine.—Tuesday, May 6th. At 8 p.m. At 1, Wimpole Street, W. 1. Second Silvanus Thompson Memorial Lecture, by Prof. W. M. Bayliss.

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

THE following is a list of further contributions received in response to the appeal made by Mr. Hunter, the chairman of the E.T.B.I.:—

Johnson, Matthey & Co ..	£5	5	0	A. C. Bostel	£0	10	0
E. Atkinson	0	10	0	E. A. Harvey	0	10	6
Wm. White & Co.	1	1	0	J. H. Sandiford	0	10	6
R. Cruickshank, Ltd. ..	0	10	6	Crypto Electrical Co., Ltd.	1	1	0
The "Electrical Review" ..	21	0	0				

ON Friday last the annual general meeting of the Benevolent Institution was held at the Institution of Electrical Engineers. Mr. C. H. Wordingham presided, and moved that the report of the Committee and the accounts for the year 1918 should be approved; he stated that the total income was £1,168, as compared with £1,164 in 1917, and the total contributions were £746, compared with £782. In 1914, the last year in which the Annual Festival was held, the total contributions were £3,140. Members' subscriptions had fallen from £138 in 1917, to £131 in 1918, but the number of members had increased from 148 to 176. Dividends received were £132, compared with £381, and the total cost of working the Institution was £186, compared with £159, the increase being due to the increased cost of postage and stationery. As the Annual Festival could not be held last year, the chairman of the last annual general meeting, Mr. Hunter, undertook to make an appeal to the electrical industry, but owing to the illness of many members of his staff, the issue of the appeal was delayed, and the amount collected—£1,302—was not included in the accounts for 1918. The pension fund had now passed £10,000; the time when pensions would be called for was approaching, and but few pensions could be paid out of the dividends from the invested funds. Only two applications for temporary relief were made during 1918, and were met by grants; it was the policy of the Institution to endeavour to find work for those who were destitute, and on many occasions in the past, applicants had been given financial assistance to enable them to obtain suitable employment—every qualified person who had applied for assistance had received it.

The total holding of War Loan had been increased to £1,500.

The policy of creating Local Committees brought about most satisfactory results in Cardiff and district, mainly due to the energetic action of Mr. Hobbs, a member of the Committee of the Institution. A concert organised by this Local Committee in January last brought in the sum of £112. Local Committees were in process of formation at Bristol, Birmingham, and Manchester, and it was hoped in 1919 to get to work in this direction at Newcastle, Sheffield, Edinburgh, and Glasgow. Collectors had gathered a considerably increased amount; it was to be regretted that the heads of the majority of firms in the electrical industry did not assist the Institution more by appointing collectors from amongst the members of their staffs; such collectors not only brought in funds, but could also gain members more effectually than any other means.

The report and accounts were unanimously adopted, and votes of thanks were accorded to Mr. Hunter, the auditors, and the Institution of Electrical Engineers.

The members of the Committee who retired by rotation were re-elected, and Mr. R. W. Hughman was also elected a member of Committee.

It was decided that Mr. W. R. Rawlings should be invited to preside at the next annual festival.

NOTES.

London Electrical Engineers, R.E. (T.F.).—All ranks who have at any time served with the above corps are requested to send full particulars of present address, promotions, appointments, rewards, and casualties to the Officer Commanding, 46, Regency Street, London, S.W. 1.

Power Station Coal Consumption.—The technical adviser to the Controller of Coal Mines (Mr. D. Wilson) estimates that 10 to 15 million tons of coal could be saved per annum if the efficiency of all industrial works was raised to a reasonable standard. For the year ending March, 1918, 1,421 steam-operated power stations in the kingdom, excluding private stations, railways, and tramways, produced 4,674 million units for a coal consumption of 3·47 lb. per unit, or a total of slightly over 7 million tons of coal, the average thermal efficiency being about 8·49 per cent. Half the electrical energy in the country was supplied by 40 of those stations, their coal consumption being 2·57 lb. per unit, with a thermal efficiency of 11·5 per cent.; the remaining stations had an average of 6·8 per cent. These figures could, however, not be taken as conclusive arguments for super-power stations, as the following table shows, the stations A. B, and C being in the South of England, while D, E, and F are in other parts of the country:—

	A.	B.	C.	D.	E.	F.
Output (million units) ...	200	40	22	200	46	28
Coal consump. (lb. per unit)	2·53	2·32	2·49	2·78	2·4	2·4
Thermal efficiency (p.c.) ...	13·88	15·05	11·95	10·38	12·35	12·15

Electricity Supply Commercial Association.—The first general meeting of the West of England Branch was held at Bristol on Friday last, Mr. Thos. H. Gait (Bristol) presiding over a numerous attendance. Representatives from Bath and Gloucester were also present. The "Aims and Objects" were outlined, and the rules governing the Association were fully discussed. A Divisional Council was elected, and it was decided to get in touch with all electricity supply undertakings in the area allotted to the Branch, viz., Oxford, Devon, Cornwall, Somerset, and Gloucester; anyone in these counties desiring information should communicate with the Acting Secretary, Mr. Thos. H. Gait, 51, Howard Road, Westbury Park, Bristol.

Co-operation.—Mr. F. B. van Doren, writing in the *Electrical World*, points out that co-operation is essential in all phases of successful living, and perhaps nowhere more so than in the work of preventing accidents. Of the safety-first idea it is the quintessence. Where little or no co-operation exists, one will find dissatisfaction, discord, low efficiency, and numerous accidents.

"Everyone must have seen plants where the attitude of the employé is, 'Why should I care? The boss doesn't care anything for me except to get 10 or 12 hours' work. Why, when we leave the shop he never thinks of us again.' Do you suppose such a company is getting what it should in production, or what it would if some thought were given to the other fellow?

"That employer who has no thought for his employés after working hours will sooner or later find the better employés seeking employment elsewhere, and the others reciprocating the feeling. His accident record will not only be high, but his labour turnover also will be high.

"Most men are born sociable, and appreciate it when a good word is spoken to them. You can call it what you please—salve or blarney; nevertheless, from the highest to the lowest, they like it. It should not be inferred that an employer should be insincere; that would be disaster. But to give out words of good cheer, and have them come from the heart, works wonders."

"If sickness or injury comes to one of your employés, visit his home. See if he or his family is in need. This cannot always be done by the employer himself, but he can appoint some good person in his organisation to do it. He will find it will never be forgotten by either the man or his family, and returns will follow beyond expectation."

"If the confidence of the employé is once gained, it is an easy matter to hold it. Before it can be held, however, one must lay all the cards on the table, and be absolutely honest and sincere. Confidence once lost is very hard to regain. Employés are not slow to resent dishonesty, and if practised it will soon cause trouble. Honesty is the best policy with employés and public alike."

An A.E.G. Peace Conference!—The following are attached to the German delegation which is going to Versailles in connection with the Peace terms —Dr. Walther Rathenau ; Herr Deutsch, managing director of the Rhenish electrical combine , Dr. Heineken, managing director of the A.E.G. ; Herr Schmidt, managing director of the Frankfort metal combine ; and Herr Penkenberg, of the Phœnix Iron Works.—*Daily Mail.*

E.T.U. Ballot Result.—The ballot of the Electrical Trades Union has resulted as follows :—For making application for a working week shorter than 47 hours, 7,840 : against, 1,179. There was a majority of 4,486 for ceasing work for a 44-hour week, and a majority of 2,452 against ceasing work for a 40-hour week. The figures are 472 short of the necessary three-fourths majority for a strike on either proposal.

G.P.O. Electricians and the E.T.U.—A number of men employed in the Telephone Engineering Department of the Post Office, unable to obtain through their trade union the same wages and bonuses as other men in the electrical industry, have joined the Electrical Trades Union.

Inquiries.—Makers of the "Premier" tumbler switch are asked for ; also makers of the "Bengal" type of regulator, and of "Platina c," a substitute for platinum.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following have been nominated by the Council for the vacancies which will occur in the offices of President, Vice-Presidents, Hon. Treasurer, and Ordinary Members of Council, on September 30th. 1919 :—

President (one vacancy).

Roger T. Smith (electrical engineer, Great Western Railway).

Vice-Presidents (two vacancies).

L. B. Atkinson (secretary, Cable-Makers' Association).

W. B. Woodhouse (manager and chief engineer, Yorkshire Electric Power Co.).

Hon. Treasurer (one vacancy).

J. Devonshire (managing director, London and Suburban Traction Co., Ltd.).

Ordinary Members of Council.

Members (three vacancies).

S. G. Brown, F.R.S. (electrical engineer and managing director, S. G. Brown, Ltd.).

Dr. W. H. Eccles (Professor of Electrical Engineering and Applied Physics, City and Guilds Technical College).

S. E. Fedden (general manager and engineer, Corporation Electric Supply Department, Sheffield).

A. L. C. Fell (chief officer, L.C.C. Tramways).

F. Gill (consulting engineer, Winchester House, E.C.).

W. Judd (late electrician-in-chief, Eastern and Associated Telegraph Companies, Ltd.).

B. Welbourn (contract manager, British Insulated and Helsby Cables, Ltd.).

Associate Members (three vacancies).

H. J. Cash (President, Electrical Contractors' Association (Inc.)).

J. R. Cowie (assistant engineer. Glasgow Corporation Electricity Department).

E. A. Gatehouse (The British Thomson-Houston Co.. Ltd.).

Associates (two vacancies).

P. R. Allen (Castner-Kellner Alkali Co., Ltd.).

P. D. Tuckett (director, City of London Electric Lighting Co., Ltd.).

The next informal meeting will, by kind permission, be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., on Monday, April 14th, at 7.30 p.m., when Dr. R. D. Gifford will open a discussion on "Electrical Instruments."

Visits to the Osram-Robertson Lamp Works. Brook Green, Hammersmith, W., have been arranged for Monday, April 14th : Monday, May 12th ; and Monday, June 2nd. Each party will be limited to 24 members, who will assemble at the main entrance of the works at 2.30 p.m. Members wishing to take part in these visits are requested to send to the Secretary of the Institution, not later than six days before the visit selected, their names, private addresses, and business addresses.

The annual meeting of the Western Centre was held at Bristol on Monday last. The ballot for Officers and Committee Members for the Session 1919-20 resulted as follows :—

Chairman, Mr. A. Ellis (Cardiff).

Vice-Chairmen, Mr. A. J. Newman (Bristol); Mr. A. C. McWhirter (Cardiff).

Committee, Messrs. T. E. Alger, J. W. Collins, F. W. Hunt, G. H. Langdon, W. Collins.

Mr. A. P. M. Fleming, O.B.E., read his paper on "Planning a Works Research Organisation," which provoked a lengthy discussion.

Iron and Steel Institute.—The annual meeting of the Institute will be held on May 8th and 9th, 1919, at the Institution of Civil Engineers, Great George Street, S.W. On the morning of the 8th, the annual report and statement of accounts will be presented, and the Bessemer Medal will be awarded to Prof. Cav. F. Giolitti, of Turin. A number of technical papers will be read and discussed on the morning of the 8th, and during the following day. At 2.30 p.m. on the 8th, by invitation of the Institution of Electrical Engineers, a joint session will be held to discuss the following papers on electric steel furnaces :—"Developments in Iron and Steel Electric Furnaces," by J. Bibby ; "The Booth-Hall Electric Furnace," by W. K. Booth ; "The Development of the Electric Melting Furnace," by D. F. Campbell ; "The Control of Electric Arc Furnaces," by H. Coates ; "New Type of Electric Furnace," by Axel Sahlin ; and "Large Electric Furnaces," by Victor Stobie. Members may obtain advance copies of these papers on application to the Institute.

To celebrate the Jubilee of the foundation of the Institute, the annual dinner will this year be held at the Guildhall.

The autumn meeting will be held on September 18th and 19th, at the Institution of Civil Engineers.

Electrical Power Engineers' Association.—A general meeting of the Barrow and North-Western Section of the Association was held at St. Nicholas View, Carlisle, on Saturday, March 29th. Mr. G. E. Smith, chairman of the Section, presided over a representative gathering of engineers. Mr. A. O. Holt (assistant divisional secretary, Manchester) gave an address on the aims and objects of the Association. A discussion ensued, and, as a result of the meeting, a considerable influx of members is anticipated into the Section. The Section Secretary is Mr. J. F. Heslop, 7, Victoria Road, Barrow-in-Furness.

The first dinner of the Glasgow Section of the Association was held in the Trades Restaurant, Glasgow, on Saturday. March 22nd. Mr. G. L. Black. chairman of the Section, presiding. The chairman gave some particulars of the progress of the Association, and Mr. W. W. Lackie, chief engineer and manager. Glasgow Corporation electricity department, expressed his pleasure at being present. Remarks were also made by Mr. Cooper, chairman of the Scottish Division. During the evening an excellent musical programme was rendered.

Electric Steel Furnaces.—Mr. Victor Stobie read an interesting paper on "Electric Furnaces in Steel Making" at the last meeting of the West of Scotland Iron and Steel Institute in Glasgow. The main points of the process of manufacturing electric steel were described by Mr. Stobie, who declared that where an electric furnace had been a failure in a steel foundry the onus had almost always fallen on the installation itself. When installing an electric furnace the following points should be kept in view :—(1) There must be plenty of room for the furnace operators all round the plant ; (2) the furnace should not be in a stagnant atmosphere ; (3) the transformer chamber should be below furnace level when possible, so as to avoid the near presence to the furnace of the chamber walls, which would tend to confine heat around the plant ; and (4), when feasible, the furnace was best at an elevation above ground level, with a stage erected as furnace platform for the melters. This arrangement reduced the cost of removing slag, facilitated better attention to the tilting gear, and the space underneath the furnace provided warm storage for refractories underneath the stage, and avoided excavating for a transformer chamber. Electric furnaces were serviceable for any output of steel required from 10 tons per week upwards. A 5-ton furnace would yield 30 tons of steel per 24 hours ; a 10-ton furnace up to 250 tons per week ; and a 15-ton furnace 360 tons weekly. Mr. Stobie afterwards dealt in detail with the working of electric furnaces, explaining points which had been criticised, and advantages which improvements had realised.

The *Transactions* of the South African Institute of Electrical Engineers for January, 1919, contains the annual report and statement of accounts of the Institute for 1918. The income was £649, compared with £557 in the previous year, and the expenditure amounted to £449, against £429. Including bad debts recovered during the year there was a total surplus of £247, against £168. The credit balance now stands at £1.248. The total membership is 325. The Victoria Falls and Transvaal Power Co. has offered an annual award of £25 for competition for good work done by members of the Institute. The following officers have been elected for the years 1919 and 1920 :—Vice-president, Mr. R. F. Botting ; Members of Council, Mr. L. B. Woodworth, Mr. C. J. Everett, Mr. V. A. Bright, Mr. E. Grafton, and Mr. C. N. O. Dutton ; Mr. G. A. Webb and Mr. P. E. Gregson have been elected Members of Council for the year 1919. The new President is Mr. A. E. du Pasquier. M.I.E.E., who was in England at the time of the annual general meeting on January 16th.

On Monday last, Mr. G. B. Williamson, chief engineer to Messrs. Horrockses, Crewdson & Co., Ltd., gave an address on "National Power Supply *versus* Private Plant," before the members of the Bradford Textile Society. He said that the actual consumption at the present time was below 3 lb. per h.p.-hour, and in the large spinning factories the consumption was rarely more than 2·25 lb. Ordinary private plant could be much more easily brought down to a figure approaching the ideal than could public stations, during the present generation, at any rate. The public supply system. from the point of view of the conservation of capital, appeared in an unfavourable light.

Society of Engineers (Inc.).—On Monday next, Prof. J. Young, of the Royal Military Academy, Woolwich, will give a lecture on "Modern Explosives," illustrated by specimens and experiments. The meeting will be held at the Geological Society's Rooms at 5 p.m., and ladies are specially invited.

"An Alternative to Electricity"?—A note appeared under this head in the *Times* last week, showing that the reference was to the "Sonic" system of transmission which is being developed at the Sonic Works. West Drayton, by Mr. G. Constantinesco, a Rumanian-born British naturalised subject. Great secrecy is maintained regarding his inventions, which include a successful synchronising gear for firing through the propeller of an aeroplane ; it is stated that the Sonic system utilises wave motion (sound waves) in liquids enclosed in pipes for the purpose of transmitting mechanical effects, and it seems, therefore, more akin to the Bowden brake type of transmission apparatus than to anything electrical. The works, or rather laboratory, was provided by the Government to enable the inventor to carry on his work.

Exhibition of Electromedical Apparatus.—An exhibition, organised by the British Medical Association, is to be held at the Imperial College of Science and Technology next week, from 9th to 11th April, at which X-ray and other electrical apparatus will be shown.

Copper Prices.—Messrs. F. Smith & Co. report April 2nd, electrolytic bars, £84; do. sheets, no change; do. wire rods, £94; do. H.C. wire, 11¾d. Messrs. James and Shakespeare report April 2nd, copper bars (best selected), sheets and rods, no change.

Appointments Vacant.—Electrical engineer and manager (£250) for the Borough of Morecambe Electricity Undertaking; switchboard attendant (67s. 6d.) for the Lancaster Corporation Electricity Works.

The City and Guilds Technological Examinations.—A series of conferences has been held between representatives of the Board of Education and the City and Guilds Institute with reference to the future of the examinations in England and Wales of the Institute's Department of Technology. At these conferences the Board's representatives have expressed the opinion that examinations by external bodies tend to interfere with the satisfactory working of the system of instruction in grouped courses of allied subjects, and that in so far as the Institute's examinations are external they conflict with the policy of the Board as regards technical education. The Executive Committee of the Institute has, therefore, endeavoured to meet the Board's views by some modification of its system of examinations, and ultimately an agreed scheme has been adopted.

Under this scheme the Institute has agreed to abandon gradually in England and Wales all examinations lower than the final, with a few specified exceptions. In 1919 the examinations will be held in all grades, as hitherto; in 1920, Grade I in all three-grade and two-grade subjects will be discontinued, but students who have passed in Grade I in a three-grade subject in a previous year will be able to proceed to Grade II; in 1921, the final examination alone, except in the few cases referred to above, will be held at all centres in England and Wales. The scheme also provides that marks are to be given for school work and for home work, and are to be taken into account in the examination results. This has already been put into force, and will tend to modify the external character of the Institute's examinations.

Although the Executive Committee of the Institute has consented to adopt the scheme, it retains its confidence in the value of its examinations synchronised with annual school courses, not only as giving incentives to students to work, but also as keeping up the standards of education in technical schools, and in a circular-letter addressed to local education authorities it expresses the hope that the abandonment of the lower examinations will not result in depressing the present standard of the Institute's final certificates, which have a recognised value in professional and industrial life.

It will remain as essential as ever that the syllabuses of the Institute should be kept up to date, and in close relationship with the courses of instruction in schools, and with the practical requirements of ever-progressing trade. With a view to this, the scheme contemplates the setting-up by the Institute of Advisory Committees in respect of the several examinations in technological subjects, on which Committees' teachers, as well as manufacturers and trade representatives are to be appointed, a policy which is fully approved in principle. This will entail considerable additional expenditure by the Institute.

The responsibility and expense of setting up or developing their own school examinations in lieu of the Institute's lower grade examinations will now fall on the local education authorities in England and Wales.

Mr. F. Peake Sexton, A.M.I.E.E., writes expressing the greatest regret that the City and Guilds Institute has decided to discontinue the majority of the Technological Examinations, at the instance of the Board of Education; at a time when all efforts should be exerted to develop our industries, it seems the Board of Education is adopting a policy that many regard as wrong. According to his experience, since the withdrawal of the Board of Education Examinations there has been a marked loss of enthusiasm for real study in the ordinary evening classes by the students, and even in some cases there has arisen a slackness on the part of the instructors. Mr. Sexton suggests that those who share his view should get into communication, and approach the City and Guilds and the Board of Education by petition. Every effort should now be made to develop our system of education.

Electroculture at Chester.—Mr. S. E. Britton, City electrical engineer, informs us that during the last growing season, the 1·4 acres of land on Overleigh Road equipped for electroculture was used on very much the same lines as in the previous year, and for the second season no manure or fertiliser was used.

The electrical equipment consists of an A.E.D. transformer, mercury-break current interrupter and Lodge valves, and the discharge network of No. 30 s.w.g. galvanised steel wire, spaced 15 ft. apart, and suspended 2 ft. 6 in. from the ground; the network is raised as the crops grow to give a clearance of 2 ft. The apparatus is supplied with 5 amperes at 210 volts D.C., and maintains a spark ¼ in. long at any part of the discharge network when an earth wire is placed within that distance of it. When climatic conditions were suitable the discharge was used from two to four hours each day.

Owing to the long spell of dry weather during the early part of the growing season, and the abnormal quantity of rainfall when growth was nearing maturity, the season was unfavourable for electroculture.

The following seeds were sown:—

Four varieties of potatoes, peas, broad beans, French beans, turnips, swedes, onions, carrots, parsnips, beet, lettuce, cabbage, cauliflowers, savoy and brussels sprouts.

The carrots, parsnips, and swedes, did not germinate. The yield of the vegetables grown under the influence of the electrical discharge, as compared with those grown under natural control, was as follows:—

	Electroculture.		Natural control.	
	No. of roots.	Average weight per root.	No. of roots.	Average weight per root.
King Edward ...	701	·416	282	·613
Summit	2,739	1·01	1,467	1·26
Great Scot ...	3,575	1·87	589	2·4
Table Talk ...	337	1·8	122	1·84

that is, a decrease on each variety, namely, 32 per cent., 20 per cent., 22 per cent., and 2·2 per cent.

Peas gave an increased yield of 27 per cent.

Broad beans gave an increased yield of 6·8 per cent.

French beans gave an increased yield of 73 per cent.

Beetroot gave an increased yield of 88 per cent.

The other crops were not measured, but a marked difference was observed in the size of cabbage, cauliflowers, savoys, and sprouts, grown under the discharge, and these were freer from caterpillar, and ready for marketing two or three weeks in advance of those grown under natural control.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—The Southampton T.C. is recommended to increase the salary of the tramway manager and engineer (Mr. Robson) from £500 to £700 a year.

Burnley Tramways Committee, having considered the salary of Mr. Mozley (tramways manager), which is £500, plus a bonus of £75, has decided not to recommend an advance at present.

Southampton Corporation Electrical Committee has appointed Mr. H. S. Ellis, South Shields borough electrical engineer, chief electrical engineer, in place of Mr. H. F. Street, who has resigned, as already stated here.

Blackburn Electricity Committee has approved of the following increases in salaries: Deputy electrical engineer, from £429 to £500 per year; station superintendent, £7 5s. per week to £8 11s. 3d.; shift engineers, £5 to £6 3s. 3d.; switchboard attendants, £3 5s. to £4 5s. 11d.; meter and mains assistant, £4 12s. to £5 14s. 8d.; motor superintendent, £4 to £5 1s. 11d.; engineering draughtsman, £3 15s. to £5 12s. 7d.; street lighting superintendent, £3 17s. 6d. to £4 19s. 2d. The financial effect is to increase the salaries of the technical staff of the department by £800 per annum. A resolution to increase the salary of the tramways manager (Mr. Cowell) from £500 to £600 was deferred for a month.

The Controller of Coal Mines wishes to continue to retain the services of Mr. Rycroft, electrical engineer to the Heston and Isleworth U.D.C., as the work upon which he is engaged is of an important character in the national interest, but is willing to arrange for him to be free to devote one day per week to the Council's work. The Electricity Committee, however, desires Mr. Rycroft to resume his full duties as from March 31st, and has notified him of its decision and requested him to arrange accordingly. The Controller, in the course of his communication, had stated that in the present difficult conditions reliance had to be placed to such a degree upon Mr. Rycroft for carrying on an extensive organisation throughout the country that it would be out of the question for the department to part with his services at this moment.

General.—Mr. J. J. Butcher has been presented with a gold watch, by his friends in the winding and inspection department of the B.T.H. Co., Rugby. Mr. Butcher has been employed by the B.T.H. for over 16 years, and is leaving to take up another position.

Mr. W. J. Larke, O.B.E., who for 20 years has been one of the managers of the B.T.H. Co., at Rugby, has been offered by the Minister of Munitions an appointment in connection with the disposal of surplus stores, and the reorganisation of the Ministry on a peace basis. The appointment involves his resignation from the B.T.H. Mr. Larke was loaned to the Ministry of Munitions by the company in July, 1915.

Sir Henry Norman, M.P., has been appointed vice-chairman of the Imperial Communications Board, of which Viscount Milner is chairman.

Mr. A. Gibson, assistant for electrical work in the chief engineer's department of the L.C.C., has resigned his appointment.

Mr. W. J. SQUIRES has been appointed chairman, and Lieut.-Commander A. COOPER RAWSON vice-chairman, of the Highways Committee of the L.C.C.

Mr. C. E. INGLIS, Fellow of King's College, and University Lecturer in Mechanical Engineering, has been appointed to the Chair of Mechanism and Applied Mechanics rendered vacant at Cambridge by the death of Prof. Bertram Hopkinson. The annual stipend of the professorship is £850, with £450 out of the receipts of the department.

Mr. H. STILGOE, city surveyor of Birmingham, has been appointed chief surveyor of the Metropolitan Water Board at £2,500 a year. He has been in the service of the Corporation nearly 13 years; and during that time he has practically "town planned" Birmingham (40,000 acres), has prepared an elaborate scheme of road widening, and has been responsible for work connected with the electric tramway extensions.

Mr. JOHN E. RAWORTH has been joined in partnership by Mr. Ernest W. Moss, A.M.I.E.E., A.M.I.Mech.E., F.C.S., who was for some years chief assistant to the late Dr. Silvanus P. Thompson, F.R.S., and was also an assistant to Mr. H. M. Hobart, M.I.E.E. Mr. Moss has had considerable experience in patent agency work, especially in connection with metallurgical and electrical inventions. The style of the new firm will be John E. Raworth & Moss, with head offices at Queen Anne's Chambers, Westminster, S.W.

Lieutenant J. A. OGILVY has relinquished his commission in the Tyne Electrical Engineers on account of ill-health.

Second Lieutenant H. D. ST. J. LIDIARD, Tyne Electrical Engineers, who was appointed to the corps twelve months ago, has been confirmed in his rank.

Captain W. C. THORNE, Renfrew Fortress Engineers (Electric Lights Company), who was a supernumary whilst employed with the R.E., has been restored to the establishment of his corps. He got his third star in June, 1916, and prior to that was a temporary captain from the outbreak of the war, he being a pre-war officer of the corps.

Major G. A. BRUCE, M.I.E.E., Tyne Electrical Engineers, who was employed as a temporary major in the Royal Marines (Submarine Miners) during the war, has been restored to the establishment of the corps. Major Bruce was commissioned in the Tyne Engineers over twenty years ago, got his captaincy in 1903, and his majority in 1915.

Captain and Acting-Major R. W. ANDERSON, M.C., Tyne Electrical Engineers, has relinquished his field rank on ceasing to be employed with the R.E. Captain Anderson was mentioned in dispatches and awarded the Military Cross for services in the campaign of 1916.

Mr. S. SIMPSON, electrical engineer with the Yorkshire Electrical Power Co., Thornhill, Dewsbury, has resigned his position, and on Saturday last the staff presented him with a mahogany desk and chair as a token of their esteem. A party of his more intimate friends entertained him to a dinner at Bradford, at which Mr. A. L. Lunn (president) and Mr. Ellis (chairman) of the Electrical Power Engineers' Association were present. Mr. Simpson has, after ten years' varied technical and commercial experience in the development of electric power supply in the West Riding and in power problems in textile mills, collieries, &c., joined Mr. J. E. Schofield, mechanical and electrical engineering consultant, Bradford, who has specialised in industrial power equipments and fuel economy.

Mr. S. R. BLADES has been appointed as representative of the Aster Engineering Co. (1913), Ltd., of Wembley. He was for many years with Siemens Bros. Dynamo Works, Ltd., both at their Stafford Works and at the London Office. For the last year of the war he was an assistant engineer in the Anti-Submarine Division of the Admiralty.

Sir ERNEST RUTHERFORD was on Wednesday elected to the Cavendish Chair of Physics at Cambridge, in succession to Sir Joseph Thomson, O.M., who had held the chair for 35 years.

Obituary.—MR. HENRY WILDE, D.Sc., F.R.S.—We regret to record the death which occurred on March 28th, at his residence, the Hurst, Alderley Edge, Cheshire, of Mr. Henry Wilde. The deceased gentleman was 86 years of age, and therefore was probably unknown even by repute to a very large proportion of the present-day electrical fraternity. He was, however, undoubtedly one of the earliest pioneers in electrical engineering research and invention. Writing in the *Philosophical Magazine* 46 years ago, on "Some Improvements in Electro-Magnetic Induction (Dynamo) Machines," he foretold great applications by which the electromagnet "as a source of electricity is destined hereafter to live in the lives of the millions of mankind when the memory of its origin, except with the curious and the learned, shall be forgotten." He invented a process of electro-deposition of copper, a process carried on entirely with the vertical revolving mandrel, and following upon his patents many thousands of cylinders were manufactured and electrocoppered by well-known firms. He claimed to have invented the dynamo-electric machine in 1864, and his invention was utilised in searchlight work executed for the Admiralty; one report states that he made the first searchlight for battleship use. The death of Mr. Wilde recalls a controversy which arose in 1900 between him and the Society of Arts regarding the terms on which that Society proposed to confer upon him the Albert Medal. He took exception to the terms of the award because, while it gave him credit "for the discovery and practical demonstration of the indefinite increase of the magnetic and electric forces from quantities indefinitely small," it made no mention of his "invention of the dynamo-electric machine and its successful application . . . to electric lighting, and to electro-deposition of metals from their solutions." The Society eventually settled the terms as follows: "For the discovery and practical demonstration of the indefinite increase of the magnetic and electric forces from quantities indefinitely small, a discovery now used in all dynamo machines; and for its application to the production of the electric searchlight, and to the electro-deposition of metals from their solutions." Mr. Wilde subsequently presented the medal and copies of the correspondence betwen himself and the Society to the Institution of Electrical Engineers for deposit in the Museum and Archives. We also recall a controversy and action which took place between Mr. Wilde and the late Dr. Silvanus P. Thompson respecting credit alleged to have been omitted from an edition of one of his important works. Mr. Wilde was a member of the Court of Governors of the Manchester University, and a contributor and donor to the Manchester Literary and Philosophical Society. He was also an honorary member of the Institution of Electrical Engineers, and a generous contributor to its funds, the Wilde Benevolent Trust Fund, in particular, being established as the result of his beneficence.

MR. G. H. MANN.—The death has occurred, at the age of 31 years, of Mr. George Henry Mann, head of the wireless department at the Central Technical School, Leeds.

MR. STEPHEN RUSBRIDGE.—The death has occurred, at the age of 88 years, of Mr. Stephen Rusbridge, who is described as the inventor of the method of electrical communication between passenger and guard, which has been employed on the L.B. & S.C. Railway over 40 years. According to the *Daily Telegraph*, Mr. Rusbridge was formerly in the service of the electrical department of the line, and had considerable experience in electric signalling in conjunction with Messrs. Saxby & Farmer.

SIR JAMES MACKENZIE DAVIDSON.—On Monday last, Sir J. M. Davidson died at the age of 63, from heart failure. A noted surgeon and ophthalmic specialist in his early days, he came to London in 1897 and took up the study of X-rays, which were then coming into prominence, and became one of the foremost exponents of their applications to therapeutics and surgery. He was knighted in 1912, and, according to the *Times*, at the time of his death he was consulting surgeon to the X-ray Departments of Charing Cross Hospital and the Royal London Ophthalmic Hospital, and consulting radiologist to the military hospitals of the London district.

NEW COMPANIES REGISTERED.

Patent Electric Shot-Firing Co., Ltd. (153,782).—Private company. Registered March 21st. Capital, £10,000 in £1 shares. To take over the business of electric fuse manufacturers carried on by W. A. Malson, and S. R. Malson at Newbold, near Chesterfield, as the Patent Electric Shot-Firing Co. The subscribers (each with one share) are:—W. A. Malson, Salter Gate, Chesterfield; S. R. Malson, Knowsley Road, Southport, electric fuse manufacturer; J. R. Cooke, Gloucester Road, Chesterfield, electric fuse manager. The directors are to be appointed by the subscribers. Solicitor: W. E. Wakerley, Chesterfield, Derby.

Nene Engineering Co., Ltd. (153,923).—Private company. Registered March 29th. Capital, £10,000 in £1 shares. Electrical, mechanical, agricultural, and general engineers, dealers in and agents for cycles and motors, &c. First directors: J. H. Keeble, Charnwood, London Road, Peterborough, ironstone mine owner (chairman); R. M. Boothman, Thornfield, Hartford, Northwich, Ches., traveller. Secretary: A. J. Dillingham.

Dynelex, Ltd. (153,913).—Private company. Registered March 28th. Capital, £3,000 in £1 shares. Electrical, mechanical, motor, and general engineers, &c. The subscribers (each with one share) are:—H. J. Holmes, 6, Newcastle Street, E.C. 4, engineer; and R. G. Holmes, Sandilands, Surbiton, Surrey, clerk. Permanent governing director: H. J. Holmes. Registered office: 6, Newcastle Street, E.C. 4.

Marston, Billington, Ltd. (152,871).—Private company. Registered March 26th. Capital, £50,000 in £1 shares. Ironfounders, mechanical, and electrical engineers, boiler makers, lamp manufacturers, &c. First directors: A. M. Billington, Eden Works, Hayes, Middlesex; and H. W. Humphries, 23, King Street, E.C. 2, chartered accountant. Registered office: 23, King Street, E.C.

R. A. Evans, Ltd. (153,829).—Private company. Registered March 24th. Capital, £10,000 in £1 shares. Manufacturers of electric, hydraulic, and hand lifts, hoists, cranes, runways, and transports, electrical and hydraulic engineers and contractors, &c. First directors: C. Wells, Oak Lodge, Knighton Road, Leicester, manufacturer; F. A. Toone, The Lindens, Mountsorrel, hosiery manufacturer; J. A. Evans, 13, Mellor Road, Western Park, Leicester, electrical engineer. C. Wells & F. A. Toone are permanent governing directors. Registered office: Prospect Road, Leicester.

Motor Exchange and Mart, Ltd. (153,848).—Private company. Registered March 25th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electric, steam, gas, oil, or other motor vehicles, proprietors of self-starters for motor cars and aeroplanes, &c. The subscribers (each with one share) are:—J. R. Burton, Upcote, Hammers Lane, Mill Hill, N.W. 7; L. Waterhouse, 25, Gloucester Gardens, W. 2, gentleman. First director: J. R. Burton. Registered office: 30, Highgate Road, N.W.

Planet Electric Co., Ltd. (153,874).—Private company. Registered March 26th. Capital, £2,000 in £1 shares. Manufacturers of and dealers in electrical accessories and appliances, &c. First directors: H. Bennett, 56, Burton Road, Brixton, S.W. 9; W. Francis, 1, Lismore Road, Gospel Oak, N.W. 5, electrical engineer. Registered office: 5, St. George's Road, S.E. 1.

Prendergast Electrical Engineering Co., Ltd. (153,875).—Private company. Registered March 26th. Capital, £2,000 in £1 shares. Engineers, electricians, founders, &c. Agreement with J. F. Prendergast. Permanent directors: J. F. Prendergast, 155, Shaftesbury Avenue, W.C., electrical engineer; Capt. N. J. Walker, 14, North Audley Street, W. Registered office: 108, Wigmore Street, W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Power Engineering Co., Ltd.—Particulars of £11,500 debentures created February 15th, 1919, of which £2,000 were issued on March 6th, charged on the company's undertaking and property, present and future, including uncalled capital.

Newquay Electric Light & Power Co., Ltd.—Particulars of £1,000 third mortgage debentures created, and all issued, March 4th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Westinghouse Electric Export Co. (1,707F).—Particulars of the Westinghouse Electric Export Co. were filed at Somerset House on March 26th, pursuant to Section 274 of the Companies (Consolidation) Act, 1908. The company was incorporated in the State of Delaware, U.S.A., on April 21st, 1915, with an authorised capital of $100,000 in $100 shares. The principal office is at Wilmington, New Castle, Delaware. The British address is 2, Norfolk Street, W.C. 2. F. B. Rogers, of 1a, Edith Road, West Kensington (European manager), is authorised to accept service of process and notices.

Evans, O'Donnell & Co., Ltd.—Satisfaction to the extent of £3,000 on December 31st, 1918, of trust deed and supplemental deed dated 1900 and 1916, securing £40,000 debenture stock.

Cosmos Engineering Co., Ltd.—Particulars of £54,000 fourth mortgage debentures created November 19th, 1918, issue January 28th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Bastian Electric Co., Ltd.—Land Registry Charge on 47, Stamford Hill, N., dated March 6th, 1919, to secure £900. Holder: J. W. F. Graham, 29, Gracechurch Street, E.C.

S. C. C., Ltd.—T. M. Till, of 28, Bucklersbury, E.C., was appointed (*a*) on March 7th, 1919, as receiver of the premises charged by debenture dated September 5th, 1918, and (*b*) on March 14th, 1919, by the Court as receiver of the personal property, goodwill, and assets under debenture dated November 11th, 1918.

Montreal Tramways & Power Co., Ltd.—(*a*) Particulars have been filed of £1,500,205 10s. ($7,300,000) five-year 6½ per cent. secured gold bonds, created February 10th, 1919, and all now issued at 92 per cent. Property charged: $7,000,000 aggregate par value of the fully-paid 5 per cent. mortgage debenture stock of the Montreal Tramways Co., and $2,500,000 of five-year 6 per cent. gold bonds of the company, dated March 1st, 1919. (*b*) Particulars have also been filed of £513,769 ($2,500,000) five-year 6 per cent. gold bonds, created February 10th, 1919, and all now issued at 92 per cent. Property charged: 21,000 shares of $100 each par value in the common stock of the Montreal Tramways Co. Trustees for both series: The Montreal Trust Co.

Yorkshire (West Riding) Electric Tramways Co., Ltd. (84,167).—Capital, £600,000 in £5 shares (70,000 pref. and 50,000 ord.). Return dated February 14th, 1919. 46,261 pref. and 40,977 ord. shares taken up; £436,190 considered as paid. Mortgages and charges: £272,373.

CITY NOTES.

Brompton & Kensington Electricity Supply Co., Ltd. At the annual meeting, on March 27th, the chairman said that having regard to the position which the company had achieved, last year's working was the worst in its history. The net receipts fell to the figure of twenty years ago, though the gross receipts were double what they were then. This result was in spite of the fact that they had gradually raised the price until they were charging lighting consumers the maximum rate authorised by the provisional order. The revenue was reduced by various restrictions, and the expenses were increased by the statutory advance of wages, so that the labour bill amounted to double what it was before the war, and equalled in amount the entire net revenue, or nearly half as much again as the dividend to be distributed on the entire ordinary capital. Moreover, the same cause was responsible for the increase in the cost of coal, and as if to add to their difficulties, the Coal Controller diverted their coal contracts in favour of less provident undertakings, so that they were compelled to accept delivery of coal of vastly inferior calorific value, involving the handling of a larger tonnage, and resulting in a coal cost of 16 per cent. more on an output of 8 per cent. less, or an increased total cost per unit of upwards of 30 per cent. They had been unable to obtain any redress for the hardships suffered at the hands of the Government. For the greater convenience of the collieries and the railways, they were asked to provide themselves in summer with a large part of the coal they required in winter, but the response they made to the appeal brought advantage only to others, and although they applied for relief under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, and submitted an estimate of the loss they would sustain if such relief were withheld—which was absolutely justified by the event—the rhetorical representations of the local authority and the London County Council, which were entirely prejudiced and uninformed, prevailed with the Board of Trade, and if the company had not received interest on its loan to the Accessories Co., and trenched upon the balance brought into the accounts from the previous year, the action of these sapient authorities would have reduced their dividend by upwards of 40 per cent., although Parliament expressly decided that it would be reasonable to reduce the losses of ordinary shareholders in such undertakings as theirs whose financial position was adversely affected by circumstances arising out of the war to 25 per cent. of the pre-war rate. Restrictions were gradually being relaxed, and the revenue for the current year already showed some signs of recovery, but the industrial position remained very unsettled, and any reduction in their expenditure must necessarily be slow to ensue. The past year had brought the renewed confirmation of the wisdom of their "accessories" policy. The Accessories Co. was not only a good customer and a good advertisement, but was a growing source of profit. The electrical industry generally was in a critical stage, and in view of the many projects which were being advanced, it was impossible to say what the future of the Metropolitan companies might be in the industrial reconstruction which was now in contemplation.

Hastings & District Electric Tramways Co., Ltd. Presiding at the recent annual meeting, Mr. George Kitchin referred to the big advances in wages of motormen and conductors since 1914. They were awaiting the result of deliberations respecting the 44-hour week proposal. They had to cut off the Sunday traffic last year owing to the Government orders to reduce coal consumption by 15 per cent. That meant a reduction of £150 to £300 per week revenue, according to the season. Petrol, which in 1914 cost under 11½d. per gallon, to-day was costing 2s. 5½d., while coal, which in 1914 was charged at 19s. 6d. per ton, was now charged at 35s. or thereabouts, and that for slack coal. Meanwhile, gear wheels had risen in price 348 per cent., pinions 450 per cent., tires 216 per cent., armature coils 245 per cent., tickets 100 per cent., rails 197 per cent., and so on throughout the whole long list of materials required to keep the lines in going order. With the demobilisation of the armies and the return to greater freedom of movement which must follow on the final conclusion of peace, it would become possible to restore not only the Sunday traffic, but also the other services which they had had to curtail owing to the war. Coal, petrol, and other materials must gradually resume more normal prices, though it was not to be expected that they would fall to as low a level as that of 1914. Still some not inconsiderable relief could be looked for in that direction. But wages—well, they could judge what prospect there was of any reduction of that item. In restoring the services they would have to restore also the number of their employés; and every motorman added to the staff meant an addition to expenses of £150 to £170 a year at the least. There was, however, grave reason to fear that the traffic receipts, which had been steadily rising throughout the period of the war, would now take a turn in the other direction. The large number of soldiers now at Hastings would probably be, to a considerable extent, demobilised; while the opening of the eastern coast resorts, and, eventually, of the Continent, to holiday traffic, must have an injurious effect on the number of visitors to Hastings. Meanwhile, they were still, in combination with other tramway interests throughout the country, endeavouring to get Parliamentary sanction to an increase of the fares as fixed by statute and agreement.

British Columbia Electric Railway Co., Ltd. The report for the year ended at June, 1918, states that the net revenue shows an improvement of approximately £42,000 over the previous year. This has enabled the payment of the full 5 per cent. dividend on the cumulative preference stock without recourse to the reserve fund. For the previous year it was necessary to take £44,000 from the reserve fund to make this payment, and for the year ended June 30th, 1916, £70,000. In June, 1918, a demand was made by employés for a large increase in wages, which in view of the condition of the company's earnings it was quite impossible to concede. The matter was referred to arbitration, but early in July a serious strike took place which paralysed the tramway services. In order to put the company in a position to meet the demand and thus resume the services, the authorities granted the company the right for a period of nine months to charge a six cent fare in the city of Vancouver, and to make certain increases in the fares in other cities and districts served. These increases in fares, the continued general improvement in conditions, and the increased demand for power for manufacturing purposes have enabled the company to meet the increased cost of wages and materials, and gradually to improve its net revenue month by month during the current year. On the other hand, the directors call attention to the fact that the right to charge the increased fares expires on April 8th next, and has not as yet been extended. The rates for domestic light and power in the city of Vancouver were reduced on January 1st, 1918, to 8 cents per KW.-hour, and in consequence of urgent representations of the public authorities and as part of arrangements for adjusting the general situation, these rates were again reduced by the company on January 1st last to 6 cents. It is as yet impossible to state with any accuracy what the cost to the company will be of this large reduction in lighting rates, but it must for some time cause a very considerable decrease in the revenue derived from domestic lighting, although it is hoped that the reduced price will, in course of time, lead to a substantial increase in the consumption of light and power. The Government of the Province of British Columbia has introduced a Bill to establish a Public Service Commission, conferring upon the Commissioners very far-reaching powers over this enterprise and all other public utilities in the Province.—*Financial Times.*

British Engine Boiler & Electrical Insurance Co., Ltd.

Interim dividend 5s. per share, paid last July. Final dividend 8s. 6d. per share and the usual bonus of 4s. per share, all less tax.

At the annual meeting, held at Manchester last week, Mr. R. C. Longridge, who presided, said that during the year there had been a substantial growth of £32,735 in the income of the company, raising it from £115,172 to £181,207, but the increase in the cost of claims, in inspection charges, and in other liabilities, had fully kept pace with this growth. Electrical plant, in the insurance of which the company specialised, had contributed a substantial proportion of the increased income, and the prospects were that there would be continued and rapid developments in the use of electrically-driven machinery. The large interest which the company had in the insurance of electrical plant of all descriptions had necessitated the employment of specially trained engineer surveyors located at convenient points throughout the country, in order that they might be readily accessible for the periodical inspection of insured plant and for dealing promptly with breakdowns. In recent years the insurance of power plant had become more hazardous than formerly. The steam turbines and gas engines in use now were often much larger than any that were met with a few years ago, but reliability had not kept pace with the development in size, so that accidents were relatively more numerous and infinitely more costly. This aspect of the case was being brought home to public authorities and those responsible for electrical generating stations, with the result that they were showing more inclination than formerly to pay for the inspection and insurance of their power plant. The increase in the size of machines had led to some demand for insurance against damage to surrounding property which might be caused by the disintegration of heavy machinery running at high speeds. Apart from the increase in hazards there had been a heavy increase in the cost of all repairs during 1918. In many cases the charges of engineers had risen as much as 150 per cent. over pre-war cost. Incidentally this very feature had caused firms to look favourably on the question of insuring their plant.

British Aluminium Co., Ltd.

The annual meeting was held on Friday last. Mr. A. W. Tait, who presided, said that the profit, after making provision for excess profits tax, amounted to £420,426, as compared with £423,662. The trading profit was £351,697, a decrease of about £17,000. On the other hand, interest and dividends showed an increase of £16,500. The trading for the whole period was under Government control, and the results were not so good as those of the previous year. That was due to a reduction in price as well as to further increased costs of production at their works both at home and in Norway. The output had been the largest in the company's history, and the demand for their productions for war purposes were heavy. The company had rendered great service in the supply of an essential metal which was urgently required for many purposes, particularly for explosives and aircraft. There had been a rapid increase in production of aluminium throughout the world, especially during the period of the war, to meet the great demand, and that increase had been considerable in Norway and America. The whole of that production was urgently needed during the period of the war, but the sudden stoppage of hostilities caused serious dislocation in the industry. The effect of the armistice was the immediate cancellation of large numbers of orders, with the result that large stocks had accumulated, not only in this country, but abroad. There was also a natural hesitancy on the part of buyers to make forward contracts due to the uncertainty and difficulty of getting industry restarted in its ordinary channels. It was necessary to take immediate steps to meet those conditions by curtailing production as far as possible to the approximate demand. That had been done in this country and in other countries where aluminium was produced, and with a view to encouraging demand there had been a substantial reduction in price. The demand depended upon the general requirements of industry. Unfortunately the resumption and development of peace production was greatly hindered by the general uncertainty which existed with regard to labour, the irksome restrictions which still remained in some measure in regard to exports, and by the shortage of freight. In view of the valuable concessions which labour had obtained with regard to hours and rates of wages, he hoped it would soon settle down to give the requisite production to justify those concessions, and that trade would rapidly begin to develop so that the country might be able to carry the enormous burden with which it had been saddled in consequence of the war, and the social and economic schemes which were urgently required for the betterment of the country might be put in hand at the earliest possible moment The question of the aluminium industry was somewhat complicated by the fact that at the present moment there were large stocks of metal in the hands of the Government. It was necessary for reasons of national safety that those stocks should have been carried during the war, but now the war was finished it was equally necessary that those stocks should be realised. The Government, however, appreciated that it would be bad business to throw those stocks upon an unwilling market, as that would have the effect of breaking prices, and bringing the selling price considerably below the cost of production. That would do serious injury to what had been admitted to be a "key" industry. The Government therefore had made arrangements whereby the stock they held would be gradually disposed of as the demand for the metal increased, in a manner which would not unduly affect the position of the industry in this country. Although the present conditions were difficult, he was of opinion that if industry could resume its normal proportions it would not be long before they saw improvement, because the developments which took place in the demand and uses for aluminium previous to the war were of a most encouraging nature, and much progress had been made since in consequence of the war. Therefore, although to-day there was a large surplus capacity of production throughout the world, he hoped that within a reasonable period of time not only would that be taken up, but that it would be necessary still further to increase production in order to supply the demand. The future for the metal was bright when they considered the large demands which must in time be made, in consequence of the development in the motor, chemical, electrical, and aeroplane industries, and for domestic utensils, and other commodities for which it was eminently suited, in addition to the demands which had been and would continue to be created by research work in connection with alloys, in which aluminium played an important part. The costs of production during the year had shown substantial increases over those of the previous year, and he thought it would be some considerable time before costs were substantially reduced. On the other hand, prices had been substantially reduced in order to re-establish the demand for the metal. Referring to the Bill which the company promoted in the House of Lords last year for the development of a large water-power in Scotland, which was withdrawn on second reading owing to opposition which certain of the provisions met with, the chairman said that the scheme was supported by the Board of Trade and other Government departments. The matter was still under consideration, but no definite decision had been taken as to future action, as that would depend largely on the Government's attitude and policy with regard to hydroelectric development. In that connection, a Government Commission had been appointed to investigate the resources of the country in that respect, which had just issued an interim report. Having referred to the figures in the balance sheet, the chairman, in conclusion, said that while their industry, like all other industries of the country, was going through an anxious time in consequence of the change over from war to peace conditions, he hoped and believed that that period of change would be comparatively short. In a large measure, however, that would depend upon the Government realising the importance of releasing industry from all unnecessary restrictions, and doing everything in their power to increase the supply and reduce the price of the necessary commodities of life. The urgent question of housing should also be tackled without delay.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

At the annual meeting, on March 25th, Mr. J. H. Armstrong, the chairman, said that the labour unrest resulting in stoppage of works within their area, naturally had reduced to an extent the profits of the year, as their heaviest load was during the last two months of the year. Their trading results during the past year had already been affected by the many increases in salaries and wages which had been thrust upon them by the Committee on Production, or as the result of Government awards to assist in meeting the increased cost of living, which, in one manner and another, resulted in an increased cost, as compared with the previous year, of more than £54,000. The restricted use of light and heat, the consequence of the Household Fuel and Lighting Order, and the restrictions in connection with new supplies to private houses, had also had an adverse effect. Taking these drawbacks into account, and the enhanced cost of coals and materials generally, they ought to be satisfied with the results of the year. The total war increases in salaries and wages during 1918 represented £103,214, or an increase of 106 per cent. upon what was paid in 1914. Their transfer to plant and renewals and improvements account was £20,000 less than in the previous year, as they did not think they would have so large an expenditure on this account as they had had in the previous year; and, further, they would be able to make use of their newer and more economical generating plant, instead of having to rely upon the older stand-by stations to meet a portion of the load. Last year they hoped that Carville station would have been completed by the end of 1918. Owing to delays, however, it was not now expected that the station would be completed until the latter part of the current year; they had had, however, the use of a considerable portion of the plant, boilers, &c., throughout the greater part of the past year. Unless anything unforeseen arose, it was hoped that a portion of the New Tees power station might be running towards the late autumn, and that the remainder would be in operation by the middle of next year. The total capacity of the three main power stations, when the developments in hand were completed, would be: Carville, 124,000 H.P.; Dunston, 96,600 H.P.; and Tees, 53,000 H.P.; a total of 273,600 H.P. Reference was made in the report to the further issue of share capital amounting to £500,000 in October last, and he was glad to say that the total applications considered amounted to £1,189,444, which showed the opinion of the public as to the soundness of the company. In regard to the Cleveland Co., the results had been far from satisfactory, owing to the heavy charges in the shape of war increases of salaries and wages, and also to the very high prices ruling for coal consumed in its uneconomical power station. Although 7,113 additional H.P. was connected during the twelve months, and the increase in units sold to consumers amounted to 3,228,000, the profits for the year (subject to audit) were only £26,788, as against £38,779 in the previous year, the result being that whilst last year the company was able to divide 2 per cent. on its preference shares, as a contribution to the Newcastle Co.'s profits, the surplus for this year, after discharging the interest on the debenture debt, was insufficient to justify a payment being made on the preference capital. They would remember that when dealing with the proposed exchange of shares with the Cleveland Co., at the meeting in March, 1917, reference was made to the difficulties under which that company was labouring as a result of the war, owing to the falling off in the supply of current from waste heat stations, and owing to its only possessing a small and uneconomical coal-fired station from which to obtain the remainder of its requirements. It was for those reasons that the new Tees station, a portion of which was approaching completion, was contemplated as part of the Cleveland development scheme that was to produce current at the lowest possible cost. The coming into operation of this station would enable material economies to be effected, and the results of that district would be further improved if, and when, the supply from waste heat stations approximated that which was received before the war. The question of electric power supply was being specially considered by Parliament, and it was probable that in a very short time there would be some definite statement as to the action which the Government intended to take under its proposed scheme of control. The board of the Newcastle Co. had no further information as to what was likely to happen in the event of the measure receiving the consent of Parliament, but he thought that under any circumstances it was not likely that they would be disturbed, or prejudicially disturbed, for some time to come. It must be borne in mind that the object that the Government was aiming at was based, to a large extent, upon the policy that that company had been following for a period of years, and which had resulted in them acquiring and bringing under one control the power supply of a number of smaller companies, which, on account of their limitations, were not able to run economically and profitably. It would seem likely, therefore, especially after the reference which was made in the report of the Parliamentary Committee to the developments in, and the working of, their area, that they might be asked to carry on without any change other than that which might be necessary both in the interest of the Government and of that company, and which would be provided for under the proposed Government control. Under those circumstances, he did not think they need expect anything but fair treatment from the new department, which was only what the company was entitled to receive, having regard to the development work which had been undertaken within their area. It was difficult, owing to the great uncertainty of what was likely to happen during the next few months to make any forecast of the future, so much depended upon the effect which labour unrest might have in delaying contemplated developments. They had also had a temporary drop in load due to the cessation of the manufacture of munitions, which had been considerable, and further, they were still faced by increased costs. Against those adverse factors they had the encouraging facts that the actual applications for additional supplies on hand at present amounted to no less than 65,000 H.P., of which 28,000 H.P. represented further supplies required in the Middlesbrough area. These additional connections, when made, would considerably more than counteract any reduction in the load due to the curtailment of the munitions manufacture, but the rate at which they would be made must depend to some extent upon the settlement of the labour problems with which the country was now faced, and must, in any case, take considerable time. He thought that, however uncertain the outlook might be, they could look forward with confidence to the future, once the transition stage was passed.

Dr. J. T. Merz seconded.

Mr. Gemmell criticised the absence of detail in the balance sheet. There was, as had been stated, no return from the Cleveland Co., which represented £800,000 of capital and more, and this, he thought, did not reflect credit upon taking over the company. Mr. Gemmell was referring to a pamphlet he had published,

When Mr. W. H. Knowles, a shareholder, interrupted, and asked for a show of hands by those who resented Mr. Gemmell's remarks, and some were held up, but the majority of those present did not vote.

The Chairman said Mr. Gemmell seemed to have a grievance, but he did not know what it was.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

Telegraph Construction & Maintenance Co., Ltd.—37,350 additional shares of £12 each, fully paid, Nos. 37,351 to 74,700.

New Issues.—An issue of 7 per cent. cumulative preference shares is now being made by the Midland Electric Corporation for Power Distribution, Ltd., to provide additional working capital. Subscriptions are invited for 40,000 preference shares of £5 each at par. These shares include the 13,079 subscribed for by the British Insulated & Helsby Cables, Ltd.

The Electric Construction Co., Ltd., is offering to the shareholders 75,800 ordinary shares of £1 each at 21s. 6d. per share, and the proceeds are to be devoted to extensions to the works and plant at Wolverhampton, and other purposes.

The Anglo-Portuguese Telephone Co., Ltd., is offering to existing share and debenture holders an issue of £50,000 5 per cent. extension debenture stock (free of income tax up to 6s. in the £) at the price of 101. The stock is offered *pro rata* to existing holders in the proportion of £1 of stock in respect of every £4 of shares or stock now held. The issue is underwritten. The prospectus states that the complete figures of the business for the year 1918 are not yet available, but it is known that both gross and net income exceed the 1917 figures. Now that the war is over the difficulties lately experienced in procuring plant, machinery and accessories for keeping pace with the normal demand for service are expected to disappear; 1,000 new subscribers are now waiting to be connected up. The present issue is being made for the purpose of providing the wherewithal to carry out these necessary extensions.

Shawinigan Water & Power Co.—The gross earnings for the past year amounted to $3,621,074, an increase of $718,864 compared with the preceding year, and the net revenue to $1,410,093, an increase of $59,229. The various companies owned and operated by the Shawinigan Co. had a satisfactory year, although the increased expenses absorbed the slight increases which were made for power and lighting. 1,058,127,769 units were generated during the year, an increase of 12 per cent., and additional power was purchased from the Laurentide Power Co. The directors estimate that work on the development of the Gres Falls will be commenced in 1920, and will take two years to construct; the Falls will produce about 100,000 H.P.—Canadian *Electrical News.*

Dividend at the rate of 7 per cent. per annum for the past quarter.

Compania Andina de Electricidad Sociedad Anónima.—The directors have recommended the payment of a dividend of 10½ per cent. for the year 1918. The available balance was $203,462. $10,000 is credited to the depreciation fund; $5,000 to the issue of obligations account; $10,173 to the legal reserve fund; $9,331 to the board and syndic; $168,000 to the payment of dividends; and $958 is carried forward. In spite of increased working expenses, the result was satisfactory. Owing to the exceptional shortage of water power, the thermic power house had to be used almost continuously for several months. An abundance of water is anticipated during the present year, and already the price of fuel is falling. The Compañia Electrica del Sud, in which the company holds considerable interests, is progressing satisfactorily, and tho results for the year 1918 will probably be similar to those of the preceding year.—*Review of the River Plate.*

Bristol Tramways & Carriage Co., Ltd.—Revenue for 1918, £749,873; working and general expenses and renewals, £634,776; net revenue, £133,249; debenture and other interest, £22,666; interest on uninvested reserve, carried to reserve, £6,634; 4 per cent. preference dividend, subject to tax, £14,250; 7 per cent., free of tax, on the ordinary shares, £35,000; to reserve for contingencies and renewals, £40,000; carried forward, £14,700. The receipts of the tramways department show a decrease of £467, and those of the carriage department an increase of £105,670. Passengers carried on cars and motor omnibuses 61,813,124, a decrease of 2,168,651. The corporation obtained a further order from the Board of Trade extending the time for exercising its option to purchase the tramways undertaking to October 31st, 1919.

Lanarkshire Tramways Co.—Revenue for 1918, £192,530; expenses, £126,050. Contributions to local authorities, £6,271; debenture and other interest accounts, £5,143; reserve for depreciation, £12,000; maintenance reserve, £7,600; balance brought forward, £3,207. Dividend on shares, 9 per cent. for the year; to directors, £1,892; carried forward, £5,912. Revenue increase, £40,095; expenses increase, £32,077. Owing to labour and materials difficulties it has been impossible to maintain the undertaking in the usual state of repair, and the £7,600 transferred to maintenance reserve is for repairs to be undertaken after the war. Passengers carried 31,695,400, against 27,570,046 in 1917. Average fare 1.45d., against 1.31d. Mileage 2,503,434, against 2,435,508.

London Electric Wire Co. & Smiths, Ltd.—Five per cent., less tax, on ordinary shares for half-year, making 7½ per cent. for the year. £10,437 carried forward.

According to the *Financier*, it is proposed to capitalise £322,035 of the reserve by the issue to ordinary shareholders of 64,407 ordinary shares of £5, credited as fully paid, in the proportion of one new share for every share held; the new shares ranking for dividend as from January 1st, 1918.

Winnipeg Electric Railway Co.—Net operating revenue for 1918 $1,176,496. Interest on debenture stock, &c., being deducted, the net income stands at $289,784; depreciation $201,050. Balance $88,734, plus $1,214,131 brought forward. Surplus carried forward $1,242,865.

Reading Electric Supply Co., Ltd.—Net revenue £13,572, against £10,573. £4,500 to depreciation, dividend, 4 per cent ; carried forward, £1,004.

Bell Telephone Co. of Canada.—Two per cent., less tax, for the past quarter.

Doulton & Co., Ltd.—Five per cent., less tax, on preference shares for the year 1917.

STOCKS AND SHARES.

TUESDAY EVENING.

GENERAL improvement in gilt-edged securities has led to a firming-up of the tone throughout the Stock Exchange. What apprehensions there were of dearer money have given place to a more hopeful feeling in regard to the money market. The Budget prospect displeases. Talk of a seven-and-sixpenny Income Tax does not tend towards cheerfulness. But even in income-tax matters the Stock Exchange has shown itself an extremist in times past, and its members delight to say that they hope for the best while they prepare for the worst.

Labour difficulties are less pressing, therefore less depressing. Industrials have begun to attract attention again. The few luckless wights who receive the same pay for their work as they did prior to the war may join with the investor in bewailing the heavy increases granted to others, but the latter reck naught of that, and each conceded demand whets the appetite for more. Home Railway stocks are mildly better on the temporary settlement in the world of railwaymen, though changes in price are of no consequence. British Electric Tractions are heavy again, the ordinary shading off to 15½. British Electrical ordinary stock has further hardened to 82, and there is little enough to be obtained at that price.

"Summer-time," cum frost, snow, and biting winds, makes a poor advertisement for electricity supply shares. The market is a quiet one. Ex dividend markings have brought in no new buyers. At the Brompton & Kensington meeting the other day, the chairman dealt lengthily with the hardships under which supply companies are labouring as a direct result of Government actions. The coal position is admittedly grave. In some directions, however, affairs are getting better. The return of men from the Services will make its beneficial effect felt more and more as time goes on, though here, again, the Government have thrown a superfluous—not to say a scandalous—handicap upon industry by their lavish extravagance in the matter of unemployment allowances.

The investor has no cause to complain that he does not know what to do with his money. New issues are receiving favourable consideration. The underwriting for the preference shares of the Midland Power Distribution Co.—the prospectus of which is now published—was taken eagerly. Numbers of newcomers are in course of preparation for the public, and before long there will be a rush of prospectuses, thanks to the raising of the Treasury's restrictions upon the offer of shares in domestic companies.

The report of the Waste Heat & Gas Electrical Generating Stations shows a reduction of about £2,600 in net profit, which comes out to £26,100 for last year, but the dividend is maintained at 8 per cent., the same as that for each of the past eight years. The Automatic Telephone Co. has declared a dividend of 6 per cent., and the shares have risen to 31s. 6d. The reason for the rise is due, however, to the strong hope that automatic telephoning may be adopted by the Post Office for the whole system. Apparently the chief reason for its not being put in hand at once is the expense that would be involved in making the change, but such a trifle would surely not be allowed to stand in the way, according to a sarcastic jobber in the market, of the present Administration. Marconis remain a firm and active market, and in their case expectation fastens upon the idea of either a big dividend or a substantial bonus—or both—to be declared shortly by the International Marconi Marine Co. The shares in the latter have gone up to 4 7/16, and Canadian Marconis to 16s., Americans remaining at a shade below 30s.

It goes without saying that the Stock Exchange is watching with the keenest interest the developments in connection with the Water Power Resources Committee, whose report, just issued by the Board of Trade, is regarded as a live contribution to the interests of the country. To utilise water power on a much bigger scale than ever before attempted has for many years past been a favourite dream of Stock Exchange men practically acquainted with electrical schemes, and at last it appears as though something were actually going to be done in this direction. The Canadian and American undertakings formed for this object have been on the whole successful, and have absorbed a good deal of British money. It is urged that the same idea can just as well be worked out on this side of the Atlantic, to the saving of coal, and the profit of water-power projects.

British Insulated shares have given way to 1⅞, which is ex dividend, apparently on some disappointment that the meeting did not produce a more optimistic speech from the chairman. British Westinghouse preference have firmed up to 2½. Siemens have had a smart rise of 12s. 6d. to 6¾, on various favourable rumours, one of which deals with the possibility of a share-splitting scheme, while another hints at amalgamation with some similar company. It is rather interesting to recall that Siemens shares were sold some time ago to a financial group, by the Public Trustee, at a price said to be about £3 5s. per share, rather less than half the present quotation.

Dealings have begun in the ordinary shares of the English Electric Co., and the price is 26s.-27s. The company owns all, or practically all, the shares of Dick, Kerr, the Coventry Ordnance Works, the Phœnix Dynamo Manufacturing and the Willans & Robinson Companies. The properties are stated to have a total area of 172 acres. Electric Constructions are not quite such a good market at 25s., the price having weakened a little in consequence of the offer to existing shareholders of about 76,000 ordinary shares at 21s. 6d., the latter price being ex the dividend of 1s. a share, which the old will receive. Naturally, this involves a turn to those who can sell the old at the market price and take up the new shares. There is nothing much doing in the rubber market, and the base-metal issues remain somewhat dull. The armament group is steady, though Vickers are slightly easier, owing to the dividend announcement not yet having made its appearance.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price April 1, 1919.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	10	8	7½	—	£6 8 0
Charing Cross Ordinary	4	4	3½xd	—	5 14 4
do. do. do. 4½ Pref...	4½	4½	3⅜	—	6 13 4
Chelsea	6	8	3¾	—	4 1 1
City of London	8	8	11⅞xd	—	6 14 8
do. do. 6 per cent. Pref. ..	6	6	10xd	—	6 0 0
County of London	7	7	10⅝xd	—	6 11 0
do. do. 6 per cent. Pref.	6	6	9¾xd	—	6 3 1
Kensington Ordinary	7	6	6⅞xd	—	5 2 2
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref...	6	6	3⅞	—	7 14 10
Metropolitan	4	5	3¼	—	7 13 10
do. 4½ per cent. Pref. ..	4½	4½	3¼	—	6 18 6
St. James' and Pall-Mall	9	10	7⅛	—	7 0 4
South London	6	6	2⅞xd	—	6 19 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6⅝	—	6 0 9
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. T l. Pref.	6	6	99½	—	6 0 7
do. Def.	1½	83/6	21⅞	—	7 13 0
Chile Telephone	8	8	7⅜	— ⅛	6 8 6
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	—	*6 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	22	22	32¼	—	6 16 6
Indo-European	13	13	67½	—	6 13 0
Marconi	20	20	4⅞	+ 3/16	4 2 0
Oriental Telephone Ord.	10	16	2½	—	4 0 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	1/3	1/3	1 11/16	—	*3 15 0
Western Telegraph	8	8	16¾xd	—	*4 16 10
HOME RAILS.					
Central London Ord. Assented ..	4	4	62½	—	6 8 0
Metropolitan	1	1¼	26½	— ½	4 14 7
do. District	Nil	Nil	24½	—	Nil
Underground Electric Ordinary ..	Nil	Nil	3¼	—	Nil
do. do. "A" ..	Nil	Nil	9/3	—	Nil
do. do. Income ..	4	5	94½	— ½	*6 6 10
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	3¼	— ⅛	—
do. do. 2nd Pref. ..	—	—	3¼	—	—
do. do. 6 Deb... ..	5	5	66½	—1	7 10 5
Brazil Tractions	—	—	55½	—	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	6	5	62	—	8 0 0
do. do. Preferred	Nil	Nil	41	—	Nil
do. do. Deferred	Nil	Nil	41	—	Nil
do. do. Deb. ..	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds ..	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds ..	Nil	Nil	62	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	67	—	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	3¾	+ 1/16	4 0 0
British Aluminium Ord.	10	10	1[illegible]	—	6 12 6
British Insulated Ord.	25	12½	1⅞xd	— 1/16	6 13 4
British Westinghouse Pref. ..	7½	7½	2½	+ 1/16	6 3 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	3¼	— 1/16	6 3 1
Edison-Swan, "A"	—	—	[illegible]	—	8 0 0
do. do. 5 per cent. Deb. ..	4	5	74½	—	6 14 8
Electric Construction	10	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6½	10¼	—	6 6 4
do. Ord.	10	10	17⅝	—	*5 13 4
Henley	25	25	2 1/16	—	6 8 9
do. 4½ Pref.	4½	4½	4	—	6 12 8
India-Rubber	10	10	17	—	*5 17 8
Siemens Ord...	—	10	6¾	+ ⅝	*7 8 2
Telegraph Con.	20	20	24½	—	4 16 6

* Dividends paid free of Income Tax.

THE PRESENT ELECTRICAL OUTLOOK IN CANADA.

By A. S. L. BARNES, A.M.I.E.E.

(*Continued from page 360.*)

Canada has probably done more than any other part of the British Empire in developing water power, not only in actual horse-power, but in proportion to her available resources, and, in addition, very extensive surveys have been made, and an enormous mass of information in the shape of stream flow records, precipitation, run-off, &c., has been gathered; when a few more years have passed, such information will be sufficiently reliable, as furnishing details from which good average figures can be obtained, to enable engineers to gauge very closely the minimum power capacity of a large number of potential sources of hydraulic power. Records covering only short periods are practically useless for this purpose.

The water-powers of British Columbia have been roughly estimated at 3,000,000 H.P., of which some 230,000 H.P. have already been developed; the following are some of the uses to which this power has been applied:—

Smelting, mining, lighting and industrial power, tramways, lumber and wood-pulp manufacture, &c.

In the "Prairie Provinces" of Manitoba, Saskatchewan and Alberta, are to be found many great water-powers on the Winnipeg, Bow, Nelson, Saskatchewan, Churchill, Athabasca, Peace, and Mackenzie Rivers; those on the Nelson River alone, are estimated at over 2½ million H.P., this is said to be conservative; on this river there are 19 possible power sites that would produce from about 80,000 to 235,000 H.P. on the turbine shaft on a basis of a minimum flow of 50,000 cb. ft. per second.

For the Province of Ontario, the following tabulation gives the best and most recent authoritative figures:—

TOTAL AMOUNT OF POWER CAPABLE OF DEVELOPMENT.

Ottawa River and tributaries	688,000	H.P.
Great Lakes tributaries	446,000	,,
Hudson Bay slope .., ...	250,000	,,
James Bay slope	1,500,000	,,
International boundary rivers	2,045,000	,,
Total potentiality	4,929,000	,,

TOTAL AMOUNT OF POWER ALREADY DEVELOPED.

Ottawa River and tributaries	71,000	H.P.
Great Lakes tributaries	137,000	,,
Hudson Bay slope	22,000	,,
James Bay slope	30,000	,,
International boundary rivers	462,000	,,
Total developed power	722,000	,,

The estimated water power available in Quebec Province exceeds 5½ million H.P., of which only about 525,000 H.P. has been developed or approximately 10 per cent. of the total.

The Maritime Provinces of New Brunswick, Nova Scotia, and Prince Edward Island, have also very considerable water powers within their confines, although these are not found on the stupendous scale which characterises other portions of Canada.

Canada's share of the estimated low-water power on the St. Lawrence river alone is 1,800,000 H.P. of 24-hour power, and if diversity be considered, a demand of nearly 2½ million H.P. could be met from this source only. The power development on this river and its tributaries is already large—the Shawinigan Water and Power Co. has five power stations in operation, with a generating capacity of 350,000 H.P.; 11 of the generators are 20,000-H.P. units; six of the transformers are of 15,000 K.V.A. each; the transmission lines comprise 1,100 miles of high-tension lines, and include one span which is the highest and longest in the world the span is 4,800 ft., and the height of the towers is 375 ft. above the St. Lawrence river; the maximum load on the systems was 220,000 H.P. in 1917, serving a population of 1,500,000 over an area of 20,000 sq. miles in 115 municipalities. The company states that the electro-chemical products manufactured in the Shawinigan Falls district annually have now reached a value of over £6,000,000; these products include calcium carbide, ferro-silicon, carborundum, aloxite, silicon, magnesium, carbon electrodes, steel, acetic acid, and its many derivatives, aluminium, &c.

The Montreal Light, Heat and Power Co. obtains most of its power from Cedar Rapids, where the Cedar Rapids Power Co. has a plant capacity of 120,000 H.P., and possesses water rights up to a capacity of 180,000 H.P. The first-named company handles altogether almost a quarter of a million H.P.: the net earnings have grown from £164,000 in 1902 to £1,120,000 in 1918.

Advertisements have recently been inserted in some of the daily papers, stating that in the vicinity of Montreal there is 300,000 H.P. of electrical energy available for sale to manufacturers; the advantages of the Montreal district were pointed out as well.

The Hydro-Electric Power Commission of Ontario expects to have 200,000 H.P. ready in 1921, and can, if necessary, increase this amount to 300,000 H.P.; and allowing time for the necessary works, a very few years would, if the demand warranted, suffice to enable it to increase this to 1,000,000 H.P., the whole being derived from Niagara Falls. It is expected that the cost of power in the Niagara district will fall below even the present favourable rates; that at Niagara Falls itself is about £2 5s. per H.P.-year.

During this year the Commission has had a peak load, on all its systems, aggregating over 200,000 H.P.; it commenced in 1910 with 750 H.P. Power is supplied at cost to 225 municipalities. About 5,000 hamlets and farm consumers are served, and during the war hundreds of applications from farmers had to be refused, as power had been requisitioned for the manufacture of munitions, about 75 per cent. of the total power supplied by the Commission being devoted to this purpose. The Commission's systems serve an area almost as large as that of England.

Canada possesses the largest electric-furnace installation devoted to steel manufacture in the world—this is located at Toronto, and comprises 10 6-ton Héroult furnaces, taking a normal full load of 1,500 KW. each; the output of each furnace averages probably about 35 tons per day, and, no doubt, it is possible to keep about eight of these furnaces in continuous operation, the other two being shut down for repairs, &c.

There are several other electric-furnace installations in the Dominion, one or two of them much larger than the one just mentioned, but the latter do not make steel.

As in England, during the war, many existing factories adopted electric driving instead of steam, gas, &c., and many new ones were equipped with electric motors.

Developments in electric traction have been held in abeyance, naturally, during the past four years, but this matter is bound to come to the fore again. Papers on the advantages of railway electrification like that of Mr. E. W. Rice, jun., before the American Institute of Electrical Engineers at the beginning of last year,* are sure to have an influence in Canada as well as in the States, and it is practically certain that if the Dominion Government takes over the Grand Trunk Railway, the question of electrifying considerable sections of this line, particularly in Ontario, will come up.

The use of electricity in houses is very much more common here than in England, and, in addition, people are more inclined to buy various appliances such as heaters, vacuum cleaners, smoothing irons (the smoothing iron load of the Hydro-Electric Power Commission on Tuesday afternoon is said to run into several hundreds of horse-power), toasters, coffee percolators, fans, electric-cooking stoves, &c.

Many farmers now have their premises lighted by electricity, and in Ontario they are making contracts for 2 H.P., this enables them to do the light work of the farm —milking, chopping, &c.—while the farmer's wife can iron, sweep the carpets, &c. At times when more power is needed, *e.g.*, for threshing, silo filling, &c., several farmers pool their contracts and work as a syndicate: ten or twelve of them will combine thus and purchase a portable equipment comprising transformers, switches, &c., and a 25-H.P. motor; this is utilised by each farmer in turn, while all the rest undertake to use practically no current during the time when the large motor is in use, so that the sum of their respective 2-H.P. contracts is not exceeded. The rural lines which serve the farmers and hamlets are beginning to pick up other loads on the way—such as stone-crushing and brick-making plant, quarries, &c.

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* ELECTRICAL REVIEW, April 12th, 1918.

Electric pumping in municipal water works is also becoming very general, while, in the smaller towns, electric pumps with stand-by units consisting of centrifugal pumps direct-connected to high-speed gasoline engines in sizes up to 150 H.P. or so, are found to make a very good combination, as the more expensive steam stand-by, required for fire purposes by the Fire Underwriters, costs a great deal more to install, takes up much more space, and requires steam to be kept up in the boilers all the year round, thus running up a very considerable coal bill.

From the foregoing it will be realised that Canada's natural resources are wonderful indeed in their extent and variety, and that there will be immense developments during the next decade or so is hardly a matter for doubt, and in it all electricity will play a very important part.

Extension of existing hydro-electric systems, building of new ones, electrification of railways, more general adoption of electric power in mines, factories, and all kinds of industrial establishments, increased use of electric power for large electro-chemical and electro-metallurgical works requiring scores, or even hundreds of thousands, of horsepower, may be looked for, as well as a rapid growth in domestic demands.

Were Canada situated as are Britain's other "Dominions beyond the Seas," the electrical manufacturers might have a reasonably good chance of securing the greater part of the available trade in their lines without excessive effort; but this country is unlike all the other Dominions in having a great manufacturing, English-speaking nation at her borders—a nation that is fully alive to all the possibilities of this land, and does not intend to let any good chances slip through her fingers.

That the United States has faith in Canada and her economic soundness is abundantly evident from the way in which the inhabitants of that country have invested capital here, by establishing large industries. What numbers of American concerns now have their Canadian counterparts it is impossible to say, but there are certainly many of them.

Canadian statesmen, since the signing of the Armistice, have been speaking optimistically about the country's future; that is good policy, but now many of the business men are doing the same, and are speaking publicly in confident terms as to the prospects for trade. Responsible men connected with several shipbuilding firms in particular, have stated that there is work in sight for their plant for several years to come.

Canada expects, and is ready, to take a share in the reconstruction of the devastated portions of Europe—whether she can compete on an economic basis with the larger and older countries for such work remains to be seen, but undoubtedly most of the large firms are keeping a close watch on the situation.

(*To be continued.*)

X-Rays Applied to Concrete-Ship Construction.—The author of an article in the *Pacific Marine Review* has devised an application of X-rays as a means of maintaining a constant standard of moisture and disposition of reinforcement in concrete-ship construction. The procedure is to show by means of a series of X-ray photographs that the standard of uniformity of mix and compactness is maintained; to observe any misplacement of reinforcing, which, recognised in time, may still be remedied; and to detect the presence of voids as the structure develops, thus permitting of their timely elimination. The outfit weighs about 90 lb., and its cost is stated not to be excessive. The method will also be valuable for examination of vessels after sea experience.

FUEL ECONOMY FROM THE HOUSEHOLDER'S POINT OF VIEW.

By ED. C. DE SEGUNDO, A.M.Inst.C.E., M.I.Mech.E., M.I.E.E.

Last autumn there appeared in the Electrical Review an article entitled "The Householder and Clause 7 of the Coal Rationing Order," which appears to have been understood by a few and misunderstood by many, and suggestions subsequently reached me from various quarters to the effect that some *positive* statement upon the relative merits of gas, coal, and electricity, for warming our houses, would be welcomed by householders. This, however, is impossible of achievement, because few householders look at the matter from the same point of view, and the conditions to be fulfilled vary widely in different households. Moreover, human beings are not like Kew-certified thermometers which respond equally to identical thermal conditions, and the knowledge that x thermal units were being let loose in a room per hour would not induce the same state of consciousness in every individual mind. You cannot make a man feel warm by arithmetic however simple, and we do not *argue* with ourselves whether we *ought* or *ought not* to feel cold, we only know that we *do* or *do not* feel cold.

The efficiency, in practice, of any apparatus is a function of the degree of skill with which it is used. We all know that no special education is necessary to teach us freely to spend other people's money, and however economical a gas cooker, for instance, may be when operated by those who are interested in promoting the sale thereof, or who have to foot the bill for the gas consumed, the actual efficiency of that apparatus in the hands of the average domestic servant will never approach the attainable efficiency, and the discrepancy between the attainable and the actual may be quite alarming. The same remarks apply, of course, to the electric cooker.

There is one thing, however, to be said for the electric heater. When your meter registers one Board of Trade unit, you know that your electric stove has given out 3,410 thermal units (subject to a small variation one way or the other due to fluctuations in the volage of supply), and there are no products of combustion to be negotiated.

But when you have consumed 1 cb. ft. of gas—especially under present-day conditions of supply—you cannot be sure whether you have liberated 450 or 550 thermal units; indeed, while it cannot be *more* than the latter figure, it may be *less* than the former, owing to incomplete combustion, to variations in meteorological conditions, or to other causes, and there are products of combustion to be disposed of. But in the disposal thereof—according to modern practice—a certain ventilating effect is concomitantly produced, the value of which, in some form or other, should be credited to the performance of the modern gas-fire.

I will just set forth the results obtained by certain modifications I introduced in my heating arrangements at home at the end of September, 1918, in consonance with the admonitions of the Coal Controller. (This does not imply agreement with *all* his conclusions.) While these results are of no scientific value, they serve at least to emphasise the influence of some of the "indeterminate factors" referred to above.

I suppressed:—

A large gas cooker in the kitchen (rated consumption unknown).
Two gas fires (rated at 44 and 50 cb. ft. per hour).
One gas radiator (rated at 50 cb. ft. per hour).
One gas stove (rated at 40 cb. ft. per hour), and
Four incandescent gas burners (presumably 5-ft. burners).

I retained:—

Four gas stoves (rated at 35 cb. ft. each per hour), and
Three gas burners (one very seldom used).

I installed:—

Three 20-in. high and one 25-in. high Magnet stoves, burning anthracite and coke (incidentally, these very useful stoves will consume many other forms of "combustible").
One 6-ampere hot plate (used very seldom).
Two two-bar and one three-bar Arora electric heaters (rated at 750 watts per bar).
One 50-watt half-watt lamp.
Two 20-watt lamps.

My house is lighted throughout by electricity.

The cost of installing and connecting up the separate heating circuit and mains, and of apparatus purchased, was, roughly, £30.

The comparative consumption of gas, coal, and electrical energy, is given in the following table :—

—	Last quarter of 1917.	Last quarter of 1918.	1917-18.	1918-19 estimated.
Coal	7 tons	4·50 tons	16 tons	18 tons (including anthracite and coke)
Anthracite ..	—	0·75 ,,	—	
Coke	—	0·30 ,,	—	
Electricity—Heating ..	—	261 units	—	800 units
Gas—Lighting / Heating } ..	51,200 c.f. Proportion for heating estimated at 40,000 c.f.	7,250 c.f. Proportion for heating estimated at 5,100 c.f.	193,000 c.f.	23,000 c.f.

So far as the gas cooker in the kitchen is concerned, I am in a position to convict it out of the gas company's own mouth—or, rather, meter readings. From September 11th to October 1st (on which date the cooker was disconnected), the consumption was, on the average, 130 cb. ft. per day. Probably the manufacturers could make it do the most astonishing things for 130 cb. ft. of gas a day. Be that as it may, by the abolition of this cooker, the gas radiator, two gas fires, one gas stove, and four gas burners, I have reduced last quarter's gas consumption by 85 per cent., as compared with the corresponding period in 1917, and have not increased my coal consumption, and everyone in my house considers that the heating is more satisfactory than it was under the old plan.

It must be clearly understood that I am not condemning the gas cooker, nor the use of gas for heating or cooking, *in principle*. I am simply recording the results of observations which show clearly the great discrepancy in practice between "attainable" and "actual" performance, but in what proportions this is to be divided between avoidable and unavoidable waste, it is not easy to say. The "coefficient of moral responsibility" is not the same in all domestic servants—or other individuals. I must, however, assume the "coefficient of rectitude" of my gas meter to be a reasonably constant quantity. I have tested for leakage, and find it negligible, about 250 to 300 cb. ft. per annum.

Now, as to the financial result. For the purposes of comparison, we must, of course, adopt the same prices for the fuels, respectively, in 1917 and 1918. Let us put gas at 4s. per 1,000 cb. ft. ; and coal, anthracite, and coke, at 35s. per ton.

The comparative cost for heating would then work out as follows :—

—	Last quarter of 1917.		Last quarter of 1918.	
Coal	7 tons ...	£12 5 0	4 50 tons ...	£7 18 0
Anthracite ...	—	—	0·75 ton ...	1 6 0
Coke... ...	—	—	0·30 ton ...	0 12 0
Electricity ...	—	—	261 units ...	1 6 0
Gas	40,000 cb. ft.	8 0 0	5,100 c.f. ...	1 0 0
		£20 5 0		£12 2 0

This shows an appreciable saving, and there is no doubt that, so far as feeling "pleasantly warm" is concerned, we have been much better off under the new *régime* than under the old. But it by no means necessarily follows that a similar "household" living in a similar house would have had the same experience. Very much depends, for instance, upon the number of rooms in which *continuous* heating is desirable or necessary. Supposing, for instance, that some of us had fallen victims to the "flu" during the last quarter, my consumption of fuel for heating would unquestionably have been much greater. I cannot be absolutely sure that, so far as *necessity* is concerned, my heating *requirements* were exactly similar last quarter to those in the corresponding quarter of 1917.

My "Arora" electric heaters have been most useful for heating rooms occupied for short periods. In such circumstances they certainly possess advantages over the gas stove, as they are portable and their "range of action" can be made as wide as one pleases by a little forethought in selecting suitable positions for the wall plugs. No doubt a gas stove would have been cheaper per 1,000 TH.U. usefully emitted, but, as I was situated, *I* would rather pay more, and have my "Aroras." That, however, is a purely personal matter.

There is not the slightest doubt that everyone of us could effect considerable economy, without sacrificing comfort, by care and attention to detail, however our houses may be heated ; but I would not like to go so far as Mr. A. H. Barker, who, I believe, claims that the 30,000,000 tons annually used for domestic heating could be reduced to 6,000,000 tons.

There are many staunch advocates both of electricity and gas for cooking. Considered purely as a means of generating heat for cooking food, I think there can be little question as to the superiority of electricity over gas. The question of cost is one which everyone must decide for himself. The cash paid for the fuel consumed is by no means the only factor, nor, perhaps, the most important factor, when cleanliness and health and dietetic considerations are in question. Furthermore—as has been remarked above—so far as heat content is concerned you know where you are with a Board of Trade unit ; you cannot always be so sure with a cubic foot of gas. A Board of Trade unit is equivalent to 3,410 B.TH.U. At 500 B.TH.U. per cb. ft., 6·82 cb. ft. of gas should liberate the same quantity of heat. Thus electricity should cost 0·2d. per Board of Trade unit in order to be on a par, as regards cash value, with 500 TH.U. gas at 2s. 6d. per thousand.

But it is difficult to see how a gas cooker—with any pretence of avoiding the risk of contamination of the food by the products of combustion—can transmit to the food as high a proportion of the heat liberated as the properly designed electric cooker. I do not think my gas friends should quarrel with me if I put the relation of the two as x for the electric cooker to $0·7\,x$ for the gas cooker. In other words, instead of 6·82 cb. ft. of gas, you would have to burn 6·82 × 1/0·7, or 9·74 cb. ft. of gas to obtain, *in effect*, 3,410 useful thermal units.

Again, there are other fuels. Anthracite, for instance, which is *not* suitable for gas making. Mr. Dowson and others have shown that 1 B.H.P.-hour can be generated with a consumption not exceeding 1 lb. of Welsh anthracite. This might easily correspond to not exceeding 1½ lb. of fuel per KW.-hour supplied if a man had his own poor-gas plant. If, moreover, the generation of electrical energy for heating were dovetailed in with the other calls on his power plant, the cost of generating the additional electrical energy for heating need not very greatly exceed the cost of the additional fuel consumed.

Putting anthracite at 30s. per ton, such extra cost, all told, might easily approach 0·25d., as against 0·2d. for gas (at 2s. 6d. per 1,000) for equivalent heat value.

In such circumstances, a man who set any store by cleanliness and other hygienic factors, would not hesitate to employ electricity for all heating purposes. If the practical efficiency of the electrical and the gas-heating devices be taken as 100 to 70, the cost would be 0·25d. for electricity as against 0·28d. for gas, and electricity would thus be practically on a par with gas as regards cost.

No very useful purpose can be served by the mere tabulation of *ex parte* statements on the relative merits of gas and electricity. It is a subject for discussion—not for controversy, because, as a very eminent man has told us, "by controversy a man is rarely persuaded of anything except of the truth of his own view." Each has its merits, and can only usefully be considered from that point of view. Many important factors enter into this question (ventilation, for instance), a complete consideration of which could only be attempted in a treatise.

If householders were to install a separate apparatus for their hot-water supply, and seek competent advice upon the system of heating best suited to this and their other requirements, we should have travelled a long way on the road to Mr. A. H. Barker's ideal saving of 24,000,000 tons coal out of the 30,000,000 tons annually consumed for domestic purposes.

SOME NOTES ON ELECTRICAL METHODS OF MEASURING BODY TEMPERATURES.

By ROBERT S. WHIPPLE, M.I.E.E.

(Abstract of paper read before a joint meeting of the Royal Society of Medicine *and the* Institution of Electrical Engineers.)

The study of body temperatures is of importance, especially in connection with the preliminary stage of phthisis. The object is to study in an elaborate manner the normal curve of the temperature of man, and the changes which that curve exhibits during the very earliest stages of pulmonary consumption and of surgical tuberculosis, when the organism is the prey of the tubercle bacillus alone and not yet subject to a "mixed infection"; for Gamgee realised by long-continued observations carried out with the clinical thermometer, the utter want of precision and insight which prevailed in reference to the very earliest stages of phthisis, when physical signs are yet almost, or completely, in abeyance, and when the cough, the anæmia, the loss of flesh, and slight temperature abnormalities are the only guides the physician has to rely upon.

Gamgee decided to adopt thermo-electric couples in preference to resistance thermometers, and for work of high precision his decision was a correct one.

The thermometers used were of two kinds, one for taking the temperature of the surface of the skin and the second for taking the temperature of the cavities of the body. The thermo-electric couples were made of copper-constantan.

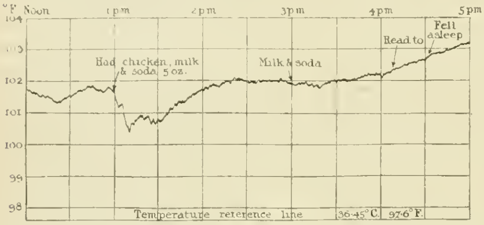

Fig. 1.—Temperature Record obtained with Photographic Recorder.

Gamgee placed his cold junction in a water bath heated by a gas burner controlled by a sensitive Lowry toluol regulator, the temperature of the bath remaining constant to within 0.01 deg. C. during periods of 10 to 15 days. By placing the cold junction in a vacuum flask immersed in the water bath so much lag between it and the water is introduced that the temperature remains constant over long periods of time to within 0.01 deg. C.

To heat the water bath electrically, a modified form of toluol regulator fitted with platinum contacts, so that the mercury opens or closes an electric circuit, may be employed. This circuit brings into operation a sensitive relay, which in turn makes or breaks the current in the heating circuit.

A great many types of thermo-couples for determining the skin temperatures have been devised, the simplest model of all proving to be the most satisfactory. It consists of a copper-constantan couple, the wires of which are 0.1 mm. (0.004 in.) in diameter, mounted between two pieces of canvas embedded in rubber and vulcanised, the couple being exposed on the surface of the rubber.

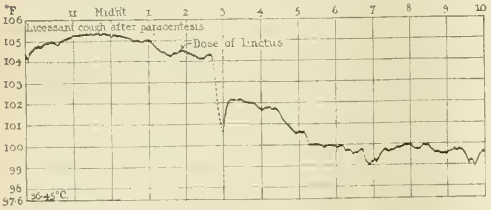

Fig. 2.—Record obtained with Thermo-couple and Thread Recorder.

In a thermometer of this type the lag is less than a couple of minutes, and the instrument is admirably adapted for taking surface temperatures. The rectal thermometer as used by Woodhead and Varrier-Jones consists of a No. 6 rubber catheter, the couple or junction being embedded in the eye of the catheter, and the surrounding space filled with rubber solution which has been allowed to dry. The junction is brought flush with the surface of the rubber tube, and is fully exposed. This thermometer also has a lag of about two minutes. The recording apparatus consists of a moving-coil galvanometer of the D'Arsonval type, the movements of which are recorded either photographically or autographically by an inking device.

The photographic recorder developed by Gamgee was a very efficient instrument. The galvanometer was of the sensitive moving-coil type, 10.5 ohms in resistance, and gave a deflection of 12 mm. per micro-volt on the photographic paper, which was 116 cm. from the galvanometer. The electromotive force given for a copper-constantan couple is about 40 micro-volts for a temperature difference of 1 deg. C. It was necessary therefore to place manganin resistances in series with the galvanometer coil to reduce the sensitivity of the galvanometer, and also to reduce the temperature coefficient of the circuit.

The manganin resistance was made adjustable so that varying degrees of sensitivity could be obtained. A sensitivity of about 40 mm. per deg. C. was frequently employed, although for special cases 120 mm. per deg. C. could be used. The bromide photographic paper (200 mm. wide) was moved by clockwork at a rate of 1 mm. per minute. By means of a shutter a beam of light from a fixed mirror was occulted every half-hour, so that a time scale was marked on every record sheet. This record also formed the zero reference line, the distance of any point on the temperature curve from it being a measure of the temperature at that point. The optical arrangements of this instrument were particularly simple and efficient. The image of a slit in front of a Nernst lamp fell on a very narrow horizontal slit placed close to, and in front of, the photographic paper. A reproduction (half full size) of a small piece of a record is given in fig. 1, which shows well the sensitivity of the apparatus.

In accurate research work no autographic recorder can compare with a photographic one. The thread recorder is a variety of the continuous recording moving-coil galvanometer.

Fig. 2 is a reproduction of a record obtained by Gamgee in a case of pneumonia, almost certainly of tubercular origin, taken with the thread recorder. At 10 p.m., paracentesis on the left pleural cavity was performed to withdraw the greater part of a large effusion which had formed. The operation was followed by a rise in temperature from 104.2 deg. F. to about 105.3 deg. F., probably in great measure accounted for by the incessant coughing of the patient. At 1.25 a.m. a dose of the hospital "linctus," containing 12 drops of liq. morph. hydroch., was administered. The cough was almost at once relieved, and at 3.25 a.m. the patient fell asleep, when the temperature sank almost suddenly, as shown by the curve, to 100.5 deg. F. This curve, which represents temperature changes, illustrates admirably the value of the method of registration under discussion.

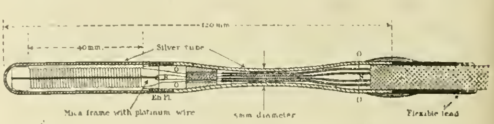

Fig. 3.—Rectum Resistance Thermometer.

The thermo-electric method is unsuitable for general use on account of the delicacy of the apparatus and the necessity of employing an elaborate thermostat. With the resistance method no thermostat is required, and it is easy to obtain a tenfold deflection with the same galvanometer. When a rectal thermometer is used, the resistance coil—assuming it is correctly designed and made—follows the temperature changes in the body without appreciable lag.

For clinical work the resistance thermometer offers the great advantage that the apparatus is robust and simple. A thermometer, the particular design of which is due to Dr. Varrier-Jones, is shown in section in fig. 3. The essential part is a fine platinum wire wound round a mica frame in the form of a cross, the coil on its frame being enclosed in a silver tube. This tube is constricted so that it may not irritate. The thermometer coil is connected by comparatively heavy copper leads to the instrument by which the temperature is to be recorded. The electrical details of the arrangement are shown diagrammatically in fig. 4. The arrangement consists of a Wheatstone bridge in which the thermometer forms one arm, balancing coils being arranged in the opposite arm to balance the resistance of the thermometer at any predetermined temperature. Ratio coils of equal resistance and of approximately the same resistance as the thermometer are inserted in the other arms of the bridge. In addition to the leads attached to the thermometer coil two other leads, or compensating leads, are carried from the thermometer to the recorder. These leads are short-circuited near the bulb of the thermometer, and are introduced into the opposite arm of the bridge to compensate for the effect of changes in temperature of the leads.

The moving-coil galvanometer is connected across the arms of the bridge, and it is the deflections of the coil that are recorded. For the small angle through which the coil is deflected (maximum 25 deg.) the deflections are proportional to the amount the bridge is out of balance, viz., to the change in resistance of the thermometer coil with a given change in temperature. In a direct deflection method such as this, the galvanometer deflection must depend on the electromotive force of the battery, and what few complications there are in the apparatus have had to be introduced to control this. The method of adjusting the apparatus is simple.

Before the battery circuit is closed the zero of the galvanometer is determined. This should be on the line corresponding to the lowest temperature (say 96 deg. F.) recorded by the thermometer. If it is not, the pointer is readily brought into the desired position by rotating the torsion head from which the galvanometer coil is suspended.

The electrical zero of the bridge—the one in which no current is passing through the galvanometer coil when the battery switch is closed—is then determined. The plugs attached to the heavy flexible leads, and shown symmetrically on both sides of the diagram, are placed in the zero positions. The thermometer coil and its leads, and the corresponding balancing coils and compensating leads, are then cut out, the ratio coil being balanced against the coils R_3 and R_4. If when the switch is closed the galvanometer is not deflected, the electrical zero is correctly adjusted. If it is deflected, the slider S is moved on a slide wire until balance is restored. The instrument must then be adjusted so that the galvanometer coil is deflected through a definite angle for a given change in the resistance of the thermometer. Experience showed that the making of the test by heating or cooling the thermometer was tedious, and as the test should be made every 24 hours it was advisable to introduce a test resistance which would be equivalent to an increase in the resistance of the thermometer for a given change in temperature. In practice a manganin coil having a resistance equal to the increase in resistance of the thermometer coil for a rise in temperature of 10 deg. F. is used. This is marked "calibrating," and is shown on the right of the diagram. When this is introduced the galvanometer should be deflected, and the pointer should read 106 deg. F. If it reads low then the electromotive force on the bridge is not sufficiently high, and should be raised by cutting out some of the battery resistance by means of the rheostat. In the same way, if the galvanometer reading is too high the electromotive force should be reduced. In the later form of the instrument the sensibility is altered by an adjustable magnetic shunt, thus avoiding the use of a rheostat.

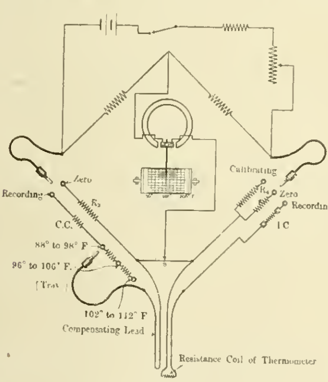

Fig. 4.—Diagram of Resistance Thermometer Circuit.

These various adjustments having been made, the two plugs are placed in the "recording" positions, and the apparatus is ready for use. The travelling plug (Trav.) is placed in the hole corresponding to the temperature range desired, the usual one being 96 deg. F. to 106 deg. F. By introducing or cutting out the coils shown in the arm of the bridge opposite to the thermometer, the range over which records can be obtained may be varied.

The thermometer should be slightly warmed, and will record the temperature of the body in about 5 minutes after insertion. A record obtained by Dr. Varrier-Jones with a thread recorder and resistance thermometer is reproduced half size in fig. 5.

In practice the outfit is simple to operate; the recorder and its accessories are so simple that to the medical man accustomed to using some of the modern medical-electrical apparatus the instrument can be regarded as another tool added to clinical medicine.

Summarising the experiments of the chief workers in the subject from the instrumental point of view, it may be said that:—A continuous record of the temperature of the human body can be best obtained by an electrical thermometer placed in the rectum. For accurate research work, when it is desired to record variations in temperature to an accuracy of 0.02 deg. C., a thermo-electric couple must be used in conjunction with a photographic recorder. If rapid or very small variations in temperature are being recorded a photographic recorder must be used. For ordinary clinical work a resistance thermometer with an autographic recorder is the most practical instrument. It can be relied upon to record body temperatures to an accuracy of at least 0.1 deg. C.

Prof. G. Sims Woodhead, in opening the discussion, exhibited numerous records showing the variations in temperature that occurred before and after the administration of tuberculin. Records of both human and animal subjects were shown, the speaker explaining how the variations of temperature so recorded aided the physician in his diagnosis. In his opinion, the method would be of very great value in all cases of fever. One advantage of the method was that the recording apparatus could be located in the laboratory while every bed in the hospital could be wired up to it, so that it was not necessary to transport the whole apparatus from bed to bed as each record was taken.

Dr. P. C. Varrier-Jones explained that resistance thermometers were preferable when measuring the body temperatures of animals, and thermo-couples in the case of human subjects. Two great advantages were that the apparatus was extremely simple, and records could be taken over long periods without the slightest objection on the part of the patient. It was also possible to obtain what might be called an inverted curve of the patient's temperature, and thereby a very early diagnosis was possible.

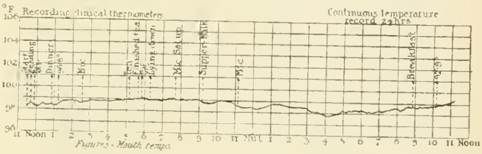

Fig. 5.—Record obtained with Resistance Thermometer and Thread Recorder.

Dr. E. P. Cumberbatch said that, in connection with recent experiments on diathermy, he had attempted to ascertain the temperature rise of an internal organ of a patient by means of a thermometer inserted close to the organ. An electric current was passed through the patient's body by means of external electrodes, but apparently the current passed entirely through the periphery, because after an interval of 20 minutes the thermometer indicated no change of temperature whatever. He suggested that if it could be possible to determine the temperature rise, if any, in such a case by the method described in the paper it would be of the greatest utility and importance.

Mr. E. H. Rayner expressed admiration for the work done and apparatus used as described in the paper. When the very small differences of temperature that were measured and the extremely low voltages and currents that were used were considered the results achieved were, in his opinion, marvellous. The degree of accuracy attained was very high, and it reflected much credit on the Cambridge Scientific Instrument Co., Ltd., for having developed the apparatus with which such results could be obtained.

CO-ORDINATION OF RESEARCH IN WORKS AND LABORATORIES.

By the late H. R. CONSTANTINE, A.M.I.E.E.

(Abstract of paper read before the Institution of Electrical Engineers.)

There was a time when this country was able to hold its own against any other nation in all branches of science, but the opening years of the present century found us rapidly falling asleep and allowing our present enemies to take our place.

The reasons for this are not to be found in any lack of ability or want of inventive genius; nor to any incapability to carry out the work prescribed by the brains of the nation. The material has been there all the time, and our backsliding has been entirely due to lack of responsiveness to scientific genius by our responsible Government authorities, manufacturers, and financial leaders, as well as to the absence of organisation. Many examples could be given of new ideas or inventions devised by British brains which have met with absolutely no reception, and have therefore been taken abroad, there to be eagerly picked up.

After having lived on the Continent for over five years, and after mixing with scores of Germans of all classes, and especially engineers, the author would emphatically state that their average intelligence is no greater than that of a batch of similarly-situated Englishmen. As a result of improved methods of education, with special reference to science and engineering, the knowledge may be greater or wider, but the actual intelligence or genius is certainly not superior. The only real advantage which the German firms have had in the past over British competitors lay entirely in the capacity for organisation and the recognition of the possibilities of raw ideas.

This capacity for organisation is not entirely inborn, but is mainly the result of intensive training and development during the past two generations. If we had gone to the same trouble, we could have become at least as proficient in the art. This has been proved time and again during the present war.

German organising capacity was devoted to the good of the German nation as a whole. This is a most important point, and may be considered as the crux of the whole question. The German people, whether willingly or as the outcome of its educational system, or compelled by force akin to militarism, has been taught to sink self for the common good, to sacrifice individualism for collectivism, for the purpose of conquering the world's markets for the benefit of the nation as a whole. The Britisher, on the other hand, has as an individual been so proud of his own prowess as to want to fight all his own battles, being too stubborn or selfish to communicate his methods of working to his fellow-workers. To be independent is in many respects a praiseworthy constituent of a man's character, but if we don't adapt ourselves to changed conditions, we deserve to get left behind in the race.

Apart from the co-operative efforts arising out of or in connection with the war, the past two years have seen the birth of many combinations of interests for the sole purpose of strengthening and extending the trade of the country after the war. We now have several powerful banking amalgamations to offer a stronger financial front against external competition, numerous unions of workmen to protect the rights of the individual worker, and various associations of employers to further their different businesses. Among the latter are to be found financial combines to assist the weaker members in times of monetary stress, manufacturing associations to prevent too keen a competition and too much overlapping between the different works, to say nothing of the co-operative selling organisations to simplify and cheapen the getting of orders, especially abroad. In every case the fundamental principle underlying the co-ordination is to be found in the words "unity is strength."

But amongst all these co-operative organisations we must look in vain for the slightest approach to any real co-ordination as far as research into new and improved principles or better methods of manufacture is concerned. It is true that quite recently the Privy Council appointed a Committee for Scientific and Industrial Research, which received a grant of £1,000,000, took over the National Physical Laboratory, and is at present carrying out researches on the production of tin and tungsten in Cornwall; also that a National Fuel Station has been established at Greenwich, that a British Scientific Instrument Research Association has been formed, and that several other minor attempts at co-ordinated research have been made, but nevertheless each individual manufacturer is still content, generally speaking, to jog along on his own, too independent or too proud to seek the help of his fellow-workers.

For the above reasons the whole proposal to erect a new national research laboratory and to employ whole-time inventors may be abandoned as being impracticable. As an alternative scheme, use could be made of the existing laboratories of the country, universities, colleges, technical institutions, and most manufacturing concerns. Although perhaps we have still a great deal to learn from foreign countries as regards adequate facilities for research, yet we undoubtedly possess many absolutely first-rate research laboratories where much excellent work has been and is being done. This is the basis of the scheme which is now propounded, as such a scheme appears to offer the only practicable solution of the problem

Briefly outlined, the scheme consists in centralising under one board or committee the control of all the research laboratories attached to the universities, colleges, and training institutions of the country, as well as of a large number of similar experimental laboratories connected with private works. Such a board would keep full records of what each individual laboratory was doing, and would receive all inquiries for research work to be done, whether the same came from inside or outside the laboratories in question. Furthermore, the board would keep all published research records of the world, and would thus be able to guide individual laboratories in their work. The board would be invested with full powers to order any laboratory to undertake certain research work or to leave another research alone, or indeed to transfer, if considered advisable, part of its equipment and personnel to another laboratory. Finally, all new discoveries would be communicated to the board, which would at its discretion publish the same openly, or else give them or sell them as trade secrets to interested British manufacturers or combines.

From what has been said, it might appear as though the board were to take absolute control of the university laboratories This is not so; the powers exercised by the board would be similar to those of the existing Board of Education, only controlling the work done, specifying certain methods of working and stating definite results which have to be achieved, without any actual interference in the ownership or management. University laboratories would still be used for training purposes as they are at present, and the ordinary degree or diploma courses would not have to be altered in the slightest. Not routine training work, but only absolutely new experimental work alone would be affected. The Board would work hand in hand with the various boards of management of the universities, and would merely order that specified research work had to be undertaken with certain equipment during a certain time, giving general instructions as to the carrying out of the research and also supplying all available information on the subject from the central library. The actual details of the experiments, as well as the selection of the personnel to carry out the tests, would as a rule be left to the university authorities.

In the above-outlined control of the board over the university laboratories it has been assumed that the exact powers exercisable would be defined by Act of Parliament. The scheme would probably work quite smoothly on a voluntary basis without any special legal powers, provided each party worked in a spirit of give and take, realising the while that the co-ordination was not only to their mutual advantage but also for the benefit of the nation.

If the scheme is to be truly national in character the laboratories run by manufacturing concerns must also be included. There are in this country a great number of well-equipped works laboratories, even if the majority are not up to the standard of those found in Germany or America. These laboratories must certainly participate in the scheme of co-ordinated research, because there is perhaps more overlapping and groping in the dark here than in the case of university laboratories. That this is so, and is indeed practically unavoidable under present conditions of working, is clear from the very nature of such laboratories.

Such laboratories cannot, owing to the nature of their constitution, be dealt with in exactly the same way as university laboratories. The latter work entirely in the general interest of scientific advancement, whereas the primary duty of the former is to give the shareholders as large a return on their money as possible. Hence the secrecy and jealousy with which the investigations in laboratories are carried on, such a state of affairs being quite natural and indeed perhaps healthy before the war. But under the changed conditions which will prevail later on, each individual firm will have to stand by and assist its fellows to the very utmost, not only in manufacturing and selling matters, but also in questions of research. In devising such co-ordination, however, there are certain rights of the individual firms which must be preserved.

One very important point is the question of recompense for ideas brought to the notice of the board and developed under the auspices thereof. Coupled to this is a problem of the patent rights attached to a new idea which has been successfully developed under the direct supervision of the board. At present each individual experimenter keeps the results of his work strictly to himself until crowned with success, and a patent is taken out. This is an important right of the individual, and cannot be abolished by a stroke of the pen. It cannot be expected that these men will sacrifice their present financial rights, however uncertain they may be.

Suppose that a chemist under the board had been successful in discovering a practical commercial formula for the manufacture of synthetic rubber. The board would, in the first place, satisfy itself through its experts that the invention was absolutely genuine and fulfilled all that was claimed for it. The rough details of the composition would then be communicated to all firms connected with the board who were likely to be in a position to take up the manufacture, and approximate estimates of the cost of production would be called for. The next step would be to pass on details of what was claimed for the material, along with the cost estimates, to all firms under the board who were likely to be able to make use of the same, and at the same time approximate figures of the quantities which could be taken per year would be asked for. Once in possession of the latter, the board would be able to decide as to the net commercial value of the invention to the nation, and would proceed to reward those who had worked to produce the result, this applying not only to patentable ideas, but also to mere suggestions for improvements.

Another reason for the introduction of protection by patents is to be found in connection with foreign competitors. Hence full use would have to be made of the existing international patent laws. It would be of no use setting up a co-ordinated scheme of research in this country if the fruits thereof could afterwards be exploited by manufacturers abroad without let or hindrance. This whole question of patents would be enormously simplified by the bringing of our own patent laws more into line with those of America and by the introduction of an Empire patent.

Regarding the disposal of the foreign rights of a patent, the board, as ultimate owner of the parent patent in this country, would have to decide whether it was advisable to allow foreign firms to take up licences in order to compete with the home manufacturers. A comprehensive national scheme such as the one under consideration cannot be carried through successfully without adequate financial support. The financial side of the question must not be made paramount to its national importance. As far as possible it is proposed to make the scheme self-supporting, with perhaps the exception of a State grant at the commencement; but even if it be found impossible for the board to pay its way this fact should not lead to the rejection of the scheme. The whole idea should be looked upon as an absolutely necessary national bulwark erected to protect and assist British manufacturers. The board should be treated in a similar way to the Boards of Trade and Education, being made as self-supporting as possible, but any unavoidable deficit being covered by a Parliamentary grant.

It is not pretended that the scheme outlined is complete in all details or that the plan proposed is the only suitable one. The chief object was to show that some form of co-ordination in research is necessary, not only from the national point of view, but also in the interests of the individual manufacturers and experimenters. The scheme outlined has been gone into fairly closely in order to show that the practical solution of the problem is by no means as difficult as might be supposed on the first consideration. Finally, the author suggests that the Institution take the initiative and invite a conference of all interested parties, to settle the absolute necessity for some such concerted action, and to come to some decision as to the general outlines which such a scheme should have. This conference could then appoint a smaller committee to work out the details, which would be submitted for approval before the plan was definitely put into operation.

Discussion in London.

Dr. W. Rosenhain, opening the discussion, said it was evident that the paper had been well and fully thought out. He, however, disagreed both fundamentally and otherwise with practically all it set forth, with the exception of what had been said in reference to co-operation. That was very necessary, not only with respect to the leeway that would have to be made up, but also respecting the application to industry of the results achieved. He took exception to the board of directors as suggested; in his opinion, such a board would very probably sterilise the whole business. In research work such a board could not possibly decide when the truth had been found. Again, it could not possibly see beforehand which particular laboratory or man was the right one to carry out a particular piece of work. That would have to be left to the initiative of the individual. Much had been said about overlapping, but in his opinion that was not such a serious thing in research as it might be in other work; indeed, in certain circumstances, it might even be healthy in research. Under any such scheme as the one outlined in the paper an important point would be the selection of the right type of man to carry out the work; but he did not think the particular scheme outlined by the author would attract the right type of man. With regard to the author's support of university laboratories in the interests of economy, he pointed out that a large central laboratory was already in existence, namely, the National Physical Laboratory. What was, in his opinion, of more immediate importance was the establishment of a central clearing house for information. In the course of his work he received numerous inquiries relating to all manner of things, and of course he was only too glad to answer any such when it was in his power to do so, but unfortunately that was not always the case, not to mention the amount of time and labour that was involved. Now it ought to be someone's particular business to supply such information on request, and a bureau where one could apply for information, no matter in what part of the world such information originated, would be of immense value.

Mr. Leon Gaster, speaking of the young man of the future and his rights, cited the case of the man who took a new idea or invention to his employers, but was turned down, told there was nothing in his idea, and probably got dismissed. Then his employers proceeded to develop the idea as their own, and reap the benefits. As long as such a state of affairs prevailed there was no incentive to invent, and he submitted that every man should have the option, if his employer turned down a new idea in the first place, to carry the thing out himself, and personally reap the benefits. He agreed that a central bureau of research information was very necessary and muchly needed. So many papers were being read that they did not really know where they were; the position was bewildering, and to search out the essential facts involved much labour and waste of time. The paper seemed to suggest that the universities would be ordered, so to speak, to do certain things or carry out specified work; such a scheme, in his opinion, would not be practicable.

Col. H. W. Couzens, who had been in charge of the wireless research department of the Army, said that Germany always maintained that this country would go under, and could not help doing so, because no attention was paid to scientific research. War had been raging between Germany and this country not merely for four years, but for the past 32 years, and it would continue. He maintained that it was much more important to inform one's partner than to deceive one's adversary, and that had been the policy throughout the war. Co-operation was necessary, not only radially, between headquarters and branches, but also circumferentially between branches. He was not altogether in favour of control, what they really wanted was information and not a central authority; that, in his opinion, was the crux of the present difficulty. Many ideas had been and were lost for the want of funds or special facilities for further development. He suggested that university scholarships should be rather in the nature of special facilities for continued work than in the form of prizes. After all, it would be the man who created who would control.

Mr. H. Pearce thought that the ideal to be aimed at was decentralisation of control. The author suggested the expenditure of large sums annually on his scheme, and he (the speaker) wondered what proportion of those sums would be devoted to actual research work. The problem of spreading information was of much importance; he suggested that the record office of every technical institution or association should be in touch with one central bureau where anyone might apply for information.

Mr. C. C. Paterson, O.B.E., agreed with most of the opinions expressed by speakers, and consequently disagreed with the author in nearly every particular. He did not believe any large scheme was necessary, they had no actual information to show that it was. He did not see why it was proposed to divorce one section of work from another; research work was a continuous process, one thing leading up to another. Again, it was a mistake to try and eliminate overlapping in research work. A certain amount of overlapping was vital if the best results were to be arrived at. It was an extremely low view to take that industry was carried on solely for the making of money; he would not believe otherwise than that industry worked in the interests of the country as a whole, and of mankind generally. That was as it should be, and the same remarks applied to research work.

Mr. E. T. Williams took a contrary opinion to the majority of speakers; he thought the scheme outlined in the paper, if not perhaps in detail, was most valuable in spirit, and it contained a number of good instances. The Germans, if in nothing else, really excelled in organisation and in getting a large view of things. This was also now the case with the Americans, who possessed the added advantage of the creative faculty, and he maintained that those nations who used their brains were the ones that would lead. By means of a diagram he showed that some simple means of co-ordination rather than a vast organisation was desirable to start with.

Mr. J. S. Highfield, in reply, said that the discussion, though highly critical, plainly showed that the paper had served its purpose. He was in entire sympathy with those who had spoken in favour of decentralising control. He had lately come to absolutely loathe the words "organise" and "co-ordinate," they sounded so very important and impressive, but in reality they meant very little indeed. With regard to overlapping, rather than being a disadvantage he thought that it was extraordinarily useful. The sporting element and spirit of rivalry had always been and still was a desirable attribute of the Englishman, and that should be remembered when discussing so-called overlapping which was really competition. At the same time, firms would have to work together more in the future; a start in this direction, which was the right one, had already been made.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Low Oscillographic Manograph.

Internal combustion is a difficult and somewhat mysterious problem. What it is really required to know is what happens to the petrol and air whilst the mixture is in the cylinder. A new apparatus—the Low oscillographic manograph, which is exhaustively dealt with in the March 4th issue of *The Motor*—enables the actual conditions inside the cylinder of an internal combustion engine to be examined while the car is running on the road, and the results can be observed on the car during a road test, or in the laboratory with the car any distance away. When an engine is running at 2,000 to 4,000 r.p.m., mechanical and gaseous phenomena cannot be observed in an ordinary manner, and to get instantaneous changes of pressure, even with the best indicators, is difficult when working close to the engine. Major A. M. Low,

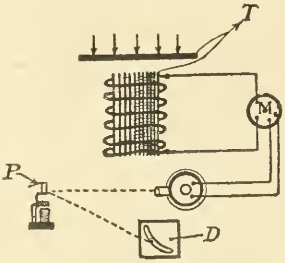

Fig. 1.—Diagrammatic View of Manograph.

R.A.F., D.Sc., has found that it is of more practical value to examine valve motion by means of a synchronous bioscope, and to connect the pressure indicator direct to the engine, utilising some simple means for roughly marking portions of the stroke which can be afterwards calculated exactly. To do this he has utilised an oscillographic manograph, with which he has investigated valve-bouncing engine indicator work, then spectroscopically testing the mixture *via* the kinematograph at any predetermined portion of the stroke. The essential features of the oscillographic manograph are shown diagrammatically in fig. 1. M is a microphone of special type; T is a kind of telephone receiver with a diaphragm of steel about 1/16 in. thick screwed into a valve cap; O is the oscillograph; P the mirror 1/64 in. diameter stiffly mounted and submerged in oil to prevent vibration, which gives the representations of the piston stroke, and is operated by a shunt current from the magneto in most cases; D is the diagram which shows by the motion of a spot of light, the pressure at any part of the stroke. It shows when a valve effectively opens and closes, as distinct from the mechanical timing, which is affected by outside influences. By means of a synchronous kinematograph the pressure at one spot can be watched on every explosion over long periods while a car is in actual use. The device is so delicate and so rapid in its operation that it is quite easy accurately to reproduce as a photograph the air oscillations of the human voice, so that the indication of an engine presents no serious difficulty.

A Novel Electric-Truck Body.

The Penn Grains & Feed Co., of Philadelphia, formerly shovelled its dried grain into freight cars from horse-drawn teams. This arrangement has now been abandoned in favour of the use of electric trucks of the type shown in fig. 2, an illustration taken from the *National Electric Light Association Bulletin*. This electric 5-ton standard truck is fitted with a 3-section dump body, and has been so developed that the truck can pull alongside of a freight car, and each section in turn can be dumped through the doorway, thus saving a large part of the labour cost. The truck has otherwise proved very successful.

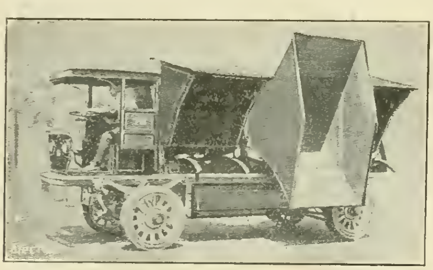

Fig. 2.—Electric Truck with Three-section Dump Body.

There are many potential electric vehicle installations awaiting development in every large city, and the type of vehicle illustrated would appear to have more uses than one. For instance, cement and gravel could be carried together when making concrete, or, again, in the case of a short-weight load having to be transported, the full load could be made up with other substances without mixing, thus enabling the wagon to be used at its full capacity on every journey.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

6,545. "Electrical terminals." J. M. Whiteside. March 17th.

6,561. "Telephone, &c., flexible cords." E. Barrington. March 17th.

6,595. "Contact terminal." A. & O. Christ, Sons & Co. March 17th. (Switzerland, March 16th, 1918.)

6,610. "Contacts of electrical switchgear." R. S. O'Neil. March 17th.

6,626. "Adjustable resistances." Evershed & Vignoles and S. Evershed. March 17th.

6,641. "Brush-rocking gear and terminal mechanism for dynamo-electric machines." H. D. Rohman. March 17th.

6,643. "Electric vulcanisers, &c." H. Frost & Co. and W. H. Welch. March 17th.

6,654. "Electrically-heated furnaces." Morgan Crucible Co. & C. W. Speirs. March 17th.

6,655. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 17th.

6,656. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 17th.

6,664. "Dynamo-electric machines." H. Chitty. March 17th.

6,695. "Sparking plugs." T. Harve. March 18th.

6,706. "Electric signalling telegraph." W. F. Grafton & A. D. Jones. March 18th.

6,722. "Electric muffles and furnaces." F. Osbourne. March 18th.

6,727. "Appliances for removing and replacing electric light shades." H. M. Mance. March 18th.

6,743. "Electric lamps." A. Garbarini. March 18th. (France, July 3rd, 1918.)

6,749. "Unidirectional radio receiving system." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 18th.

6,760. "Electric transformers." H. S. Burn & Ferranti, Ltd. March 18th.

6,781. "Galvanic batteries." G. Oldham & J. Oldham. March 18th.

6,788. "Starting and lighting devices for automobiles, &c." J. Bethenod. March 18th. (France, August 7th, 1918.)

6,838. "Electric steering gear for ships, &c." T. Reid. March 19th.

6,855. "Railway signalling." W. R. Sykes Interlocking Signal Co. and L. S. Tiddeman. March 19th.

6,856. "Railway signalling apparatus." F. A. Russell, W. R. Sykes Interlocking Signal Co. & L. S. Tiddeman. March 19th.

6,864. "Protective devices for electric circuits." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 19th.

6,898. "Installations for electrically lighting, heating and ventilating railway carriages, &c." H. D. Rohman. March 19th.

6,903. "Sparking plugs." I. Lubbock. March 20th.

6,935. "Electric heaters." D. Anderson & C. Scott-Snell. March 20th.

6,942. "Electrical primary cells." P. Dorrian. March 20th.

6,951. "Producing vacua." Western Electric Co. (Western Electric Co., U.S.A.) March 20th.

6,987. "Systems of electric power transmission." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 20th.

7,018. "Ignition apparatus for internal-combustion engines." Soc. Anon. pour l'Equipment Electrique des Vehicules. March 20th. (France, April 18th, 1918.)

7,032. "Electric terminals." Remy Electric Co. March 20th. (U.S.A., April 22nd, 1918.)

7,034. "Ignition apparatus." Dayton Engineering Laboratories Co. March 20th. (U.S.A., March 23rd, 1918.)

7,071. "Electric fuse plugs." J. Glatz. March 21st.

7,102. "Arc lamps." S. E. Crick. March 21st.

7,110. "Antennæ for wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 21st.

7,142. "Electrodes for electric arc welding." I. B. Blaiberg. March 22nd.

7,167. "Filament electric lamp." D. W. McCoulough. March 22nd.

7,173. "Control of electric motors." W. Brooke & E. M. Kerr. March 22nd.

7,174. "Automatic contactors or electrically-operated switches, &c." W. Brooke & E. M. Kerr. March 22nd.

7,175. "Electrical contactors or switches, &c." W. Brooke & E. M. Kerr. March 22nd.

7,179. "Electric cells or batteries." H. Adkins & A. T. Austin. March 22nd.

7,181. "Electrical switches." J. W. Haran & H. C. Tofield. March 22nd.

7,206. "Method of disinfecting telephone instruments." W. A. Morris. March 22nd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1914.

24,830. Electric fire control for guns. Pollen & Isherwood. December 31st, 1914.

1915.

895. Electrical receiving apparatus especially intended for use with ordnance. Dawson & Horne. January 19th, 1915.

1,802. Wireless apparatus. F. M. Clarke (Executrix of E. R. Clarke). January 28th, 1915.

8,321. Apparatus for use in wireless telegraphy and the like. Sueter, Groves & Binyon. June 4th, 1915.

1917.

18,476. Holders for incandescent electric lamps. F. Quarmby. February 12th, 1918. (123,544.)

19,041. Electrical apparatus for subjecting articles to varying temperatures. W. E. Prescott & G. R. Baker. December 22nd, 1917. (123,545.)

1918.

3,430. Electric accumulators and the like. V. G. Yourieff. February 26th, 1918. (123,582.)

3,433. Regulatable self-induction coils for use in high-frequency circuits. L. Rouset. February 26th, 1918. (123,583.)

3,606. Fittings for electric incandescent lamps. B. J. Grigsby & O. E. Grigsby. February 28th, 1918. (123,596.)

6,342. Railway traffic-controlling apparatus. McKenzie, Holland and Westinghouse Power Signal Co. April 16th, 1917. (115,035.)

6,761. Covers for electric motors. British Thomson-Houston Co. (General Electric Co., U.S.A.) April 22nd, 1918. (123,449.)

6,795. Current-regulating devices for dynamos running at variable speed. H. Wade (Officine Elettro-Meccaniche). April 22nd, 1918. (123.451.)

7,877. Ignition magnetos for internal-combustion engines. H. Lucas and J. H. Chambers. May 10th, 1918. (123,244.)

8,936. Incandescent electric lamps. Osram-Robertson Lamp Works and T. J. Sack. May 30th, 1918. (123,249.)

9,003. Distributors for use with magneto-electric machines. British Thomson-Houston Co. & A. P. Young. May 31st, 1918. (123,468.)

9,578. Method of and apparatus for the manufacture and adjustment of contact plates in Swan lamp bases. H. C. Ghijsen & Naamlooze Vennootschap Vitrite Works. June 11th, 1918. (Addition to 6,055/18.) (123,469.)

9,754. Thermic telephones. Baron van R. A. Lynden & Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. June 13th, 1918. (123,255.)

9,810. Apparatus for producing detonating signals for controlling the operation of trains, trams, and the like. W. L. Rowe. June 14th, 1918. (123,470.)

10,188. Electromechanical arrangement for the distant working of searchlights and other similar appliances. G. Rebora. June 20th, 1918. (123,677.)

11,625. Electric soldering irons. J. G. Clemens. July 16th, 1918. (123,266.)

11,395. Railway signalling. E. P. A. Abric. October 7th, 1916. (117,462.)

12,486. Spark plugs. E. O'Connell. July 31st, 1918. (123,687.)

14,856. Electric meters. E. Bjerknes. September 12th, 1918. (123,286.)

18,746. Moulds and method of casting grids for accumulator electrodes. H. F. Joel. October 16th, 1917. (Divided application on 14,991/17.) (123,701.)

20,518. Rectifying X-ray systems. W. A. Winter. December 10th, 1917. (121,480.)

20,960. Electrically-operated abraiding machine. N. G. Olson. December 16th, 1918. (123,512.)

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Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. ed.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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PERTH, W.A.: Gordon & Gotch, William Street.
ROME: Loescher & Co., Corso Umberto 1° 307.
SYDNEY: Peter G. Tait, 273, George Street; Gordon & Gotch, Pitt Street.
TORONTO, ONT.: Wm. Dawson & Sons, Ltd., Manning Chambers; Gordon and Gotch 132, Bay Street
WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE I.E.E. COUNCIL NOMINATIONS.

THE list of members nominated by the Council of the Institution of Electrical Engineers for the vacancies on the Council which will occur next September is of exceptional interest.

In view of the setting-up of the Ministry of Ways and Communications, the selection of Mr. Roger T. Smith for the office of President is timely and appropriate. It means that the Government, in considering the measures by which the service given by the railways can be improved, and the running costs reduced, will have available, with the full authority of the highest position the profession can bestow, a qualified and experienced railway engineer. Whether the Government will take full, or any, advantage of the opportunity of consultation so afforded remains to be seen, but we may at least hope it will do so.

Mr. Chattock and Mr. Woodhouse retire from the office of vice-president, and Mr. Woodhouse is nominated to serve again. We regret the disappearance (temporary, we hope) of Mr. Chattock, but we suppose it likely that the course adopted has his approval. Mr. Ll. B. Atkinson is nominated for the other vacancy, and this will introduce a welcome diversity into the complexion of that particular section of the Council.

We have before remarked that the consequences of the explosive advent of Mr. H. Faraday Proctor, some years ago, have been unexpectedly far-reaching. When he was nominated, from outside, the Council contained no representative of the electric supply engineers. At the present moment all four of the vice-presidents are central-station men.

For the three vacancies in the Council among the rank of Members, seven names are put up; for the three Associate Members, three names; and two for the two Associates.

Dr. W. H. Eccles, who succeeded the late Prof. Silvanus P. Thompson as Professor of Physics at the Finsbury Technical College, is a renowned scientist, and a capable administrator. Mr. Fedden, of Sheffield, has only recently become a member of the Institution, but it has long been recognised as desirable that he should become one, and his record is such as to assure us that, if he secures election, he will do useful work. Mr. Welbourn would add one more to the scanty numbers of the representatives of the manufacturing interests. The firm with which he is connected, the British Insulated and Helsby Cables, Ltd., is at present represented by Mr. G. H. Nisbett, who retires on September 30th next.

Three representatives of the class of Associate Member are nominated, in the persons of Mr. H. J. Cash, President of the Electrical Contractors' Association; Mr. J. R. Cowie, one of Mr. Lackie's young men, and Mr. E. A. Gatehouse, of the B.T.H. Co., in whose nomination a sign of the times may be discovered by the discerning. We think it safe to prophesy that more of this class will be nominated. We hope we shall be justified in reading into the nominations of new and, perhaps, somewhat unexpected men, an indication that fresh life is about to pulsate through the veins of the Institution. The list of papers to be read, which was lately circulated, is decidedly more attractive and covers a wider ground than has been the case for several years, and interesting discussions ought to be provoked.

Now that Mr. Wordingham is approaching the end of his second year of office, we take the opportunity of again expressing the view we put forward three years ago—that the President should, save in the most exceptional circumstances, hold office for one year only.

That is also the view of Mr. Wordingham himself, as we pointed out last year; but we did not then raise any objection to his re-election, because, in our opinion, the exceptional conditions which justified it were fulfilled—he had put forward a lengthy programme of reforms, and had been so successful in attaining the realisation of some of them that we thought it highly desirable that he should be enabled to continue the good work. Our opinion has been amply vindicated by the further crop of useful innovations for which he has been largely responsible during the past year, to which we hope many others will be added during the remainder of the session. Let it not be forgotten that Mr. Wordingham was the author of that epoch-making declaration of policy to which we would have every President-Elect subscribe: "*I do not think there is any matter affecting the electrical industry which is not the business of the Institution*"—a priceless saying.

The forward movement in the engineering institutions in general is at all times exceedingly slow, and we cannot afford to let slip any source of motive power for the sake of conforming to a rule; but the exception and the rule have become interchanged, and, in our opinion, it is time to restore the normal state.

With new blood on the Council, and the representation of up-to-date ideas regarding the conditions in the profession and industry, it may well be that the time is appreciably nearer when every electrical engineer will be able to look to the Institution as his guiding star, and to obtain therefrom inspiration which will enable him at once to carve out his own career successfully and to advance the prosperity of the country.

GERMAN INDUSTRY ON THE ROAD TO RUIN.

A remarkable statement has just been made on behalf of the Siemens-Schuckert Co. in order to inform the workmen and staff and the industry in general of the economic prospects of the undertaking, so as to induce the labour interests, if possible, not to allow this great concern to go to ruin, together with themselves as employés. The statement, which is made by Herr C. F. von Siemens, and is addressed to the men who returned from the front, is also specially noteworthy from the fact that it throws light on the work carried out by the company during the war, and also on the capital held in countries not allied with Germany.

The statement first deals with the work accomplished during hostilities. It is mentioned, for instance, that, apart from having embarked upon the manufacture of fuses, arms, and shells, the company was engaged to an increased extent in its own particular branches. These comprised the construction of wireless stations, the extension of the company's high-speed telegraph system, the improvement of the method of transmitting orders on ships, the technics of U-boats, of which 97 per cent. were equipped on the Schuckert system (electrical control); the development of substitute materials (zinc, iron, in replacement of copper, substitutes for rubber and gutta-percha, and the production of nitrogen); experiments with new and gigantic aeroplanes of a size hitherto unknown, and the construction of a faultless rotary motor having an efficiency superior for its weight to that of all others. Coming to the question of the turnover, it is stated that 70 per cent. of the value in 1917 consisted of electrical manufactures and only 30 per cent. of non-electrical war material. The number of workmen increased during the war from 57,357 to 64,124. During the four years the voluntary payments made on behalf of the workmen and staff amounted, on the rough pre-war conversion basis of 20 marks to the pound sterling, to £3,500,000, whilst the wages, salaries, and war bonuses reached £28,000,000 in the same period of years. On the other hand, the profits allocated to the shareholders and partners only totalled £2,625,000. The value of the turnover advanced from £25,000,000 in 1913 to £42,500,000 in 1918. The amount formerly paid for coal in Siemenstadt was £75,000; it is now £275,000; for gas it was £27,500, as compared with £75,000 at present; whilst the prices paid for copper and dynamo iron are now five times greater than formerly, tin and oil are ten times higher, and insulating material is 50 times greater in cost than previously.

The statement then raises the question of the capital which the Siemens-Schuckert group already had invested in hostile countries prior to the war. According to Herr C. F. von Siemens, the capital amounted to £6,150,000, and how much of this can be recovered cannot be seen at the present time. In Russia alone it is probably certain that a sum of £2,250,000 is lost; the number of workers there has declined from 5,000 to 100, "notwithstanding the most strict laws for the maintenance of working and against dismissals." On the other hand, an amount of £1,700,000 was invested in England, and this had been expropriated. The value had been deposited with the English Government, and it was to be hoped that it would not be set against English demands. In that event it appeared to be more than questionable whether compensation could be obtained from the German Government. The sum invested in the works in France was £350,000, and this ceased to be operative a long time ago, as the machinery had been removed and the buildings served the purpose of storage sheds. In addition to these cases, there were also losses in Italy, Portugal, Rumania, and all other enemy countries.

The present situation of the works, it is declared, is such that the deliveries of manufactures have very considerably declined. As compared with the average monthly output in the year 1917-18, the production in October, 1918, receded by 13 per cent.; and in November, by 40 per cent. It is submitted that neutral countries are deterred from placing orders with the Siemens-Schuckert group through this diminution in efficiency, the doubt concerning labour conditions, and the consequential lack of certainty respecting the time of delivery; and, as an instance, mention is made of the loss of an order for Denmark, although the price quoted was lower than that of neutral competitors. If a disposition and readiness to work did not soon return, Herr von Siemens remarked, all of them would be ruined, especially as they would have to reckon with much keener competition on the part of England, as well as of neutral industries which had been strengthened during the war.

Important Exhibition at Athens.

In view of the known scarcity of every kind of manufactured article in Greece and the neighbouring markets, solid business ought to result to firms who make an adequate representation at the forthcoming exhibition in Athens of British manufactures. The exhibition is the outcome of the visit paid to this country last autumn by a number of Greek business men, and of the subsequent examination of the trading position in Greece which was made by the commercial representative there of the Federation of British Industries (Major E. Kennard). It is to be of the type which ought to appeal to the British manufacturer, who is accused, with some justification, of being at times too prone to hesitate at any expenditure until he can see an immediate and highly profitable return. It is to be a purely *selling* exhibition. In Major Kennard's opinion, every exhibitor who can guarantee immediate, or at all events quick, delivery in bulk to the samples which he exhibits, will not only pay his expenses, but will make a very large and immediate profit, without undue expense or risk. It is hoped to attract traders from Turkey, the Balkans, and Asia Minor. In all these countries there is great scope for electrical and other engineering enterprise. In Greece itself the proposed commercial development of the military railway between Piræus and Salonica gives promise of new industrial activities, with their resultant openings for British trade. The country is said to possess 66,000 H.P. in water-power, only just over 6,000 H.P. of which has yet been utilised. There is talk of many new lines of manufacture and much extension of existing lines in Piræus, Salonica, and other industrial centres, particularly in the direction of shipbuilding. Altogether the opportunity looks an exceedingly favourable one. The demand for goods is wide and insistent, the customer is favourably disposed towards the British supplier, the money is there all right, and the Federation shows an easy way of getting the business through the medium of its exhibition.

The Greek Government has lent for the purpose the "Zappeion" building, close to the centre of Athens, and nearly a third of the available space was taken up within four weeks of applications being invited. It is said that nearly all the most important branches of British manufacture are represented already. However, an annexe is being constructed on land adjoining the Zappeion—also lent by the Government—where the larger exhibits can be housed. There seems an excellent chance of making Greece a stepping-stone to the trade of the Balkans and Levant.

National Electricity Supply. An important addition to the numerous reports on the national scheme is summarised on p. 425 of this issue. It embodies the opinions of the chairmen of the Sections of the Advisory Council to the Ministry of Reconstruction, and deals with the administrative aspect of the subject. It is interesting to note that not one of the chairmen, so far as we know, is associated with electricity supply in this country, though the three titled gentlemen are closely connected with electrical undertakings abroad.

The main question that was submitted to them was "whether electric power should be generated on a national system," and if so, under what conditions. The reference might have been more intelligibly framed, but apparently the chairmen understood it, for they unhesitatingly answered in the affirmative, though they found fault with the system of administration recommended by the Board of Trade Committee on Electric Power Supply. Sir Clarendon Hyde dissented from the principle of compulsory purchase of existing undertakings, and Mr. W. L. Hichens fundamentally disagreed with the report.

The chairmen, all noted men of business, recommended a national unified system under State regulation, and largely financed by the State; and we are very glad to see that they add that it should be framed and administered on a commercial basis, not upon Civil Service lines. This is a matter of the very first importance. As we all know only too well, the telegraph system in Government hands was established on Civil Service lines, with unfortunate results from the point of view of profit and loss: it is controlled nominally by a Member of Parliament, but actually by a permanent Secretary, and the engineering department, with a technical staff of first-class quality and undoubted efficiency, is subordinated to an executive of purely clerical character, so that even the Engineer-in-Chief himself can perform no administrative act on his own authority. Now the telephones have been incorporated in the same paralysing system, with the inevitable result that by degrees all initiative will be dried up and we shall follow in the wake of other nations where we used at least to hold our own. Above all, let the national electricity supply system be preserved from such a fate!

The chairmen agreed that generating plant and main transmission lines should be nationalised, but that distribution might be left in the hands of existing agencies; they would enlarge the Electricity Board to six members, and give it full authority, while the schemes which it devised would be carried out by an "Operating Executive." It is fairly safe to surmise that the Electricity Bill which is so eagerly awaited will be cast on some such lines, and to our mind the suggestions of the Council make for efficiency and celerity, leaving the Board free to deal with the broad principles while the Executive translates them into practice. The urgency of the matter is emphasised in the report—but it has been emphasised for many months; when will the machine begin to move?

Since writing the foregoing we learn that by an amendment in Committee the control of electricity supply has been withdrawn from the Transport Bill.

ELECTRICAL ENGINEERING RECONSTRUCTION: THE RIGHT MEN IN THE RIGHT PLACES.

By D. S. MUNRO, M.I.E.E.

During the recent war our national resources of skill and experience were woefully misapplied. So much had to be done, and there was so little time to do it in! No organisation existed for putting the skilled man where his skill would be most useful. Our great engineering societies could have done a great work in this respect, but they were not asked. Occasionally they were appealed to for men for certain work, and at once responded; but the men put forward were seldom given government employment commensurate with their knowledge and capacity. They were lucky if they were ranked only below their youngest apprentices; usually their departmental chiefs had been something even more inappropriate in pre-war days.

If, before the war, Britain did not stand first among the nations in the commercial exploitation of electricity throughout the world, it was easily first in scientific imagination and in inventive resource. Both in the war-army and outside it the country possessed great resources of capable men, some highly trained in the schools, and many in the practical applications and development of electrical and kindred branches of engineering. Our army methods in the generation and distribution of electricity for lighting and other purposes were as crude and wasteful as those of the Germans were efficient. Yet all the time there were in our armies hundreds of men who could have remedied this. If the army secured a first-class electrical workman, he was as likely as not to find himself an officer's servant, or in any other position where his special knowledge was wasted.

One has heard it stated as an example of German cuteness, that they could pick up our field telegraph messages. Of course, in the earlier years of the war, our field telegraph systems were so designed as simply to ask for this. In an army signalling lecture book, the familiar "Lineman's" or "Britannia" joint was described as the "German joint." But it is needless to multiply minor instances of a state of affairs which was notorious.

Now that this country is entering upon the period of reconstruction after the war, most of the skilled men will be absorbed back into civil industry, where they will sooner or later find their level. With national reconstruction schemes, government departments will have much to do. These departments will require big technical staffs, and these must be carefully selected if things are to go smoothly. Some of them will be formed from war-time staffs, and for these, in theory, the best men will be retained, the others being released. In practice this is not likely to be so. There is always the "easy supremacy of patronage over merit." The men chosen to lead are likely to be men of social influence rather than of practical capacity. They will at best be selected from men who find themselves at the head of large business concerns, a position usually, if not always, indicative of "good" business qualities.

When a strong man is at the head, he can control only by a rigid system of procedure, so "procedure" will continue its tyrannical and paralysing reign. System is a good servant, but a bad master. So long as the executive staffs consist of inferior men, strict "procedure" determining every act may be necessary. Thus any good man here or there will be so occupied and manacled by rules that all initiative and personal resource are eliminated. The whole staff may eventually consist of those who can move with the most perfect precision as the red tape permits and compels.

To lessen this inevitable evil, decentralisation is the only sure course. The kernel of the case for Individualism as against Bureaucracy lies in the freedom of initiative and the variety of method characteristic of the former. The danger of Individualism is that men who have acquired the knack of obtaining great sums of money for their schemes sooner or later kill off or absorb all competitors. Great companies and combines have all the disadvantages of

Bureaucracy without its national compensations. And there are many things good for the nation as a whole which a government may do but no combine would attempt.

Seeing, then, that we are about to witness the growth of national departments of engineering, it is of vital importance to the profession to consider its position during the selection of the staff and afterwards. The question may be considered from two aspects :—

1. How will it affect engineers generally—civil, mining, mechanical and electrical?

2. How can the government be assisted to choose and get the best men for their various jobs of all grades?

1. Take as illustration the coming great changes in electricity supply. Those engineers who now occupy salaried posts under local authorities or private companies are likely to fare best. Many of those displaced will be absorbed into the extended local distribution plans for power, heating, and lighting, and will remain, therefore, with their present employers. Others will be appointed on the high-tension cross-country cables; and the great central power stations should easily absorb the remainder, as well as some new men. If any are left out, they are going to be recompensed.

As to the foreman and rank and file, they are not dealt with in this article. If the right men are appointed as chiefs and sub-chiefs, good workmen will speedily find themselves in demand.

It is the local consulting engineers who may find themselves most seriously displaced. When the schemes were first mooted, and the support of engineers generally was appealed for, promises were made that vested interests would not be neglected, but rather improved. But when a government is about to spend public money, it is almost compelled to employ those consulting men who have a national reputation. If they propose to act anywhere under the guidance of a man of merely local repute, their schemes are more open to parliamentary criticism. It is hardly permissible to suggest that those consulting engineers whose commercial instincts have enabled them to build up a very big business, and who strongly desire to further its interests, might be prejudiced unconsciously against all proposals other than their own.

Yet there remains a possibility that government activities may have this usual result, that "to him that hath shall be given, and from him that hath not shall be taken away even that which he hath." Yet many of the provincial consulting engineers dealing with water power, electric generation and distribution, coal and steam economy, and the like, are the very best men in the country in their special branches. Apart, therefore, from the question of fair play to the men themselves, it is to the general interest of the country that these engineers should be employed upon the working out, erection, and maintenance of sections of the government schemes. The claims of local men assume further importance where nationality enters into the matter. A Scottish engineer, let us say, who has for many years been preparing local public opinion for such developments as those now contemplated, and who has hopefully gathered data and surveyed possibilities, is not likely to enjoy seeing the entire matter handed over to some excellent and influential London gentleman, the while his whole normal local field of work is destroyed by the new arrangement.

Take, as an example, the Coal Controller's war economy methods. It was a wise, and, indeed, necessary thing during war time to give free advice in detail to steam users as to how, by saving coal, they could save themselves hundreds, perhaps thousands, of pounds. But now that war is over, ought not government action to be restricted to putting pressure on these steam users, compelling them to economise coal, leaving them to employ the expert assistance of those independent engineers who are now very slowly rebuilding the practice which they temporarily abandoned for more urgent and direct war service? These remarks apply also to water-power development, light agricultural railway work, and other schemes.

The lessons of such considerations as have been mentioned may be summed up as follows :—(*a*) Centralisation and uniformity, good and useful as these are, must not be overdone. A central department having settled upon a general national scheme, should either appoint established local consulting engineers to investigate, report upon, and (with necessary modifications, if any) superintend sections of the scheme; or they should create or empower district authorities to undertake them, leaving these authorities to employ consultants, preferably more or less local. (*b*) Those consulting engineers who desire to be employed upon sections of the work should have their claims carefully considered by a government sub-department entrusted with the duty.

Some such policy as the foregoing would not only be fair to established interests, and provide an experienced body of assistants to secure economy and efficiency through their knowledge of local needs and conditions, but it would smooth away many possible sources of future friction in arranging with local authorities.

2. How to assist the government to select the best men. Those who have temporarily worked in government employ, know that the methods of selection were very faulty. They seem excellent on paper, but did not always work well in practice.

The method herein advocated is that engineers be selected with the help of the engineering institutions, but not solely or even chiefly through their general councils. For work in each district, the district sections of these institutions should be consulted, and even these should avoid the awkwardness of provisionally choosing men from around their own table by asking members generally to suggest names or to send in their own names as candidates if they desired the class of work offered. Thus for this purpose also, is suggested reduction of the rigidity of centralisation.

Later on, when contractors have to be appointed to undertake work, contracts also ought not to be made too large. To save trouble by letting large inclusive contracts, is to cancel the utility of thousands of those contractors who are the very best in the country. When competition is confined to one or two of the great contracting combines, the prices are apt to be high and the work moderately good. In any case, openings are provided for nepotism and a condition of things which calls for legislation against combines, and eventually for nationalisation as a remedy against the intolerable evils which we have helped to create.

The modern tendency is towards the creation of overswollen commercial Frankensteins. All the good that these can effect in extension of trading is due to their ready access to the money market. That advantage can be obtained otherwise if government reorganises the banking facilities of ordinary trade. As things are now shaping, the nation is building up new tyrannies of more unassailable privilege. Even the good and great Reconstruction Schemes may be moulded into machines for the further aggrandisement of select coteries. The workers' unions may disappoint some of these expectations—they are likely to do this so far as national benefit is concerned. When great industries are nationalised, their special workers have the unfair triple weapon of vote and strike and "go easy." Already we find the miners claiming beforehand all the prospective benefits of Reconstruction in getting and using fuel. If all follow this road, we enter the land of universal and unceasing disunion and strife. The wise alternative is a controlled individualism, and a public opinion alert for the interests of all classes, even of the unfortunate middle class, the geese that laid the golden eggs hitherto. If we must have nationalisation, let us avoid its more immediate and obvious disadvantages and injustices. It is as a small contribution towards this end that one has ventured to offer the foregoing suggestions.

In conclusion, is it archaic to desire the revival of the old and tried influences for the improvement of personal character and the old-fashioned virtues of plain living, high thinking and hard working? Nothing else will ever bring peace and happiness to any man or to any country.

Exports to German Austria and Poland.—The B. of T. gives notice in the *London Gazette* of April 4th, of general licence in connection with the resumption of trade with the above countries, under certain restrictions.

THE LIGHTING OF PUSEY HOUSE CHAPEL, OXFORD.

Pusey House comprises four blocks on the quadrangle principle. The chapel forms the north wing, and, with portions of the east and west wings, since completed, was the first to be built and electrically lighted. The lighting of the chapel was finished early in November, 1914. Current is taken from the 100-volt D.C. supply mains of the Oxford Electric Lighting Co.; the mains enter the east wing on the ground floor in one of the sacristies near the main entrance in St. Giles Street. They terminate in the usual fuse-boxes and meter of the supply company, from which they are connected through an ironclad D.P. main-switch fuse to an ironclad main switchboard provided with six main circuits, each controlled by interlocked D.P. switches and fuses. The sub-mains run from the latter into ironclad fuseboards in convenient positions in the different blocks, and the circuit wires radiate direct from these boards to the lamps, &c.

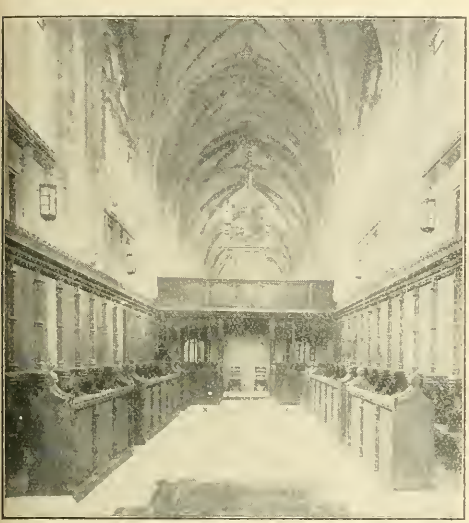

Fig. 1.—Concealed Lighting Fittings in the Chancel, Looking Westwards.

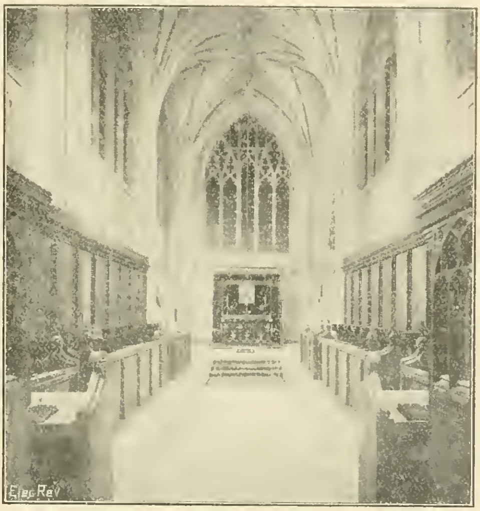

Fig. 2.—Fhe Chancel Photographed by Electric Light, Looking Eastwards.

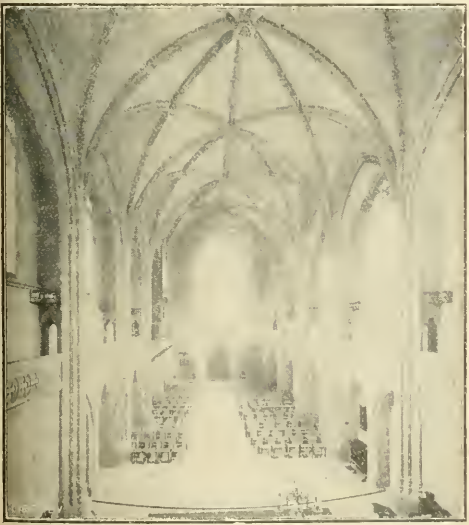

Fig. 3.—Concealed Lighting Fittings in the Nave, Looking Westwards.

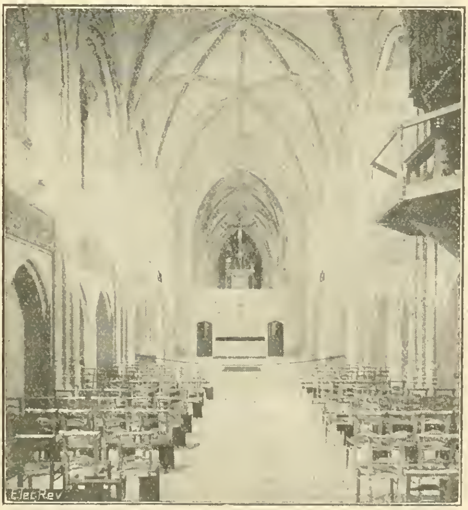

Fig. 4.—View of the Nave, Photographed by Electric Light. Looking Eastwards.

There is also a separate power supply at the same point of entry for the organ, accelerator pump and ventilating system; the power is, of course, separately metered and controlled, and kept quite distinct from the lighting.

The whole of the wiring, including the sub-main cables, whether for power or lighting (with the exception of the sub-main to the west wing, which is lead-covered and laid solid in bitumen in the quadrangle), is carried out in solid-drawn, galvanised, screwed steel conduits, forming with the ironclad boards (most of which are recessed in walls and covered with special oak doors, so that they are completely hidden), boxes, &c., a mechanically and electrically continuous system, earthed at frequent intervals.

No ceiling roses or wood blocks of any description are used. All switches are mounted inside galvanised iron boxes, in most cases recessed in the walls, with only the antique brass covers and dollies showing.

The lights in the cloisters, passages, corridors, staircases, and in many of the rooms (library, lecture halls) are controlled by two-way switches, and, in certain cases, intermediate switches as well, so that no matter where one goes, the passage of approach can always be lighted, and the lights in the corridors or passages, &c., in the rear can be extinguished. In this way considerable economy is obtained, and the system has given great satisfaction.

Of course, the whole of the conduit system is concealed.

The conduits, where they pass in the heating trench or along the passage ways in close proximity to the heating pipes—and practically everywhere these runs had to be followed in the lighting of the chapel—are all covered with asbestos tubing, to prevent excessive differences of temperature arising, and to eliminate the possibility of condensation troubles. This plan has been highly successful. The hot-water pipes are not lagged, as the heat radiated from them forms part and parcel of the general heating system.

Illumination.—The Chapel is illuminated by concealed lights from the west window jambs on the north and south walls, in special lanterns (see figs. 1 to 4).

In the nave the lamps in each lantern are arranged in two horizontal rows at right angles, and in the chancel in one vertical row, and in each case the direction of a lamp can be altered in both the vertical and horizontal planes.

Nave.—On the north side there are five lanterns, each containing four "Axial" lamps, frosted, but no opal reflectors. Two of the lamps are 60-watt, and two 30-watt. On the south side there are only four lanterns, owing to the organ, and one of the lanterns contains only three lamps, which in this case are each 60-watt; otherwise they are identical with those on the north side.

Total	9 lanterns
Lamps	$35 \left\{ \begin{array}{l} 19\ \text{60-watt} \\ 16\ \text{30-watt} \end{array} \right\} = 1{,}620$ watts.
Floor area	1,892 sq. ft.
Efficiency	0·856 watt per sq. ft.
Height of lanterns above floor ...	17 ft. 1 in.

Chancel.—There are three lanterns on the north side, each containing three 30-watt clear "Axial" lamps with opal reflectors; two lanterns on the south side, ditto.

The passage beneath the gallery, from which access is obtained either to the chancel or nave, is lighted by two white alabaster bowl ceiling fittings, each with one 60-watt clear "Axial" lamp, and the light from these two fittings partially illuminates the first portions of the choir stalls at this end.

Total	5 lanterns.
Lamps ...	$\underline{17} \left\{ \begin{array}{l} 15\ \text{30-watt} \\ 2\ \text{60-},, \end{array} \right\} = 570$ watts.
Floor area	1,180 sq. ft.
Efficiency	0·483 watt per sq. ft.
Height of lanterns above floor	11 ft. 10 in.

The lights in the chapel (nave and chancel) are controlled by switches centralised in one large galvanised box, recessed in the wall of the cloister under the tower by the entrance to the passage beneath the gallery. The cloister is on the south side of the chapel.

The electrical work was entirely carried out by Messrs. Hill, Upton & Co., electrical contractors, of Oxford, to the specifications and plans of Mr. H. G. Solomon, M.I.E.E., consulting engineer, London, and under his supervision. They also supplied, in accordance with Mr. Solomon's requirements, the special lanterns, the effect of which, as shown by the accompanying illustrations, is to illuminate the nave and chancel most efficiently, whilst the source of light is wholly concealed from the congregation. This is not an example of indirect illumination, but of direct illumination scientifically planned—attaining the desired result with a remarkably small expenditure of power.

Sodium as a Copper Substitute.—Before the war experiments had been made in Germany with sodium as a substitute for copper electrical conductors. The metal is obtained by electrolysis, and the difficulties that had to be overcome were its low melting point (at 96° C.), and the impossibility of using it in the open air. These difficulties were surmounted by using sodium in a fluid state and filling thin-walled iron pipes with the fluid. In the opinion of the *Zeitung für Blechindustrie*, this opens up a new way for German industry to make itself independent of foreign copper, inasmuch as sodium can be obtained cheaply from the inexhaustible stores contained in German beds of rock salt.

THE APPLICATION OF STANDARDS.

By MAJOR E. A PELLS, R.E.

Any work which has to be carried out with accuracy must be performed with strict regard to some predetermined measurement. Thus, in "Scientific Management," to get the perfect inter-relation of men, machinery, and industrial effort, it is necessary to have some predetermined standard which will form the basis upon which the efficiency of any industrial operation may be calculated. To facilitate the determination of standards, "Work Instruction Cards" may be used, setting out the various elements of a complete operation only, but as soon as the standard is fixed, the time allowed for each of these must be entered on such instruction card, so that the operative, when he receives the card, can see, after his first few attempts, just where he falls short of "championship form," and also the elements where he loses time. When introducing the standard into the workshop, the wage rate should be carefully adjusted; at the same time, it is necessary to provide an incentive, so that the operative will make a definite effort to reach the standard. The various wage systems will be considered in a later article. The incentive should be such that an additional reward accrues to the operative if he exceeds 60 per cent. efficiency, as if this figure is set too high, after a few failures, the operative becomes discouraged, and will put forward no further efforts, giving it up as a bad job and something beyond his powers.

When introducing any alteration into a shop, it will be found good policy to commence with one worker, thus providing an object lesson to the rest of the operatives engaged in similar work. In this you provide ocular proof, which is far more convincing than any amount of talk. Also, the first operations tackled should be those which will be to the best advantage of the operative, whilst upsetting the existing condition the least.

Never try to hurry at this stage, nor, in fact, at any stage, of the process of introducing "efficiency methods," as hurried results and "jumped-at" conclusions often spell disaster and the discrediting of "scientific management" in its entirety. Don't expect results of great magnitude too soon—a big change is not healthy. What is needed is a gradual evolution, not revolution. Remember, it is essential that right at the introduction of standards, the worker must become impressed with the opinion that he is getting a fair deal; he has been swindled so many times in the past that it is only by dealing with the whole matter carefully and disinterestedly that the best results can be obtained. Once the feeling in the shop is sure of the fact that the man engaged on the standard job is being very well treated by the management, and is making a good thing out of it, then all haste may be made to complete the installing of standards throughout the shop. Do not hesitate, once the workers are completely receptive, get your standard-practice instruction cards out for all operations; should, however, it be impossible to standardise some new or changing operation, don't allow it to prevent you from standardising the rest of the shop.

In the worker who introduces the standard by exposition we have the potential instructor in standardised methods, and in this way he will perpetuate the efficiency of working attained by himself; the increased output from the rest of the shop will soon justify his extra pay. This is also found to appeal to the workers, and invites their co-operation generally, as the efficient workers receive their just reward. A bonus should also be paid to the foreman, according to the number of men working under him who qualify for bonus or extra pay by exceeding an efficiency of 60 per cent., and if all his men qualify, an additional bonus. This has the effect of changing the foreman from a driver to an instructor and friend. Of course, one must not expect too much from the worker, whose interest in the success of the firm usually finishes at the pay table.

The introduction of any scheme by which the worker gets rewarded according to his skill, increases the pride and self-esteem of the worker. Also, it is a noticeable point that one's best bonus workers invariably provide one with one's future overseers and managers, and even although at first they do not trouble much about the firm's prosperity so long as they get their pay, there comes a time when the thinking men among the workers must appreciate that the prosperity of the firm is their own, and that any scheme that might be put forward that did not benefit both employer and employé would tend to destroy democracy, and produce revolution. For prosperity of any kind not based on efficiency is an edifice on an unstable foundation.

To encourage a feeling of interest, it is a good idea to show in "graph" form the daily or weekly progress of the shops, thus arousing the sporting spirit of competition amongst the operatives. It often occurs that operatives have to be educated to the value of the standard methods, and one will sometimes find that a man who is giving bad results is disregarding some apparently small thing on the instruction card; this should not be allowed, and firmness is necessary, especially where the man has the support of his foreman, which may often happen.

Finally, once certain of your standard, stick to it, and as soon as the operative appreciates the value of standardised methods, you will have no trouble on that score. Never in a single instance have there been labour troubles at a works where efficiency methods have been installed on good scientific and sympathetic lines.

THE FULLER UTILISATION OF TRAMWAY PLANT.

By GEO. H. HOOLE.

At the present time very little goods traffic is carried over the existing tramway routes, even though in some towns a parcel service is afforded. The question therefore arises, how best to make full use of the existing plant, and that question can only be effectively answered when the solution provides for the maximum use being made of the plant.

Take any large town, and it will be found that along the majority of the routes there are warehouses, mills, factories, and workshops of every description from the patent medicine manufacturers, who send their goods in small lots, to the engineering firm, whose consignments are the heaviest. During one week, taking all the railway companies into account, it can be safely stated that hundreds of visits are made to these warehouses, &c., by railway lorries for the collection and delivery of goods.

It is for the tramway companies and corporations to provide facilities which will render unnecessary these visits of the railway lorries, and the major portion of the plant necessary to meet the requirement is already *in situ*, only connecting links being necessary.

The different goods yards of the several railway companies in most towns are central, adjoining a tramway route, and advantage should be taken of that fact to link up the goods yard with the tramway system.

The proposal, therefore, I wish to put before the readers of the Review is stated roughly as follows:—

1. Each railway goods yard should have an internal tramway system, *i.e.*, it should be possible to draw up a goods tramcar or freightcar to any of the warehouse landing stages, and also to run the cars alongside of the railway trucks as they stand on rail in the sidings.

2. The internal system mentioned in (1) should be linked up with the town system.

3. Manufacturers, &c., along the several routes of the tramway system should have small loop lines connected with the town system to allow of the goods tramcar entering that loop for loading and unloading to prevent interference with the town passenger system.

4. The goods cars should be worked by the Corporation of company, and not by the separate railway companies, so as to enable the collection and delivery of goods along a particular route, irrespective of by what railway company the goods have been, or are to be, consigned.

For instance, if, say, the G.N. Rly. cannot provide a full car load for delivery on one route, the car would complete its load with Midland Railway goods, and so on.

5. The charge made against the separate railway companies could be agreed to, at a per-ton rate, after the mean distance has been arrived at. The majority of warehouses, &c., would in most towns be within a three-mile radius.

6. Advantage should be taken of the quiet hours of passenger service for the conveyance of known large consignments.

7. Special goods tramcars should be of two patterns, for light goods, *i.e.*, equivalent to the ordinary lorry, and for heavy goods.

8. The heavy goods could be dealt with between the hours of 6 a.m. and 8 a.m., whilst the light goods service could be maintained throughout the day.

Take as an example the number of lorries running every morning between the goods stations and the markets. Now, it is reasonable to assume that the tramway goods car would carry twice or thrice the load of a horse-drawn lorry; the service would be quicker and a considerable saving effected if the goods tramcars were brought into use; the initial cost of the loop into the market would soon be covered.

Further, take the cases of firms who daily use each of the railway companies, Great Northern, North-Eastern, Midland. Such firms would not require separate cars, but one could distribute to each of the railway companies those goods proper to its system.

It is not necessary for me to enumerate the many possibilities which underlie the proposal, as they will be apparent to any student of organisation whose attention has been drawn to the congested nature of our streets, a congestion entirely due to the lack of organisation.

The present absurd system of collection or delivery of goods results in three or four lorries being in the same street at the same time—a duplication of service, waste of labour, and capital outlay.

Such a system would result in the following advantages:—

1. Quicker distribution and delivery.
2. Saving in men, horses, and lorries.
3. Facilitating the work of the goods yards considerably consequent upon the more rapid clearing.
4. The work at manufacturers' warehouses would also be facilitated, as one car would take the place of several lorries, and the loading of the car would be quicker than the loading of three lorries, consequent upon there being only one "drawing up" to the stage and "clearing off," as against three.
5. Saving of stabling, &c.

Whilst against these there would be:—

1. The cost of provision of cars.
2. The cost of loops and internal systems of goods yards.
3. The cost of power.

The system would result in a more efficient method of distribution, and from a national point of view this is very essential; a subject which should be exercising the brains of all interested in the nation's welfare.

We have to go forward in peace in the same spirit as we carried on the war, *i.e.*, we have to win, and we cannot win with an effete organisation.

Coal Tar or Coke Oven By-Products (Returns) Order.—The Ministry of Munitions has suspended the operation of the above order as from April 4th, 1919.

ELECTRIC VEHICLE PROGRESS.

In the March issue of the *Electric Vehicle* interesting particulars are given of a test of a 2-ton Edison electric over a period of four weeks. The vehicle ran over some of the worst roads and gradients in and around Birmingham, with loads at times exceeding two tons. The weather was particularly bad, and on some days there was snow. The following results are of interest: Total working time, 225 hours; total load transported, 849.2 tons; distance covered, 761.6 miles; total gross ton-miles (weight of vehicle plus load), 3,320; average miles per hour over whole working period, including standing time, 3.34; average load on vehicle over total distance covered, 1.115 tons; ampere-hours per vehicle-mile, 8.55; ampere-hours per ton-mile, 1.96; units per vehicle mile, including battery losses, 0.825; units per ton-mile, on same basis, 0.189. With electrical energy at 1.625d. per unit, cost of power per vehicle mile, 1.34d., and per ton mile, 1.2d. of load transported. The vehicle ran without a hitch, and covered a distance equivalent to 9,900 miles per annum.

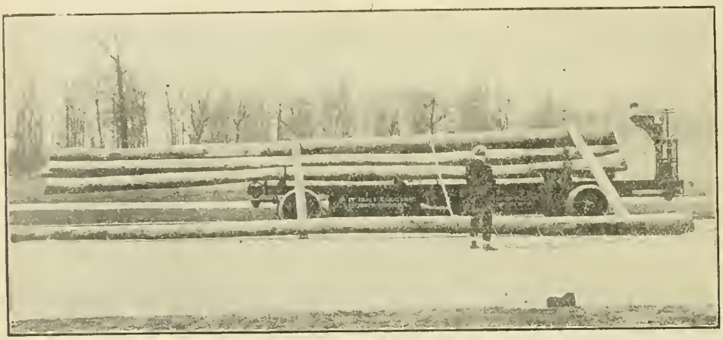

Fig. 1.—An Electric Pole-carrying Wagon.

Our illustrations, derived from the same source, show types of electric vehicles which for special purposes should prove very useful. In fig. 1 is seen a special pole-carrying wagon used by the Philadelphia Electric Co., while fig. 2 shows a powerful wagon with a motor on each of the four wheels, by the Couple Gear Wheel Freight Co., U.S.A.

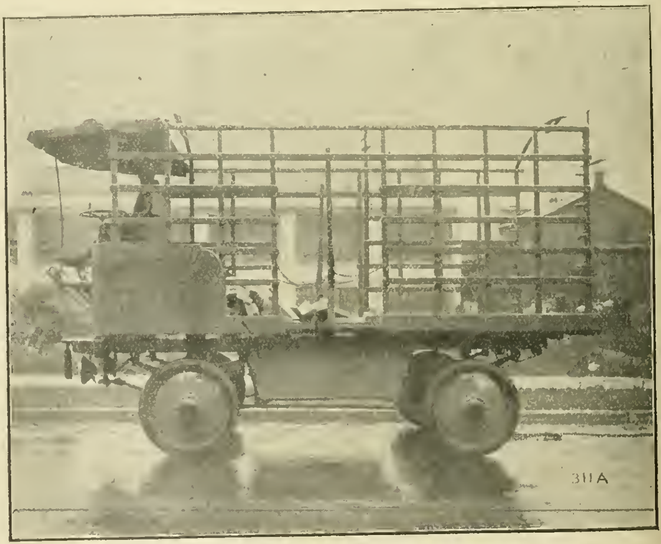

Fig. 2.—An Electric Wagon with 4-wheel Drive.

Recent orders received by Messrs. Drake & Gorham, Ltd., for electric vehicles include three 3½-ton tipping wagons for Messrs. Greenall, Whitley and Co., Ltd., Warrington, two additional elevating platform trucks for Lever Bros., Ltd., and a works truck for Messrs. Tweedales & Smalley, Ltd.

The same firm has also supplied a 2-ton chassis to the Blackburn Corporation, a tower wagon to Warrington Corporation, four works trucks to Messrs. Sir W. G. Armstrong, Whitworth and Co., Ltd., one works truck each to the Ford Motor Co., Ltd., and Callender's Cable & Construction Co., Ltd., and three elevating platform trucks to Lever Bros., Ltd.

Eloquent testimony as to the utility of electric vehicles for municipal services comes from Mr. W. E. Lowe, engineer and surveyor, Pontypridd, and we note that many Berlin carrying companies have turned over from horse-drawn to electric vehicles rather than to petrol-driven lorries in view of the saving that is effected. In lining up at railway stations, &c., the electrically propelled vehicle is not obliged to keep its motor running, as is the case with the petrol lorry. Enumerating the advantages of the electric vehicle, a writer in *Der Motorwagen* points to the simplicity of its construction, the ease of driving, and the certainty of keeping within reasonable limits the figures for repairs, depreciation, current consumption, &c. Owing to the ease with which they can be driven, electric lorries are specially adapted for such concerns as carrying companies, warehouses, and omnibus undertakings.

Seven new electric motor 'buses have recently been put into service in Rio de Janeiro. The bodies are of all-steel construction and somewhat similar in appearance to the street tramway car. Each car has accommodation for 32 passengers.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Re-settlement of Officers.

In recent issues of the Electrical Review several letters have appeared under the heading of "Re-settlement of Officers." Surely "Fed-up" and "R.E. Sapper" are not under the impression that the fact of one's having held a commission is an essential qualification in applying for a technical post. The majority of employers are fully aware that there were just as good men in the ranks who, for some reason or other, did not get their commission, and naturally employers make their selection on purely technical grounds.

It is not necessary for "Fed-up" and others to point out that the fact of one's having held a commission is not a sure indication of technical efficiency. In my own experience, I have seen officers holding technical appointments whose lack of technical ability was deplorable, but who, fortunately, had good technical men under them who did their best to keep the plants in an efficient state. On the other hand, I have come across officers who were sound technical men, knowing their business inside and out, but the majority were not employed in a technical capacity; in the Army it is not always considered good policy to put square pegs in square holes.

With regard to some of the remarks made *re* commissions, I know of several cases where technical men have applied for a commission and have been turned down either on medical grounds or on the plea of indispensability. I myself made three applications, but was twice turned down on the former grounds and once on the latter plea, but still, that does not lead me to think that I have a grievance against those who held commissions. I advise "Fed-up" and "R.E. Sapper" not to worry about preference being given to those who have held commissions; in the majority of cases the employer is more concerned with technical efficiency than with the military rank an applicant may have held, and as "Fed-up" and "R.E. Sapper" are presumably fully qualified men they have nothing to fear in open competition.

In conclusion, I should like to point out that the Editors of the Electrical Review have not given undue preference to re-settlement of officers. In November last I was appointed Instructor in Electrical Engineering in Army Schools in France, and I asked the Editors' assistance in obtaining up-to-date technical matter; not only was every assistance given, but the Editors sent along a number of sound technical works from their own library, and these proved of valuable assistance to those attending the classes (all rankers), and I take this opportunity of thanking them for the invaluable assistance they gave to those who were fully alive to the need for technical efficiency on return to civil life. The letters *re* technical books were published in your issues of November 1st and November 29th under "Notes."

H. Bligh Hill.

London, N.17, *April 1st*, 1917.

Smooth versus Undercut Commutators.

I have very recently returned from France, and have just seen an article in your "Correspondence" Columns of the issue of December 27th, 1918, under the heading "Smooth *versus* Undercut Commutators." The article stated that on a certain set of rotary converters with undercut mica no trouble was experienced when running on a fair load or overload, but when they were operating at no-load the brushes commenced chattering violently. Inherently, undercutting the mica had nothing to do with the trouble, although the same trouble might not have been experienced if the mica had not been undercut, due to the difference in friction when operated with flush mica. The explanation lies in the fact that brushes have a lower coefficient of friction with high-current density than at low-current density, and this is particularly true of high-friction brushes. It is the writer's opinion that this is due to a partial graphitisation of the brush face, caused by the minute arcs through which the current is carried from the commutator to the brush. Several years ago the writer conducted extensive experiments along this line, and on one particular grade of brush found the coefficient of friction to vary from 0.82 at no load to 0.25 at 60 amp. per sq. in., with all other conditions maintained uniform.

E. H. Martindale,
Brush Engineer,
NATIONAL CARBON CO., INC.

Cleveland, Ohio, U.S.A., *March 19th*, 1919.

Consumption Curves for Power Stations.

With reference to the article on "The Coal Consumption of Steam Power Plant" by Mr. Robert H. Parsons, in your issue of February 21st, 1919, if you remember, you very kindly published in your issue of July 15th, 1910, a short article by me in which I advocated the use of the same coal consumption curves that are now being put forward by Mr. Parsons. I have used this method of checking coal consumption for about 10 years with excellent results.

A point to be observed in the use of these curves arises when steam-driven auxiliary plant is changed to electrical drive, as then a portion of the total units generated becomes actually a "standing charge," and the curves must be adjusted accordingly.

Roland Wheeler, A.M.I.E.E.,
Electrical Engineer.

Gibraltar, *March 26th*, 1919.

[The short article by Mr. Wheeler certainly contained the germ of the system, which is more fully worked out in Mr. Parsons's article, and he is to be congratulated on having developed the idea in practice. We again commend it to central-station engineers as a most valuable aid to economy and efficiency.—EDS. ELEC. REV.]

How NOT to Obtain a Situation.

A few weeks ago a letter appeared in these columns on the method of applying for a situation; I was too busy at the time to comment on it, but it appears to me that the fault is with the "hidden hand" methods of advertising in these days; this secrecy causes an enormous waste of time, paper, and postage, and there is no need for it, in fact it is in many ways dangerous.

I wonder how many of our employers are aware of the amount of private information about their businesses which has been supplied to Germany, and other countries, through these Box No. advertisements, not to mention other obvious dangers?

What I would say to situation advertisers is this:—

Don't advertise behind a Box No. above all things; if you don't want interviews in the first instance, say so; it's quite easy. Remember very few good men reply to Box No. advertisements, and no sensible man will give a lot of private information about himself or references to a Box No.

Don't say "state salary required," you know well enough what you want to pay, be British, and state it; if you want to vary it according to experience, state the limits, but don't make the lower limit too low; there is a big cry about more technical education, &c., just now, but before we have more technical knowledge there must be more incentive for it, as the capitalists say, if this country is to hold its own. Remember neither the capitalist nor the working man would be able to get a living if there were no technical men.

Don't say "not over 40"; in the engineering profession a man must be about 40 before he has really good, sound technical and business experience, and there are plenty of good men over 40 who have never had an opportunity of showing their best. Again, no sensible man is going to waste his time on high technical knowledge if he is not sure of a post at 40.

Further, say what you want in your advertisement; I have read dozens of advertisements which gave scarcely any idea of what was actually wanted, and again, don't think a man cannot do something if he hasn't happened to have actually done 'it before'; our English employers stick in one groove too much.

To those applying for situations, I would say, leave Box No. advertisements alone; my experience is that they are hardly worth the paper and postage.

Wake Up.

April 7th, 1919.

Scientific Illumination.

I was recently on leave in London, and one evening found myself in the gallery of the House of Commons. For at least an hour I was absorbed in the faces and speeches of members, but as I began to relax and realise that the country's elect were, after all, ordinary folk like ourselves, I suddenly noticed a most remarkable thing—"Big Ben" had just struck seven, yet the chamber was illuminated, and no lamps met my eye. Suffused light was filtering through the immense stained-glass windows in the ceiling of the chamber in a most natural manner. It was just as though the sun were setting and throwing his last yellow beams inside.

I then noticed that the actual source of light was either clusters of lamps or half watt lamps placed above the stained-glass ceiling, and the light which reached the chamber was toned down and diffused in a most charming manner. At the same time one found no difficulty in reading. The effect must be seen to be realised. Later I noticed that members' seats under the gallery were illuminated by a few lamps, as they would otherwise be in the shade. I consider the lighting scheme of the chamber admirable, and an object-lesson—scientifically and artistically. I fear me that hon. members received but scant attention during the technical ruminations of

G. E. Moore.

B.E.F., *March 27th*, 1919.

[But it is possible to be too "scientific." As a striking example of the best-intentioned illuminating engineering producing disappointing results, the lighting of the lecture theatre of the Institution of Civil Engineers may be cited.—EDS. ELEC. REV.]

Rotor Currents of Slip-Ring Motors.

I should like to express my agreement with "Rotor" in last week's issue of your valuable journal. The manufacturer will greatly assist engineers in such installations by giving more technical data with regard to windings of stators and rotors, viz., rotor amperes, rotor volts, rotor resistance, stator resistance per phase, whether star or mesh connected, and radial air gap.

I have not known a manufacturer give any of the above data except by request. The writer was recently called to inspect a motor starter which was reported to be giving a great deal of trouble, since another motor had been substituted for the original one supplied with the starter; the electrician in charge remarked that it was of the same H.P. and the stator current was the same.

The suggestion given to the manufacturer by "Rotor" would greatly enlighten men in charge of such apparatus, when motors of different makes were adopted as spares.

C. Jones, M.I.E.E.

Chasetown, *April 5th*, 1919.

An Electrical Rupee Tester.—An interesting machine for use in automatically eliminating false coins from good coins is described in the annual report of the master of H.M. Mint, Calcutta, for the year 1917-18. The idea originated from Mr. Hart, of the Calcutta Mint, who placed his plans at the disposal of Messrs. Siemens Bros., with the result that the above-mentioned machine has been constructed. Rupees are placed into a hopper and mechanically ejected, one by one, so as to rotate on edge and roll down a narrow inclined plane fitted with guide strips, which delivers them into an intense magnetic field. Eddy currents are induced in the moving coins, which consequently experience retardation of movement in proportion to the currents generated. Good coins (of superior conductivity) experience most retardation, and fall into the first of two receptacles, whilst base coin (of low conductivity) are carried by their greater momentum into the further receptacle. The machine will not distinguish between good and counterfeit coin made of metals with similar conductivities. It can be used, however, to separate good coin from mint defective coin, such as split coin or coin containing air bubbles. As a general rule it is claimed that 90 per cent. of false coin in any remittance can be eliminated by it, and it should prove useful in mints, Government treasuries, railways, and banks.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Higgs Bros.' Electric Motors.

We have often dwelt upon the importance of specialisation of product in the past; it is vastly more important in the conditions which will obtain in the future, when it will be necessary to employ every possible means of reducing costs and increasing output—a double problem which is ever increasing in difficulty as wages go up, and working hours go down. It is interesting, therefore, to note that Messrs. Higgs Bros., of Summer Hill Street, Birmingham, pursue the policy of specialisation exclusively; they manufacture electric motors, and do nothing else—they do no factoring business at all. They concentrate all their energies on the design and manufacture of motors, and have thus become specialists in machines of small and medium size. Even when, in their early days, sometimes orders ran short, they did not take up other work—they closed the works for a time, rather than depart from their settled policy. But that is a thing of the past, and is not likely to recur.

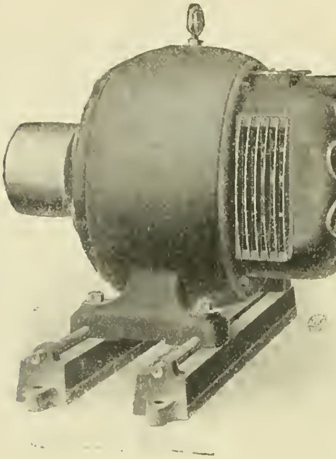

Fig. 1.—Higgs Bros. Protected d.c. Motor.

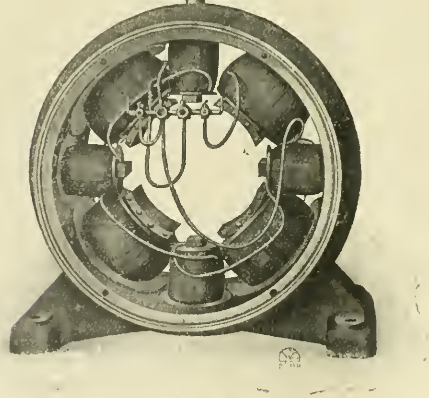

Fig. 2.—Field Magnet.

In view of the foregoing facts, the accompanying illustrations of some items of the company's products will be of interest. Fig. 1 shows one of its d.c. motors, protected type; these are made in sizes from 0.15 b.h.p. to 70 h.p., and are guaranteed to comply with the British standardisation rules, being sparkless at all rated loads without moving the brushes, and capable of carrying 25 per cent. overload for a time depending on the size of the machine. Every part is interchangeable.

Fig. 2 shows the magnet frame of the machine, which is fitted with interpoles. The yoke is of cast iron, with mild steel poles and laminated pole shoes; the field coils are wound with enamelled wire, and are readily removable. The armature is shown in fig. 3, with a patent fan mounted on the winding cup, the armature coils being former wound, and the commutator built up on a separate core. Roller bearings are used throughout. The end covers are of cast iron, with ventilating covers of patented design. Enclosed ventilated and totally enclosed motors are also made, as well as 2 and 3-phase induction motors, and small single-phase commutator motors (0.1 to 0.5 h.p.)

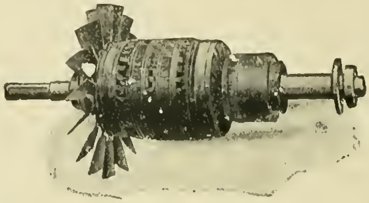

Fig. 3.—Armature of Higgs Motor.

British Locomobiles.

Messrs. Marshall, Sons & Co., Ltd., of Gainsborough, are building locomobiles of sizes up to 250 b.h.p., and will shortly issue full particulars. These machines which combine in one a boiler, superheater, compound engine, and, if desired, a condenser, represent the limit of compactness, whilst attaining to a remarkably high efficiency, and are very suitable under appropriate conditions for driving electric generating plant.

Amongst the advantages of the locomobile are the fact that the plant is self-contained, and requires little in the way of foundations, while it can be housed in a small and inexpensive building; whereas it is difficult to clean the water side ordinary semiportable boiler tubes, in the case of the locomobile the whole of the firebox and tubes can be bodily withdrawn, cleaned, and replaced in a few hours.

The "W.R." Combustion Indicator.

The accompanying diagram shows the arrangement of an ingenious device which has been perfected during the war by Messrs. "W.R." Patents, Ltd., 8, Old Jewry, E.C.2., and gives a continuous automatic indication of the percentage of CO_2 in flue gases; we are informed that it is already in use in several large generating stations, and is giving excellent results. As shown diagrammatically in fig. 4, an aspirator worked by a minute jet of steam continuously draws gases from the flue through a filter F into a chamber containing a porous pot, inside which is a dry reagent; a pipe connects this chamber with a vessel containing water, into which dips one end of another pipe G, the other end of which is taken into the inside of the porous pot. Some of the gases penetrate into the interior of this pot, and are absorbed by the reagent, with the result that a partial vacuum is formed, and the water is forced up the pipe G. The latter is provided with a scale so graduated that the percentage of CO_2 in the flue gases can be read. Where forced or induced draught is in use, the steam injector can be dispensed with. The amount of steam taken by the injector is very small—not more than 1 lb. per hour. The only renewal required is a cartridge of absorbent, which is renewed every other day. The accuracy is said to be within 1 per cent.

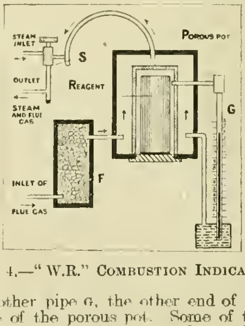

Fig. 4.—"W.R." Combustion Indicator.

THE ELIMINATION OF STATICS IN WIRELESS TELEGRAPHY.

The invention by Mr. Roy A. Weagrant, chief engineer of the Marconi Co., which we announced in our issue of March 14th, of a device which, it is claimed, will completely eliminate static interference of wireless signals, was explained in full last month at a joint meeting of the Institute of Radio Engineers and the New York Electrical Society.

According to the *Electrical World*, the inventor claims that it is possible to eliminate interference from the "grinders" by placing two low rectangular loops in the same vertical plane, but at the same elevation. The static waves, moving vertically, reach both loops simultaneously, whereas the signal waves, travelling horizontally from a given direction, set in vibration, first, the loop which is nearest to the sending station, and afterward the second loop. As a result the currents set up in the two loops by the static disturbance are in phase, and may be cancelled by proper connection of the loops. Currents set up by the signal waves will be out of phase by an amount depending on the sending wave length and the distance that the loops are apart horizontally. By placing them exactly one-half wave length apart a phase difference of 180 deg. will be obtained, but these currents can be made to add arithmetically by proper connection of the loops, so they really strengthen the signal received. Another advantage is that costly towers are eliminated. Experiments were mentioned by the investigator in which he was able to obtain very satisfactory results with antennas laid on the ground or slightly buried, provided that the length was not too great.

While the foregoing method eliminated "grinders," it did not reduce the disturbance from "clicks." Investigation indicated that the static waves producing these disturbances follow no definite direction, but seem to come from all azimuthal points. Of the many methods tried to eliminate these "clicks" one using three loops was most satisfactory. Two of the loops were placed as in eliminating "grinders," while the third loop was placed between. The connections were made in such a way that the currents produced in one set of loops by the second kind of static could be used to cancel those produced by the same cause in the other set of loops, leaving the signalling current free of disturbances. These devices have actually been tested on a commercial scale in a number of places and under very severe conditions. Mr. Weagrant has been able to maintain undisturbed communication with European stations during summer months and in the afternoon when disturbances are the worst. He has been able to screen out interference from neighbouring stations rated as high as 200 kw., provided that they are not in the direction of the sending stations—this by changing the directional-sensitivity characteristics, which can be easily done with three loops.

Mr. Weagrant has been able to receive trans-Atlantic messages with antennas which can be set up in an average-sized room, provided that amplifiers are used.

Several men noted in radio circles took part in the discussion which followed the presentation of the paper, and all hailed the investigation as an epoch-making accomplishment. The value of amplifiers in radio work was also emphatically brought out, their use and the manipulation of phase differences being two distinct steps in recent wireless development.

REVIEWS.

Electricity and Magnetism for Engineers. Part I: Electric and Magnetic Circuits. By Harold Pender, Ph.D. London: Hill Publishing Co., Ltd. Pp. xi + 380; 98 figs. Price $3.00 net.

This book is a distinctly quantitative account of the laws and phenomena of magnetism and electricity as applied to the generation, transmission, and utilisation of electrical energy. The author has realised that the electrical engineer must be able to answer not only "how," but also "how much"; he has therefore set himself the somewhat thankless task of writing a text-book in which problems are analysed quantitatively and definite mathematical relations obtained. The more popular and easy method of quoting formulæ should be studiously avoided by the electrical engineer, for both safety and economy depend upon his ability to solve problems not by a rule of thumb, which may have serious limitations, but by analysis based on first principles.

The quantitative idea underlying the book is an entirely admirable one, but its development in this volume cannot be regarded as entirely successful.

An introductory chapter gives a good account of force, work, and energy—fundamental conceptions without which no progress can be made. Chapter II introduces the general phenomena of the electric circuit, together with units and measuring instruments. The descriptions of the potentiometer, Wheatstone's bridge, voltmeter, and other instruments are simple and well illustrated. In general there is little to take exception to in this long chapter, but an extraordinary error of definition which is set out in specially bold type on page 62 must be pointed out: "The quantity by which the current in a given conductor must be multiplied in order to give the rate at which heat energy is developed in it is called the electric resistance of this conductor." The growing custom of explaining resistance by means of the heat equation $JH = I^2Rt$ is to be deplored, because it is an essentially clumsier method than that derived from Ohm's law; but when such circumlocution leads to errors such as that pointed out above, whatever tolerance we had extended to it must be withdrawn.

After defining E.M.F. as "the electric power developed in any source of electric energy per unit intensity of the electric current through it," the author arrives at Ohm's law, and then concludes a successful account of the difference between the E.M.F. (e) of a source and the P.D. (v) between its terminals by stating the following ridiculous equations: "$v = e - ri^2$ for a source of electrical energy; $v = e + ri^2$ for a receiver of electrical energy." No doubt the author has been guilty of careless proof-reading, but it will probably result in his readers getting singularly unorthodox notions concerning the dimensions of voltage, energy, and power.

The value of the two following chapters is considerably enhanced by the inclusion of 30 well-selected problems on continuous-current circuits and resistance. These are followed by two very brief and ordinary chapters on electrolytic conduction and sources of E.M.F., succeeded by an extensive treatment of the magnetic circuit.

The unutterable muddle into which the average student flounders concerning the relations between magnetic flux, magnetic intensity, magnetic-flux density, lines of force, lines of induction, and tubes of force, is largely the fault of text-books in which too little trouble is taken to define the terms used. Mr. Pender cannot be accused of this fault—his definitions are fastidious to a degree—but we must confess to a suspicion that, in spite of this fastidiousness, his chapter on the magnetic circuit will on the whole tend to increase rather than diminish the prevailing confusion. As an illustration of the general lack of perspicuity we may quote the following definition: "As the quantitative measure of the magnetic flux through any surface is taken the time integral of the electromotive force which is induced during the establishment of this flux, in the closed loop formed by the boundary of this surface."

The following chapters on the calculation of flux density and magnetic energy and eddy currents appear to us to be more useful, and are enriched with numerous problems with answers. The treatment of inductance and mechanical forces in magnetic fields is also of a higher standard than much of the earlier portion of the book. The establishment and decay of the current, the principles of the transformer and the alternating-current generator are all dealt with clearly and illustrated by examples.

Recognising the difficulties inherent in its production, we must allow that Mr. Pender's book, while imperfect in many details, has much to recommend it to the notice of engineering students. It is certainly likely to be useful to the engineer whose electricity and magnetism have been so essentially qualitative as to leave him unable to tackle practical problems.—P. H. S. K.

Gyrostatics and Rotational Motion. By A. Gray, F.R.S. London: Macmillan & Co., Ltd. Price 42s. net. Pp. xx + 530; figs. 122.

The theory of gyrostatic action is one of the most fascinating studies of the physicist, and one of the most important to engineers; it is, however, beset with difficulties to the non-mathematically minded, and pitfalls for inventors who do not thoroughly understand the peculiarities of gyrostatic phenomena, and is rarely expounded in such a way that the inexpert can form a clear conception of it. The author, pupil and successor in the University of Glasgow of Lord Kelvin, whose enthusiastic lecture demonstrations in this subject will never be forgotten by those who were privileged to witness them, has set himself the task of filling a gap in the literature of the subject by producing a treatise which, we believe, will become a classic—in which the theory and applications of gyrostatics are fully dealt with systematically and on the basis of constant reference to first principles, so that instead of mechanically absorbing a series of formulæ, the student shall be enabled to form a physical conception of the action of the devices which are discussed. Although the volume before us would appear to be exhaustive, the author has naturally been unable to include in it particulars of apparatus used for naval and military purposes, but a supplementary volume is foreshadowed for publication after the war to deal with these and kindred matters.

The contents of the book are necessarily very largely of a mathematical nature, treating first of the principles of gyrostatic action, then of tops and gyrostats, various physical and astronomical questions, flywheels, the whirling of shafts, and many allied questions. An ingenious gyrostat devised by Dr. J. G. Gray and Mr. G. Burnside, in which the flywheel is the rotor of a D.C. motor, is described. The stabilising effect of gyrostatic action on bicycles, ships, projectiles, &c., is discussed, and the gyrostatic action of revolving bodies, such as the rotors of turbines, is considered. The admirable treatise which Prof. Gray has provided will be of great value not only to students, but also to engineers, who will find many new applications for gyrostats as time goes on.

BUSINESS NOTES.

Good Friday Week.—Next Friday being Good Friday, the Electrical Review for April 18th will appear two days earlier than usual—that is, on Wednesday morning. All copy—editorial and advertising—should, therefore, be sent in at the earliest possible moment. The latest time for receipt of alterations to displayed advertisements is to-morrow, Saturday morning.

Our Letters from the Forces.—A correspondent writes:—"It is with feelings of deepest gratitude that I write to you. For two years you have faithfully supplied me with your excellent journal, which is undoubtedly the leading paper in the electrical engineering world, and which on account of its beneficence to the soldiers will, I am sure, be supported in return with a loyalty that it richly deserves. Your journal had a good name before the war; it has even a better one now. I have resumed my former duties in the electrical world, and shall constantly look forward to having the Review by my side, appreciating the aid of its bright intellectualism, its technical ability, and its advertising excellence."

A Willesden "Welcome Home."—The electricity department of the Willesden Council commenced a new era of social activity at the electricity offices, Salusbury Road, on the evening of Saturday, March 29th. The occasion was a "Welcome Home" arranged for some 20 members of the staff who have seen active service during the war. Councillor W. A. Hill, chairman of the Electricity Committee, presided. A meal, served by the Willesden Co-operative Society, was followed by a varied musical entertainment provided by the staff of the department. For the toasts, men of different sections of the service were grouped, each group being toasted by one of the lady members of the staff. Every man in turn replied to his particular toast. A toast in honour of the lady members of the staff was heartily drunk, as was the toast of the chairman and members of the Council present. The men who had been on service expressed their thanks to the Council for granting an allowance to those dependent on them during their absence. The room was tastefully decorated by the ladies. A Roll of Honour containing no fewer than 30 names (five of whom have made the great sacrifice) was exhibited. Accompanying this was a collection of photographs of all the men referred to in the Roll of Honour. A small pamphlet had been prepared setting out the work of the department. An introduction by the chairman of the Electricity Committee was followed by a brief record of every man's service in the Army.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for April 8th.

Iron and Steel.—The Ministry of Munitions announces that all subsidies in connection with the manufacture of iron and steel, including those on iron ore, coke, and pig-iron, will be withdrawn on April 30th, 1919. The control of prices and allocation of all descriptions of metallurgical coke, iron and steel scrap, cinder and scale, iron ore, pig-iron, manufactured iron, and steel and tinplates, will cease as at that date. Subject to the provisions of existing contracts, and to any regulations in force from time to time with regard to export, makers and others are free to make their own terms and arrangements in respect of delivery of any of these materials for home or export on and after May 1st, 1919.

Silvertown Cables.—Now that the Government Departments' demands for Silvertown rubber cables and wires have been relaxed, the India-Rubber Co. are in a position to devote practically the whole of their attention to ordinary industrial requirements. Prompt deliveries of all standard sizes can be made from the works, or any of the company's branches at Belfast, Birmingham, Bradford, Bristol, Cardiff, Dublin, Glasgow, Liverpool, London, Manchester, Newcastle, Portsmouth and Sheffield. The firm have had great experience of cable manufacture having made and laid their first submarine cable in 1867. In addition to the standard "Association" rubber-insulated, taped and braided, lead-covered and armoured cables, they make the following special lines:—Hard cord-braided and leather-braided flexible trailing cables, for use in connection with coal cutters. Double wire-armoured cables, twin or three-core, for collieries, to meet the Home Office regulations. Fire-proof braided cables. Shot-firing wires, either rubber or gutta-percha insulated. Bell wires, all classes. Cotton or silk-covered wires for coil winding. H.T. and L.T. ignition cables to meet the Air Board specifications, also for use in connection with motor-car ignition. Flexible cord for use with heating apparatus. The Silvertown Co. has had 60 years' experience in the manipulation of the many varieties of india-rubber. Concerning the company's gutta-percha insulated wires, it may be remarked that the application of this material as an insulating medium has occupied a foremost place in Silvertown manufactures for a great many years.

Diesel Engine Amalgamation.—It is announced that Messrs. Petters, Ltd., have entered into an agreement with Messrs. Vickers, Ltd., for a combination of interests in the manufacture and sale of the Petter patent semi-Diesel oil engines. A subsidiary company is being formed, under the title Vickers-Petters, Ltd., with a capital of £500,000, in which the two companies will be the sole shareholders. Messrs. Petter's works at Yeovil are not included in the agreement, and varied engineering manufactures will be produced there. Vickers will transfer to the company the Ipswich works of the Consolidated Diesel Co., which they acquired during the war.

The Excess Profits Tax.—Addressing a meeting of the Bolton Chamber of Commerce, Lord Leverhulme said the Excess Profits Tax operated very unfairly. Profits should be set free to be poured back into business for purposes of development and expansion. By expansion of business cheaper goods would be produced and work would be found for a greater number of people. But the continuance of the tax would stunt the growth of businesses and greatly discourage enterprising young men. The tax would make it impossible to expand, and would even make difficult the maintenance of their business. The desire for expansion would also be killed. If they put fresh capital into their business, and made additional profit, the Government took 80 per cent. of it, but if they made a loss, they could take the whole of it themselves. It was a sort of nigger partnership—the nigger took the profits and Sam Johnson got the losses.

At an extraordinary meeting of Erinoid, Ltd., last week, Mr. Andrew Binnie referred to the effect of their application for an increased percentage over the statutory rate of 6 per cent. Having regard to the percentages which have been settled in the case of other undertakings, which did not compete with Germany, did not export from this country, and did not employ English labour, they had every reason to expect a reasonable increase. The result of the hearing of their case, however, was a serious disappointment to them. They were placed in almost the lowest category and given an increase of only 1½ per cent., making a total percentage on capital of 7½ per cent. "On an 80 per cent. basis, for every £5,000 made in excess of our standard we should have to pay £4,000 as duty, and of the remaining £1,000, roughly one-third would be taken as income-tax, leaving to the company only £600 out of £5,000. Out of that negligible margin we are expected to make good depreciation and other charges not allowed in the Inland Revenue computation of profits, also to provide additional working capital by way of reserves. As business men, you will realise that that cannot be done, and that increased sales cannot be successfully financed on such a basis. To put our case in a sentence, we were working hard to capture what was a German trade, and we have been, if I may use the expression, 'snookered' by the Inland Revenue. We were therefore bound to go carefully pending the production of the next Budget. The Inland Revenue methods of taxation by cramping new industries are restricting exports and employment and losing income-tax in the process. The officials do not seem to realise, if I may adapt a well-known phrase, that you cannot run an A 1 business on a C 3 standard."

If the excess profits duty was to continue, said Mr. Binnie, even in a modified form, new industries in this country had an overwhelming case for special consideration at the hands of Parliament. They should in fairness be placed on the same basis as pre-war industries of a similar type. The present methods discouraged new enterprises, and did not raise revenue from them.

Whitley Councils for the Civil Service.—The Committee who were appointed to consider the application of the Whitley Report to the Administrative Departments of the Civil Service, in their Report recommend its adoption with some modifications. In view of the essential differences between public and private employment, and the need for maintaining Ministerial responsibility and Parliamentary control, the joint bodies, the Committee consider, must be consultative, and must not be invested with any executive functions. According to the *Daily Chronicle*, it is proposed to establish a National Council for the whole of the Administrative Departments; one or more Departmental Joint Committees for each Department; District or Local Office Joint Committees in suitable cases; Sectional Committees of the Departmental Committee.

Overseas Trade Inquiries.—In the annual report of the Royal Colonial Institute, it is stated that since the signing of the armistice, large numbers of inquiries have been received from oversea firms and individuals desirous of being put in touch with British manufacturers and merchants with a view to obtaining goods which, prior to the war, were chiefly supplied by enemy countries; and also from persons wishing to act as representatives of British manufacturers. As a result of the introductions given, extensive business will be taken up.

Government Trade Missions Abroad.—In reply to a question in Parliament, Sir A. Steel-Maitland, of the Overseas Trade Department, states (according to the *Times*) that general economic missions have been sent under the auspices of his Majesty's Government to Poland and Serbia with the object, on the one hand, of investigating the requirements of these countries for material necessary to the reconstruction of their damaged industries, and, on the other hand, to inquire into the opportunities of developing British trade. It has been decided to send a similar mission to Belgium. A small mission has also been sent to Bulgaria to investigate the openings for British trade with that country. A special mission is at present in France dealing with questions relating to sugar-making machinery. Four investigators have been sent out by the Department of Overseas Trade in co-operation with trade associations in this country to inquire into the prospects and conditions of (1) the market for jewellery and electro-plate in South America; (2) the engineering trade in Brazil; (3) the confectionery trade in South America; and (4) the market for motor vehicles in Australia and the Far East. Other investigations of a similar character are now in contemplation.

Department of Export Restrictions.—The President of the Board of Trade has changed the title of the War Trade Department, to the "Department of Export Restrictions," but its address will remain at 4, Central Buildings, Westminster, S.W. 1.

Output of Iron and Steel.—The following statement as to production of iron and steel in the United Kingdom is issued by the Ministry of Munitions :—

Pig Iron.

	Output during week ending Mar. 15th, 1919. Tons.	Number of furnaces in blast.
Hematite	62,000	102
Basic	52,000	83
Foundry, forge, and other qualities	37,000	97
Ferro-alloys	5,000	13
Total	156,000	295

Steel Ingots and Castings.

Output during week ending March 15th, 1919 .. .. 185,000 tons.

Imports of Machinery into Australia.—Essential machinery which cannot be manufactured in Australia is to be admitted duty free.—*Times*.

The New Library at Birmingham.—The Chief Librarian of Birmingham (Mr. Walter Powell) reports this week to the Birmingham City Council that the work of getting together, re-classifying, and cataloguing the books suitable for inclusion in the new Commercial Library is well in hand, and with the return from the Army of members of the library staff, will soon be completed. In order to secure the interest and assistance of gentlemen associated with the trade and commercial life of Birmingham, the Libraries Committee has formed an Advisory Committee of representatives of the University of Birmingham, the Chamber of Commerce, the Business Club, the Rotary Club, the Birmingham and District Trades and Labour Council (artisans' indnstrial organisation), and the Birmingham Iron and Steel Exchange. It is hoped to open the library this month.

Trade Announcements.—Messrs. Wood & Cairns, Ltd., wholesale electrical factors, Edinburgh, Glasgow, and Dundee, have appointed Mr. John Pendreich as their representative in Fife, the Lothians, and the South of Scotland. Mr. Pendreich was formerly with the General Electric Co., Ltd., and Messrs. Millar and Stewart.

Messrs. Armstrong, Elder & Co. are amalgamating with Messrs. John Ackland & Co., Ltd., 80, Gracechurch Street, E.C., and the business is now being carried on under the latter name at the address stated. Mr. Henry J. Tossell (of Messrs. Armstrong, Elder) becomes a director of the concern. New and extensive premises have been taken at 12, Old Street, and 11, Middle Row, E.C., for warehousing large stocks.

Mr. H. Odell, electrical engineer, has opened the Spital Works, Windsor.

Mr. C. W. Newall, who has been discharged from the Forces, has commenced business as an electrical engineer at Earle Street, Crewe.

Messrs. Goodenough & Harris, electrical engineers, of Barnstaple, have taken larger premises at Rackfield, Bontport Street.

Messrs. Rose Bros., of London, have now opened a branch office and warehouse at 83a, Radcliffe Street, Bristol, for the wholesale trade only.

Messrs. Peter Brotherhood, Ltd., of Peterborough, have just opened a branch office at 47, Pilgrim Street, Newcastle-on-Tyne, under the management of Mr. E. Jones, late of the Mirrlees. Watson Co., Glasgow, to deal with their business in the North of England. Their specialities include air and gas compressors, steam engines, steam turbines up to 1,500 b.h.p., internal combustion engines of small sizes, centrifugal pumps, dynamometers, &c.

Messrs. Purit Specialties, Ltd., Park Street, Birmingham, announce that Mr. W. Balmford (late of British Westinghouse E.M. Co.) has been appointed their general manager. He will devote special attention to their "D.L.S." fittings, which are now offered from stock.

Mr. William Sykes, many years foreman for the Darlington Corporation Electricity Department, has commenced business on his own account as an electric light and power engineer at High Row, Darlington.

Stocks of Non-Ferrous Materials.—The following particulars are published of the stocks (exclusive of old metal and scrap) in this country in possession of the Minister of Munitions on April 1st, 1919 :—

Copper	48.702 tons	Soft pig lead ...	96.456 tons
Spelter, G.O.B. ...	27,676 "	Nickel	2,389 "
Refined ...	10,371 "	Antimony regulus	4.361 "
Alnminium ...	11.210 "		

Trade Restrictions to be Removed.—The *Daily Telegraph* stated last Saturday that in official quarters it was understood that the Government would shortly be in a position to announce the removal of a number of restrictions which hampered the development of trade. "This action will be of great importance to the industrial community."

A Berlin Strike.—It was reported in the Press last week that the technical office employés of the Berlin metallurgical industry struck on April 2nd. The strikers included all categories of employés—engineers, draughtsmen, foremen, shorthand typists, &c., roughly estimated at over 30,000.

Joint Control of Canadian Industry. — A *Times* dispatch from Ottawa states that the Government has decided to appoint a Commission, consisting of representatives of Labour and Capital, to investigate the feasibility of joint control of industry in Canada by Capital and Labour. The Commission will visit various cities and take evidence.

French Companies.—The Société Industrielle d'Optique de Précision has been constituted at Paris, with a capital of 1,250,000 fr., to manufacture all kinds of instruments of precision and electrical and mechanical apparatus for the use of science and industry.

The Anciens Etablissements Edmond-Picard, Paris, mechanical and electrical mechanicians, have been converted into a company, with a capital of 300,000 fr.

Under the style of L'Outillage Electrique (Allion et Vignal) has been formed a company at Lyons for the manufacture of electric drills, sewing machine motors, and the installation of motors, alternators, and transformers.

The Electria is a company formed at Paris, with a capital of 450,000 fr., to carry on works now under construction at Bruay, for the manufacture of all kinds of electrical and mechanical material.

Government Sales.—Messrs. S. Dixon & Son, Ltd., of Leeds, have written to the *Times*, suggesting that the Government should issue in the *Board of Trade Journal* a weekly catalogue or summary of coming sales of Government material, as at present it is difficult to keep track of them.

Turbine Plant for Glasgow.—In our issue of March 28th, under this head, it was stated that the condensing plant would be of the Willans surface type, with duplicate air extraction plants on the Willans rotary water-jet system. We are informed by the Mirrlees Watson Co., Ltd., Glasgow, that this is not correct ; the condensing-plant portion of the contract is being supplied by them through the English Electric Co., Ltd., as main contractors The condensing plant is, generally, a duplicate of a plant now being erected by the Mirrlees Watson Co. at the Dalmarnock Station in connection with Messrs. Fraser & Chalmers's turbine, the only difference being that for the new set the air pumps are of the Mirrlees-Leblanc steam multijector type, fitted in two units. Each unit consists of four ejectors arranged in parallel ; thus one or more ejectors can be operated according to the air leakage, which makes a most efficient and flexible arrangement.

Industrial Housing Schemes.—The Joint Housing Committee of the Federation of British Industries and the National Alliance of Employers and Employed have expressed the opinion that the new Housing Bill of the Government is a great improvement on existing powers, and will in the course of time do much to secure the building of working class houses. The Bill, however, is complex, and some delay must inevitably occur before it takes effect. In view of the urgency of starting building all over the country *at once*, both to meet the housing shortage and to curtail unemployment, the Committee urge the Government to pass a short Act enabling a grant per house to be made to any public authority or public utility society, for working class houses built within one year from the passing of the Act. As the cost of building has considerably more than doubled from pre-war prices, it is suggested that the Government should pay 40 per cent. of the cost of building, and that the grant should be given for a definite number of houses, say 100,000, distributed over the whole country. The Committee hold that the financial terms offered to Public Utility Societies should be at least as favourable as those granted to local authorities.

South African Trade Inquiries.—Since Mr. H. M. Senior, Trade Commissioner in South Africa, opened his offices at Winchester House, Loveday Street, Johannesburg, in February, he has received numerous inquiries showing a great desire to renew business connections which were suspended during the war. A library of catalogues, trade journals, and directories has been established at the office. Communications should be addressed to him as above.

Imports Restriction Committee.—The *Daily Chronicle* states that Mr. Stuart Bunning, chairman of the Parliamentary Committee of the Trade Union Congress, has resigned from the Imports Restriction Committee, as after attending its first meeting "the discussion convinced him that the personnel of the Committee was such that it was bound to report in favour of a Protectionist policy." The Trade Union Congress, which was allotted four seats on the Committee, is taking no further part in the proceedings. As already stated, Lord Emmott recently resigned the chairmanship of the Committee.

Foreign Trade.—The March Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures :—

Imports.	*March*, 1919.	*Inc. or dec.*	3 *months*, 1919. *Inc. or dec.*
	£	£	£
Electrical goods, &c. ...	119,909	+ 53,561	+ 79,826
Machinery	1,743,350	+ 889,851	+ 1,660,737
Exports.			
Electrical goods, &c. ...	328,129	+ 217,122	+ 461.407
Machinery	1,950,148	+ 814,097	+ 1.514.892

Electrical Exhibition at Barcelona.—An international exhibition is to held at Barcelona in 1921 devoted to electricity and allied industries. The exhibition will be divided into 13 sections, covering the whole domain of constructive electricity. It is well known that before the war Germans enjoyed the major part of Spain's foreign custom, her exports being to a value of 25,326,184 pesetas in 1913. The exhibition should, therefore, offer an excellent opportunity for Allied exporters to improve their position in the Spanish market.

Fire.—A correspondent states that the electric generating station at Shilbottle Colliery, near Alnwick, Northumberland, was completely destroyed by fire on Monday morning.

British Scientific Products Exhibition.—At the Exhibition to be held at Central Hall, Westminster, from July 3rd to August 5th, the exhibits will be divided into the following sections — Agriculture ; Aircraft : Chemistry (inorganic and organic products, plant, laboratory ware and apparatus) : Education ; Electrical Appliances (including instruments, wireless apparatus and magnetos) ; Engineering (prime movers, traction, mechanical devices and models) ; Fuels ; Medicine and Surgery (including bacteriological and X-ray apparatus) ; Metallurgy (ferrous and non-ferrous products, furnaces and plant) ; Paper, Illustration and Typography ; Physics (mechanics, heat, optics, illumination, photography, sound) ; and Textiles. Other exhibits in suitable sections.

Canadian Engineering Standards Association.—The Canadian Engineering Standards Association has recently been incorporated, with head office at Montreal. The chief objects of the Association are to co-ordinate the efforts of producers and users for the improvement and standardisation of engineering materials ; and to prepare and promote the general adoption of standards in connection with engineering structures, materials, and other matters and things, and from time to time to revise, alter, and amend the same. The following distinguished professional men are listed as the incorporators :—Sir John Kennedy, Dr. Robert Ruttan, Dr. John Bonsall Porter, Richard John Durley, and Henry Hague Vaughan, all of Montreal. The operations of the corporation are to be carried on without share capital.—*Board of Trade Journal.*

Book Notices.—"*Mechanical World* Electrical Pocket-Book for 1919." Pp. 274, 105 figs., and diary. Manchester : Emmott & Co., Ltd. Price 1s. net.—The present issue has been further enlarged and improved. The section on electric motors in industrial service has been re-written and expanded, and now contains information on the selection, operation, and care of motors. The new sections on the use of fly-wheels with electric motors, and on the care of commutators and brushes, will also be of interest. The sections on alternators, alternating currents, static transformers, and fuses, have all been re-written ; while new sections have been introduced dealing with phase sequence, &c., and synchronous alternators. The sections on electric lamps and lighting have been partly re-written. The mathematical tables have been extended, and additions made to several other sections.

"*Journal* of the Institution of Electrical Engineers." Vol. 57, No. 280. March, 1919. London : E. & F. N. Spon, Ltd. Price 7s. —This issue contains Lieut.-Col. W. A. J. O'Meara's paper on "The Functions of the Engineer : His Education and Training," and the discussions on the following papers :—"Carbon Brushes" : "The Use of High-pressure and High-temperature Steam in Large Power Stations" ; and "The Supply of Single-phase Power from Three-phase Systems."

"Aeroplane Construction." By Sydney Camm. Pp. viii + 138 ; 126 figs. London : Crosby Lockwood & Son. 1919. Price 7s. 6d. net.

"Catalogue of Lewis's Medical and Scientific Library," including a classified index of subjects, with the names of those authors who have treated of them. Revised to the end of 1917. Pp. 492. London : H. K. Lewis & Co., Ltd. Price 12s. 6d. net.

"Annual Report of the Dominion Water-Power Branch, 1916-1917." Ottawa : Department of the Interior.

"Practical Elementary Manual of Magnetism and Electricity." By A. Jamieson. Tenth edition. Pp. xiv + 372 ; illustrations. London : Charles Griffin & Co., Ltd. 1919. Price 5s. net.

For Sale.—Preston Corporation tramway department has for disposal one heavy treble-geared tram-wheel lathe. For particulars see our advertisement pages to-day.

Edinburgh Corporation invites offers for one drum-type rotary water strainer, and three 1,500-KW. 6,600-volt three-phase switch panels. For particulars see our advertisement pages.

Liquidations and Dissolutions.—RESISTO ELECTRICAL MANUFACTURING CO., LTD.—A meeting is called for May 7th at 167, Fenchurch Street, London, E.C., to hear an account of the winding up, from the liquidator, Mr. De W. Layton.

TRAMWAYS AND GENERAL WORKS CO., LTD.—Winding up voluntarily. Meeting of creditors, April 22nd, at 57, Moorgate Street, E.C. Liquidator, Mr. E. C. Price.

BRITISH HUHN METALLIC PACKING CO., LTD., London, E.C.—Return to contributories. First and final payment of £1 2s. 10½d. per share, payable at office of Official Receiver and Liquidator, Carey Street, W.C.

LARNE ELECTRIC LIGHT WORKS, LTD.—A meeting is called for May 12th at Suffolk House, Laurence Pountney Hill, London, E.C., to hear an account of the winding up from the liquidator, Mr. J. D. A. Norris.

OWEN LUCAS & PYKE, consulting engineers, 39, Victoria Street, S.W.—Mr. O. D. Lucas and Mr. L. Pyke have dissolved partnership. Debts will be attended to by Mr. L. Pyke, who will continue the business under the style of Lucas & Pyke.

Catalogues and Lists.—MESSRS. WARD & GOLDSTONE, Sampson Works, Salford, Manchester.—New sectional list, No. M200, of 16 pages, giving many illustrations, descriptive notes, and tabulated prices, relating to electrical supplies for the motor-car, motor cycle, and the garage. A new range of electric side, head, and tail lamps, accumulators, Ford accessories, and high and low-tension automobile cables, is included. The list is really an advance supplement preparatory to the issue of their large catalogue.

"W. R." PATENTS, LTD., 8, Old Jewry, London, E.C. 2.—Pamphlet on the "W. R." Combustion Indicator, which is described in our "New Electrical Devices" to-day.

Trading with the Enemy.—The *London Gazette* for April 4th and 8th contains a number of additions to the list of those with whom trading is prohibited, and the names of about 2,000 persons and bodies now removed from the list.]

LIGHTING AND POWER NOTES.

Aberdeen.—LOAN SANCTION.—The Secretary for Scotland has consented to the borrowing by the Electricity Committee of £100,000 for extensions.

Aberystwyth.—PROPOSED MUNICIPAL PURCHASE.—The E.L. Co. having intimated its willingness to dispose of its undertaking, the T.C. is taking the opinion of valuers on the matter.

Birmingham.—L.G.B. INQUIRY.—Colonel Ekin held a L.G.B. inquiry last week into the application by the T.C. to borrow £1,626,140 for the erection of a new electricity generating station at Nechells. Mr. R. A. Chattock, Corporation electrical engineer, said the estimate for structural steel work was between £95,000 and £100,000, and a tender for £94,000 had been provisionally accepted. Colonel Ekin pointed out that the cost of the station in relation to the supply of electricity was higher than that at most places, and suggested that it was double what it was before the war. Mr. Chattock agreed that it was more than double; something like three times. Mr. C. P. Sparks stated that at the new power station, electricity would be generated much more cheaply and efficiently with new plant than was possible with a temporary station at Nechells, and with the old power stations at present used.

An inquiry was also held into an application to borrow £38,000 for the purchase of the Hams Hall Estate, near Coleshill, as a site for a new power station. Colonel Ekin remarked that the Council had made an excellent bargain. Both inquiries were concluded.

Bridgend.—E.L. SCHEME.—At a meeting of the Bridgend, Penybont, Maesteg, and Ogmore and Garw Councils, it was decided that the engineers of the four Councils should prepare a joint scheme for the supply of electricity to the district : it was suggested that power could be obtained from the rivers in the district.

Bridlington.—OVERHEAD MAINS.—The B. of T. has consented to the Corporation using overhead lines for the supply of electricity at 220 and 440 volts to works in Penfold Lane.

Bolton.—MAINS EXTENSIONS.—The Electricity Committee has decided to extend the mains from Duncan Street substation to Spa Road electricity works.

Bournemouth.—E.L. CHARGES.—The T.C. informed the Bournemouth E.S. Co. that it would be prepared to pay 33⅓ per cent. increase on the electricity charges if the company would waive the right to terminate the agreement in June next. The company could not concede this, and the Council is to continue to pay an increase of 25 per cent.

Carmarthen.—ELECTRICITY CHARGES.—The T.C. has agreed to receive a deputation from the E.L. Co., in connection with an application of the company to increase the charges for electricity by a further 20 per cent.

Cavan.—E.L. SCHEMES.—The B. of G. has appointed Mr. J. A. Kenny, of Dublin, to complete the scheme of electric lighting in the workhouse, which was being carried out by the late Mr. J. P. Tierney.

A scheme is also on foot for the formation of a company to install electricity in the town.

Chesterfield.—PROPOSED LOAN.—With a view to improving the supply of electricity to the Whittington Moor area, the T.C. has applied for L.G.B. sanction to a loan of £8,600, for mains, buildings, &c.

Cippenham.—MOTOR DEPÔT.—At the annual meeting of the Slough and Datchet E.S. Co., the chairman said that as they had accommodation at their station for considerable extensions, they approached the authorities in December, 1917, with proposals for the supply of electricity to the new Motor Repair Depôt at Salt Hill. The terms were such that, in their opinion, a saving of many thousands of pounds would have been accomplished, and the necessity for the Government to build and equip an entirely new station with the necessary duplicate plant would have been avoided. Apparently no consideration was given to the proposal, as they learnt, through the Official Report of Parliamentary Debates in October, 1918, that the Government had decided to proceed with its own scheme. He was not in a position to state how far this had advanced up to the present.

Continental.—RUSSIA.—The *Times* states that the Moscow water, electricity, and gas works and tramways are at a standstill.

Cost of Public Lighting.—Dr. Addison stated in the House of Commons, last week, that the expenditure of local authorities in England and Wales on public lighting for the year ended March, 1915, was £2,277,000.

Halifax.—Mill Driving.—Agreements with the following firms for the supply of electricity for mill driving have been signed by the T.C.:—Farrar Bros., Ltd., of Well Lane Mills; and Mr. Thomas Robinson, of Boothtown Mills.

New Plant.—The electrical engineer has been instructed to obtain quotations for a 1,500-kw. rotary converter and the necessary switchgear and transformer.

Charges for Motor Hire.—The Electricity Committee has decided to increase the charges for the hire of electric motors by 25 per cent., as from April 1st.

India.—Water Power in Burma.—The first hydro-electric installation in Burma has been made at Kannauk, in the Tavoy district, in connection with the wolfram mines there. The available energy is 1,000 h.p., but by the plant now installed only half the power is utilised. The head of water at the power house is 2,094 ft., and it is locally believed to be higher than any other installation save in a few instances in Switzerland and the U.S.A.—*The Times Trade Supplement.*

Ipswich.—National Electricity Supply.—The E.S. and Tramways Committee has recorded its objection to the proposal to place the control of electricity supply under the proposed Ministry of Ways and Communications, in view of the fact that supplies of electricity to factories and other users largely preponderate over supplies to railways and other undertakings which it is proposed to bring under the control of the new Ministry. The Committee considers that the best interests of the nation would be served by leaving the control of electricity in the hands of the B. of T.

Killarney.—Proposed Price Increase.—The County Kerry E.L. Co. is applying to the B. of T. for permission to increase its charges for lighting from 6d. to 8d. per unit.

Letterkenny.—E.L. Scheme.—The U.D.C. has decided to apply to the L.G.B. for sanction to a loan of £10.000 for the lighting of the town with electricity.

Lighting Restrictions.—In reply to a question, Mr. Bridgeman, on behalf of the B. of T., stated in the House of Commons that the question of the suspension of the present control of lighting during the summer months was engaging the attention of the Controller of Coal Mines, and a decision would be reached in the course of the current month.

Limerick.—Year's Working.—On the past year's working of the Corporation electricity department there was a deficit of £900.

Liverpool.—Loan Sanction.—The L.G.B. has sanctioned the borrowing by the T.C. of £122,155 for electric mains, £80,000 for plant and switchgear. £47,000 for boilers, economisers and accessories, and £21,000 for cooling towers and foundations.

Maidstone.—Proposed Loans.—The T.C. has applied for loans of £6,000 for electricity mains and £1,000 for services.

Maybole.—E.L. Scheme.—Representatives from the town have interviewed the borough electrical engineer of Ayr, and considered the advisability of introducing electricity for power purposes. The engineer's statement was favourably received, and a further meeting has been arranged.

Newcastle-under-Lyme.—Bulk Supply.—The B. of T. has issued an order permitting the Stoke-on-Trent T.C. to supply the Newcastle T.C. with electricity in bulk.

Nottingham.—In our report of the L.G.B. inquiry at Nottingham, a regrettable error crept into the statement that Messrs. Boots had offered a supply of electricity at £3 per kw.. plus 8d. per unit. The error was obvious; 8d. should have read 0·8d., and we may point out that Messrs. Boots are not the profiteers our note might have suggested, their technical knowledge being far above making such unwarrantable charges for energy in bulk.

Pembroke (Co. Dublin).—Price Increase.—The U.D.C. has increased its charges for electricity by ½d. per unit for lighting and ¼d. for cooking and heating, as from April 1st.

South Africa.—Strike.—As a result of the T.C. deciding to dismiss 30 men from the municipal power station, the remainder of the employés struck work on March 30th, and refused to allow any lighting in the town. The strikers called for the resignation of the Town Council, and formed a Board of Control to act in conjunction with the general manager of the electricity works and tramways, to keep the tramways running. The dispute was settled on April 5th, on the basis of a 48-hours' week, payment during the strike, the appointment of a Committee to investigate into local government, and other terms.

Swansea.—Motor Rentals.—The Electricity Committee has decided to increase by 33⅓ per cent. the rentals for motors on hire.

Lighting of Workmen's Dwellings.—A report on the electric lighting of 27 workmen's dwellings showed that at 8d. per week the average price obtained per unit was 2·86d.: to meet the extra charges, depreciation of wiring, &c., the weekly charge is to be increased to 1s.

St. Helens.—Proposed Loan.—The Electricity Committee has decided to apply for L.G.B. sanction to a loan of £800, for the purchase of a transformer, switchgear, &c.

Walthamstow.—Proposed Bulk Supply.—The Electricity Committee has informed the N. Metropolitan E.P.S. Co. that it has no intention of taking a bulk supply of electricity.

Yorkshire.—Wages.—Representatives of a number of electric supply authorities in Yorkshire met in conference at the Leeds Town Hall, on April 1st, to discuss the advisability or otherwise of forming a Committee to consider questions of rates of pay and conditions of labour of employés in electric generating stations. The proceedings were conducted in private.

TRAMWAY AND RAILWAY NOTES.

Barry.—Proposed Extensions.—The U.D.C. has decided to communicate with the Cardiff T.C. regarding the extension of the tramways and electric lighting.

Birmingham.—48 Hours' Week.—The T.C. estimates that the recent concessions to its employés regarding hours of labour, &c., will cost £160,000 per annum, and an immediate increase in fares will be necessary.

Bournemouth.—Sunday Service.—The T.C. has recommenced the running of a Sunday tramcar service.

Bradford.—Supply of Material.—It is stated that 52 electric motors. for which the tramways department has been waiting for the past three years, cannot be delivered for four months. Strong efforts are being made to secure 800 tons of steel-girder rails, but it is said that a year will elapse before the order can be completed.

Continental.—Spain.—Railway Electrification.—H.M. Ambassador, Madrid, reports that in connection with the proposed Paris-Algeciras Railway the question of a sufficient supply of electricity for its operation has arisen. A scheme for a national network for distributing electrical energy has been suggested, the power to be derived from the water-power resources of Spain. The full amount obtainable is calculated at 2.300,000 kw. The limit, however, suggested at present for the calculation of returns is 300,000 kw.. in addition to the 300,000 kw. already independently in use in the country. The total length of the main transmission lines is estimated at 2,350 km., and that of the feeders and branches at 2,050 km. The cost of the whole system has been estimated at about £5,200,000. The main distribution will be effected at 120,000 volts, 50 periods. which is that generally in use in the country. The conductors will be connected up with the principal waterfalls and coalfields, and particularly with those which are not well adapted for exploitation in the usual way. These coalfields will be used to supplement the water power in times of drought. The direct line between the northern frontier and Algeciras will probably be the backbone of the system, while that between Madrid and Valencia will constitute the main artery of traffic to Eastern Spain. After these lines, a direct route from Madrid to Vigo has been suggested, and, in connection with this, an addition of transmission lines passing through Corunna, Vigo and Ferrol, has been recommended.

According to a Royal Decree, the rates per unit and per km. at present in operation may be proportionately increased up to a maximum of 15 per cent., although this increase may exceed the legal maximum provided by the various railway concessions. The companies are obliged to keep a separate account of the revenue derived from the increased tariff, and this revenue will not be calculated to increase the realisable value on a possible reversion of the railways to the State.—*Financier.*

At the recent meeting of the Compania del Metropolitano Alfonso III, it was stated that excellent progress was being made with the construction of the underground electric railway at Madrid, and if the rolling stock and other material which had been ordered in the United States was delivered to time, it was expected that it would be possible to open the first section of the line in October next.

Switzerland.—The *Times* states that, in order to relieve unemployment, the States Council has voted £180,000 for preparatory work in connection with the electrification of the Brique and St. Gothard branch lines.

Darwen.—New Tramcars.—The Tramways Committee has decided to obtain tenders for the construction of three new tramcars.

Dewsbury.—Extension of Time.—The Electricity and Tramways Committee is applying to the B. of T. for an extension of time in respect to the completion of proposed tramways to Shaw Cross and Dewsbury Moor, the periods for which expire on August 18th and August 7th next.

Doncaster.—New Tramcars.—The T.C. has decided to purchase 10 new tramcars, at an estimated cost of £21,000.

Edinburgh.—Tramway Electrification.—The Sub-Committee which visited London and Bournemouth to inspect the conduit tramway systems has recommended that the cable system should be electrified by sections as soon as possible, and that the overhead system should be generally adopted. The recommendations have been adopted by the T.C.

Isle of Thanet.—Fare Revision.—The Isle of Thanet Tramway Co. has increased its fares by 50 per cent.

Lincoln.—Railless Traction.—A deputation from the T.C. has visited Bradford and Rotherham to inspect the railless systems in those towns, and is preparing a report on the subject.

Liverpool.—Proposed Municipal Purchase.—The T.C. has approved of the promotion of an order for the purchase of the Liverpool and Prescot Light Railway. It was stated that the 3⅛ miles of track would be purchased for £18,000, and to repair the line it was estimated another £27,000 or £30,000 would be necessary.

Accident.—The report of the B. of T. inquiry into the collision between two electric trains at Brocklebank Dock Station on the Liverpool Overhead Railway, on January 13th, states that the general conclusion arrived at is that the incorrect position of a signal was the chief cause of the collision. It was clear that some failure of the signalling or train-stop arrangements must have occurred, but it was not easy to determine what actually took place. The collision took place in a fog, and a number of passengers were injured. A similar accident occurred in a fog on February 12th. The report states that the evidence in both cases showed that there was much to take exception to in many directions with regard to automatic signalling and block instrument working on this electric railway. Various technical amendments for the automatic signalling system are recommended, and the report states that if a reliable automatic system of signalling and train control can be arranged, it will not be necessary to retain block telegraph working, which in itself is ill adapted for a frequent service amounting to 18 or 20 trains an hour. There should, also, be telephone communication at all stations to both platforms. The company should be asked to submit its proposals to effect the necessary improvements.

Deputation to America.—The T.C. has decided that a deputation, consisting of the city engineer, tramway manager, electrical engineer, lighting engineer, and four members of the Tramways and Electricity Committee, shall be appointed to visit the United States and Canada for the purpose of inspecting and studying tramway systems and methods of street lighting.

London.—L.C.C. Pays Damages.—Judge Grainger last week, at Greenwich, ordered the L.C.C. to pay £150 damages to a young lady, who was injured as the result of a collision between two tramcars at Peckham in July last year.

Fare Revision.—Increases of from ½d. to 2d. per fare came into operation on the Central London, Piccadilly, and Bakerloo Tubes on April 6th. Increases on certain District routes have also been made.

Derailment.—A tramcar left the rails at the southern end of Blackfriars Bridge on Monday, and stood across both up and down lines. Traffic was for a time brought to a standstill.

Owing to an accident to a train near the Temple station on Thursday morning, one line of traffic on the District railway was held up, and passengers had to alight and walk along the line to the station.

Newcastle-on-Tyne.—Year's Working.—At a meeting of the T.C. it was stated that last year 101,000,000 passengers were carried on the tramway system, compared with 65,000,000 the year before the war. The receipts per car-mile were 1s. 6d., against 1s., and the working costs were 6·62d., against 3·22d. During the current year, £55,000 will be spent from the reserve fund. £14,000 was transferred from the surplus to the relief of the rates.

Worcester.—Wages.—Tramcar drivers in the employ of the tramway department have received an advance of 24s. per week over pre-war rates. By agreement, four women do the work of three men, and receive wages on a proportionate basis.

TELEGRAPH AND TELEPHONE NOTES.

Cable Ship Honours.—Four London men from H.M. cable ship *Monarch* were to be decorated with the O.B.E. on Saturday "for good work on cable ships in dangerous waters." Throughout the war London was in telephonic communication with G.H.Q. in France, thanks to the cable men. The present *Monarch* is the second ship of that name; the other was torpedoed in 1915, her stern part being blown right away. Depth charges dropped by the Navy played havoc with the cables. At the height of the U-boat attacks, a large number of hydrophone cables had to be put down for detecting the positions of enemy submarines.

Egypt.—Arising out of the recent disorders, a Ministry of Communications has been formed, which will "for the present" control telegraphs, telephones, and posts, as well as all the means of transport, &c.

Germany.—The Post Office announces that commercial telegrams may now be accepted at sender's risk for inhabitants of Germany territory on the left bank of the Rhine in Allied occupation, at a charge of 3d. per word, providing that such telegrams relate to the supply of goods to that territory. Personal or domestic telegrams are not allowed except to members of the Forces.

Post Office Wages.—The Government has agreed to the Post Office Controlling Officers' Association's reorganisation scheme. The increased pay will amount to £120,000 to £150,000 a year, dating from January 1st, 1918, and all grades have been advanced.

Syria.—Telegraph offices at Beirut and Tripoli were opened on March 15th, and will now take business or social telegrams in plain language, English or French, at sender's risk.—*T. and T. Age.*

Telegrams for the War Zone.—The Post Office announces that commercial, personal, and domestic telegrams can now be sent at sender's risk and subject to censorship to the following countries at the following rates per word:—Austria (excluding Hungary), 3d.; Poland, 4d.; Esthonia, 5½d.; Czecho-Slovakia, 4d.; Albania, 4½d.; Turkey, 6d.; Montenegro, Bosnia-Herzegovina, Croatia, Rumania, Serbia, and Slavonia (*viâ* Eastern), 6½d.; Bulgaria (*viâ* Eastern), 7d.; Trieste, Illyrian Littoral, and Dalmatia, 2½d.

In every case the telegrams must be in plain language and written in self-explanatory English or French. The service is uncertain, and the telegrams are liable to delay.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Brisbane.—May 15th. Department of the Treasury. H.T. switchboard, storage battery and motor-generator set for the electric power house, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

Melbourne.—May 14th. Victorian Railway Commissioners. Cells, renewals, caustic soda and mineral oil for caustic soda batteries. (Contract No. 32,194.)

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

Bedford.—Corporation Electricity Department. Geared turbine to drive an existing alternator. (March 21st.)

Birr (King's County).—May 1st. Birr Electric Light and Power Co., Ltd. Hydraulic turbine and accessories, electric generator, reducer set and motor booster, switchboards, alterations to P. & G. storage battery, overhead distributing lines, wood poles and fittings. (See this issue.)

Birmingham.—April 12th. B. of G. Rewiring internal telephone installation, call bells, &c., at the 2/1st Southern General Hospital, Dudley Road. (March 28th.)

Dublin.—April 24th. Electricity Supply Committee. High-tension switchgear and alterations to existing switchgear. (See this issue.)

Dundalk.—April 29th. U.D.C. Electricity Department. Replating of storage battery. (See this issue.)

Eastbourne.—April 16th. Electricity Department. One water-tube boiler, with superheater and travelling-grate mechanical stoker. (April 4th.)

Lancaster.—April 25th. Corporation tramway uniforms. (See this issue.)

London.—H.M. Office of Works. Two 10-ton, three-motor type, 450-volt, D.C. travelling cranes, 42-ft. span and 60-ft. span. (March 28th.)

Hammersmith.—April 9th. Electricity Department. Exhaust steam feed water heater, hot air forced-draught fan and air heater. (See this issue.)

H.M. Office of Works.—April 14th. Supply of electric bell fittings to September 30th. (See this issue.)

Battersea.—May 1st. Electricity Department. One water-tube boiler, superheater, economiser and mechanical stoker, induced-draught plant for main flues. (See this issue.)

Sale.—U.D.C. Electricity Department. 200/250-KW., 460-volt. Diesel engine and generator, switchboard panel, &c. (March 28th.)

Tynemouth.—April 24th. Corporation. One 500-KW. rotary converter, with accessories. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Aylesbury.—B. of G. E.L. installation at the infirmary, &c:—

E. T. Mackrill & Sons	(accepted)	**£188**
G. C. Gowan		261

Barrow.—Town Council. Accepted :—

Motor-driven electric feed pump, £295.—James Howden & Co., Ltd.
Cables for turbo-alternator and auxiliary plant motors, £119.—Charles Mackintosh & Co., Ltd.
Gangway and handrail for switchroom, £22.—Babcock & Wilcox, Ltd.
E.H.T. switchgear, £740.—Ferguson, Pailin, Ltd.

Annual supplies :—
Engine, &c., oils.—Vacuum Oil Co., Ltd.
Engine room stores.—J. B. Bolton.
Packing and jointing material.—W. R. Thornton & Son, Ltd.
Joint rings.—W. J. Tranter, Ltd.
Copper wire, vaseline oil, joint boxes, switch cut-outs, &c.—B. I. & Helsby Cables, Ltd.
Para strip and prepared tape.—A. Arkine.
Insulating compound, bitumen and E.H.T. compound.—Dussek Bitumen Co.
Electrical stores and rubber gloves.—L. Andrew & Co.
Electricity meters.—Chamberlain & Hookham, Ltd.
Prepayment meters.—Ferranti, Ltd.
Earthenware pipes and troughs.—Doulton & Co., Ltd.
Brass saddles and pins.—General Electric Co., Ltd.

Doncaster.—Dick, Kerr & Co. Ten new tramcars : car body, £1,145, £67 for the vestibule, and £589 for equipment, making a total of £1,792 per car, exclusive of truck.

Halifax.—B. of G. Electric fittings. H. Hodgson and Company.

King's Lynn.—Corporation Electricity Committee :—

Brush Electrical Engineering Co. – 1,000-KW. turbo-alternator and condensing plant ; interconnecting pipe work and air filter, £12,750 ;
British Thomson-Houston Co., Ltd.—400-KW. rotary converter, E.H.T. switchboard and D.C. switchboard, £4,150; 400-K.V.A. transformer and switchgear for sub-station, £1,025.

London.—Battersea.—Electricity Committee. Annual contracts :—

Coal.—Rose, Smith & Co., Ltd.; Foster & Co.
Troughing bends, &c.—Callender's Cable & Construction Co., Ltd.
Electrolytic meters.—Reason Mfg. Co., Ltd.
Electricity meters.—Chamberlain & Hookham, Ltd. ; Ferranti, Ltd.
Trinidite joint-box compound and bitumen (six months).—Dussek Bitumen Company.

Manchester.—Electricity Committee :—

Motors.—Electromotors, Ltd.
Meters.—Ferranti, Ltd., and Chamberlain & Hookham, Ltd.
625-K.V.A. transformer.—Ferranti, Ltd.; 250-K.V.A. ditto.—British Electric Transformer Co., Ltd.

FORTHCOMING EVENTS.

Chief Technical Assistants' Association.—Friday, April 11th. At 7 p.m. At Anderton's Hotel, Fleet Street, E.C. Discussion on "Problems of Linking-up."

Royal Institution of Great Britain.—Friday, April 11th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "Piezo-Electricity and its Applications," by Sir J. J. Thomson, F.R.S.

Saturday, April 12th. At 3 p.m. At Albemarle Street, W. Lecture on "Spectrum Analysis and its Application to Atomic Structure," by Sir J. J. Thomson, F.R.S.

Junior Institution of Engineers.—Friday, April 11th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "The Training of the Disabled Man from the Electrical Engineer's Point of View," by Mr. F. H. Taylor.

National Foremen's Association of Engineering, Shipbuilding and Allied Trades (West London Branch).—Saturday, April 12th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

Birmingham and District Electric Club.—Saturday, April 12th. At 7 p.m. At the Grand Hotel. Paper on "Electric Converting Plants," by Mr. F. Gould.

North of England Institute of Mining and Mechanical Engineers.—Saturday, April 12th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. Paper on "Coal Cutting by Electricity and Timbering at Cannock Chase Colliery," by Mr. W. P. Cheung.

Institution of Electrical Engineers.—Monday, April 14th. At 7.30 p.m. At the Chartered Institute of Patent Agents, High Holborn, W.C. Informa meeting. Discussion on "Electrical Instruments," introduced by Dr. R. D. Gifford.

(North-Eastern Centre).—Monday, April 14th. At 6.45 p.m. At the Mining Institute, Newcastle. Ordinary meeting.

(South-Midland Centre).—Wednesday, April 16th. At 7 p.m. At the University, Birmingham. Ordinary meeting.

Industrial Reconstruction Council.—Wednesday, April 16th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture on "The Industrial Situation," by Mr. Stephen Walsh, M.P.

Tuesday, April 15th. At 5.30 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Planning Department in Scientific Management"; opening address by Mr. J. P. Whiteford.

NOTES.

French Water Power.—The conviction of the need for developing the water resources of France, in view of the present and future dearness of coal, has had the practical result of the nomination by the Minister of Public Works of a Committee to study the most scientific methods of utilising the country's water-power on the largest scale. A further departure meditated is that of erecting hydraulic laboratories, fully equipped for the investigation of turbines and other water machinery under ordinary working conditions ; the erection of standardising stations for machinery employed in the hydro-electric industry, and testing stations for such machinery. The Technical Institute of Toulouse has gone ahead of this projected departure by planning an installation, estimated to cost between 1,500,000 and 2,000,000 fr., to demonstrate practically the best conditions of working high, medium, and low waterfalls, as well as a water-gauging station, with special regard to the circumstances of the region of the Pyrenees. The Government has recognised the value of such individualistic efforts, and deemed it well to encourage them by financial help. In response to the request of the Minister of Public Works, last year, Parliament voted 440,000 fr. in aid of private hydraulic laboratories, nearly half of which has already been allotted to the Toulouse Institute. A supplementary vote of 250,000 fr. has since been asked for to help the scheme for the erection at Grenoble of an electrochemical and electrometallurgical institute. The third of the existing institutes—that of Nancy—is concentrating its attention on the use and improvement of electric motors.

Energy Consumption of Electric Ranges.—Some interesting figures showing the energy consumption of an electric range for a specially-cooked roast beef dinner were obtained at a recent sales banquet of the North-Western Electric Equipment Co., of St. Paul ; 55 members of the sales and executive staff of the company were present.

The menu pepared for the banquet included soup, roast beef, three vegetables, bread and rolls, pudding, and coffee. These foods were prepared with the following energy consumption :—

	Watt-hours.
Ten cans soup	469
18 lb. roast beef	2,325
1½ pecks potatoes and two cans peas	1,188
Five cans corn	300
Six loaves bread	1,000
Five dozen rolls	700
Fifty portions pudding	1,275
Seventy cups coffee	525
Total	7,782

The average consumption per person served was, therefore, 172·9 watt-hours. The entire cost for energy at the prevailing rate of 4 cents per kilowatt-hour was 31·128 cents, or 0·691 cent per person.—*Electrical World.*

Lock-Out Notice.—In the *Electrical Contractor* for April there appears a notice on behalf of the National Federated Electrical Association, signed by the general secretary (Mr. L. G. Tate), with regard to a dispute in progress between a London contractor and the Electrical Trades Union. It is stated that in 1914 the Union in London accepted a rule that no exception should be taken to the employment of any workman on the ground that he was not a member of a Trade Society, and it has never applied for a modification of the rule. The London Branch of the Federation would agree to a modification which, while precluding the engagement of Non-Union men, provided that the members should be entitled to continue to employ old servants who had been with them many years, but for their own reasons declined to join the Union ; the members of the London Branch emphatically decline to give an old employé the alternative of joining the Union against his will or immediate discharge.

Although no application for modifying the rule has been received, a London member has had all his Union labour withdrawn since January 8th last, and his customers have been threatened with the cutting-off of supply if they allow his men to continue at work ; the London secretary of the Union has stated that this procedure will be applied to all firms in succession. "The matter was reported to the National Joint Industrial Council, and various proposals put forward by the employers showing their willingness to assist the Electrical Trades Union in the gradual and peaceful absorption of all their workmen, and as a result the National Joint Industrial Council accepted an offer of the general and London secretaries of the Electrical Trades Union to recommend the London District Committee of the Union to withdraw the action taken against the firm in question, pending discussion of the difficulty by both sides within 14 days. At the same time, the employers' representatives agreed to withhold notice of lock-out until after the meeting of the District Committee of the Electrical Trades Union. Failing this discussion taking place, a lock-out appears inevitable."

Canadian Water-Power Appeal.—The Judicial Committee of the Privy Council, on Monday, allowed an appeal from two orders of the Appellate Division of the Supreme Court of Ontario in proceedings relating to the use of the water power at Niagara Falls for generating electrical energy and other commercial purposes. The title of the case was the Electrical Development Co. of Ontario, Ltd., *v.* the Attorney-General of Ontario and the Hydro-Electric Power Commission of Ontario, and a long report of the matter will be found in *The Times* for April 8th.

Indian Society of Engineers.—The proposed Indian Society of Engineers shows every prospect of becoming a body thoroughly representing the engineering professions in India. The rules have already been drafted, and the Viceroy has promised to preside at the inaugural meeting, which will be held towards the end of the year. It is intended to apply for a Royal Charter, and the Indian Government has promised its support in this matter. Amongst the officials who are taking a keen interest in the formation of the Society are Sir Thomas Holland, K.C.S.I., K.C.I.E., President of the Munitions Board ; the Hon. Sir George Barnes, K.C.B., Member of Council for Commerce and Industry ; and Sir Claude Hill, Member of Council for Revenue and Agriculture. It is expected that the membership of all grades will run into four figures from the start. The Hon. Secretary is Mr. E. M. Hughman Bombay Club, Bombay.

A Royal Visit.—The King and Queen, on Saturday afternoon, visited Sir Frederick Milner's Shell-Shock Hospital at Hampstead, where they witnessed demonstrations of the curative effect of electrical treatment for nerve cases, and inspected the institution and grounds. In the electrical department the visitors saw how patients had their affected parts "ironed" or "charged," and also bathed in electrically treated water, according as their particular cases required. Other forms of electrical treatment were also demonstrated.

Parliamentary.—West Hartlepool Corporation has applied for powers for the construction of new tramways and the running of motor-'buses.

Walsall Corporation is applying to Parliament for powers to extend its area of supply of electricity, and to provide and run motor-omnibuses.

Birmingham Corporation is making application to Parliament for further powers to construct and equip new tramways, &c.

Rotherham Corporation seeks power to postpone the date of sinking-fund payments and for extension of the period for repayment of loans for the electricity undertaking.

Fatalities.—The *Daily News* states that, while crossing a gangway at the South Metropolitan Electric Light and Power Station, East Greenwich, W. Plumeridge (16), slipped and fell into the machinery below. He was dead when discovered a few minutes later.

In the Durie Foundry of Messrs. H. Balfour & Co., Ltd., Leven, Alex. Myles (55) was carrying an iron pipe through one of the shops when it came in contact with a live wire. The shock killed Myles instantaneously.

Of the six men killed in the explosion at Oxcroft Colliery, near Chesterfield, on Sunday night, two were electricians.

Borrowing by Local Authorities.—In February last Mr. H. Faraday Proctor, Hon. Secretary of the Incorporated Municipal Electrical Association, on behalf of the Council, wrote to the Local Government Board asking for relief in the matter of sanction to expend capital for the connection of new consumers; he pointed out that the gas suppliers had been very busy in making new connections, whilst electricity undertakers had had to look on. The L.G.B. replied that applications could now be made for connecting installations for industrial purposes, but Mr. Proctor rejoined that this limitation debarred the electrical equipment of new residential property, and, in particular, prevented the adoption of electric lighting in connection with the Government Housing schemes, whilst it also reacted unfavourably upon manufacturers and hindered the employment of labour. Further, the Board of late, whilst authorising loans for extensions of mains, had disallowed loans for "house services," which included industrial premises, and thus the extension of mains without powers to connect installations would be useless.

To these representations the L.G.B. replied as follows, on April 7th:—

"I am directed by the President of the Local Government Board to advert to your letter of the 19th ult., and to state that since the date of the Board's letter of the 10th ult., the Treasury restrictions upon the borrowing of money by local authorities have been further relaxed, and that the Board are now authorising the raising of loans for mains, services, transformers, and meters in connection with the supply of electrical energy, both for industrial and domestic purposes.

"As regards the latter part of your letter, I am to state that in cases where 'house services' have been referred to in the Board's letters, the applications of the local authorities have so described the works for which the loans were required. In such cases the Board will raise no objection to the expenditure of the moneys upon services required for the purpose of affording a supply of electrical energy for industrial purposes."

Institution and Lecture Notes.—Institution of Electrical Engineers.—The following is a complete list of the members of the Wireless Sectional Meetings Committee (for Radiotelegraphy and High-Frequency Engineering) of the Institution of Electrical Engineers:—

President (*ex officio*).

Major E. A. Barker, M.C., R.E.
Mr. Charles Bright, F.R.S.E.
Dr. W. Eccles.
Prof. G. W. O. Howe.
Admiral Sir H. B. Jackson, F.R.S.
Mr. W. Judd.
Sir Oliver Lodge.
Prof. E. W. Marchant.
Dr. G. Marconi.
Major J. Erskine Murray, R.A.F.
Mr. J. Sayers.
Major T. Vincent Smith, R.A.F.
Mr. A. A. Campbell Swinton, F.R.S.
Mr. J. E. Taylor.

and

Capt. J. K. Im Thurn, R.N., nominated by the Admiralty.
Lieut.-Colonel A. D. Warrington-Morris, O.B.E., R.A.F., nominated by the Air Ministry.
Lieut.-Colonel W. Ll. Evans, C.M.G., D.S.O., R.E., nominated by the War Office.

North-Western Centre.—The annual general meeting of the North-Western Centre was held on Tuesday last, Mr. A. P. M. Fleming in the chair.

The Chairman moved the adoption of the annual report, which stated that the number of papers had been well maintained at the meetings (10 in number), the quality of the papers was high, and the discussions good. Special reference was made to the popular lecture delivered by Sir Ernest Rutherford, at which the attendance of the general public was most gratifying. It was the hope of the Council to make this a precedent for future years, and to contribute in this manner to the education of the public in matters electrical. There had been increases in all classes of membership, the numbers now being:—Members, 128; Associate Members, 487; Associates, 27; Graduates, 69; and Students, 129; a total of 833.

Mr. Allcook, in seconding the motion, said they must look back with satisfaction and pride to the fact that during the whole of the war period the membership of the Section had continued to grow, and the attendance had been always satisfactory.

A vote of thanks to the retiring chairman was passed unanimously on the motion of Mr. Robertson, seconded by Alderman Walker, who expressed a strong wish that the work done by Mr. Fleming among the Junior Section should be continued and developed.

Votes of thanks were also passed to the hon. secretary, Mr. J. Frith, who retired after seven years' service; and to Mr. A. L. Green, assistant secretary. The election of officers for the next year resulted as follows:—Chairman, J. A. Robertson; vice-chairmen, Alderman W. Walker, and W. J. H. Wood; hon. sec., Mr. A. G. Ellis; Committee, Messrs. Furlong, Lamb, Lunn, Peck, and Romero.

Institute of Cost Accountants, Ltd. (by Guarantee).—A series of lectures is being arranged for next winter sessions. Details will be announced later.

Glasgow Corporation Electricity Department Engineering Society.—This Society held its annual general meeting on March 31st, Mr. W. W. Lackie presiding. The secretary reported that the membership numbered 146, and that the average attendance at the 14 meetings held during the session was 71. Office bearers and members of Committee were appointed, and arrangements were made for the preparation of next session's syllabus.

The Irish Association of Electrical Station Engineers.—The second annual general meeting of the Association was held at Dublin, on March 28th. In the absence of the president the chair was occupied by Mr. William Nolan. The minutes of the first annual general meeting were read and approved, and the report of the Executive Committee for the year 1918-19 was unanimously adopted. Mr. Wm. Nolan, Mr. W. P. Croly, and Mr. W. T. Dycher were unanimously re-elected as chairman, hon. treasurer, and hon. secretary respectively.

A report of the Executive Committee dealing with affiliation or amalgamation with the Electrical Power Engineers' Association was left in the hands of the Executive Committee, to report to a special meeting of the Association.

A discussion on the fixing of a minimum rate of salary or wages for engineers was left to be dealt with at an ordinary meeting.

The annual report states that during the year the organising of electrical station engineers in Ireland progressed very considerably. All stations were circularised, but it was found that many Irish engineers belonged to other bodies. The Executive Committee has seen that the rights of the members have not been infringed, and has taken action in some instances to safeguard their interests.

The members of the various grades are now as follows:—Honorary member, 1; members, 26; associate members, 23; graduates, 9.

In his address the chairman stated that this was the third attempt to form such an Association in Ireland. During the year all actions taken by the executive for improving the position of the members were successful. He wished members to constitute themselves agents, and to encourage electrical station engineers to join up, and to bring to the notice of the Executive Committee anything likely to be of advantage. If they improved their knowledge of electrical practice, and brought this knowledge to bear on their work, they would prove that they were entitled to promotion and improvement in position. It would then be known that the Association was for the good of all interests, and that for any concession they gained they intended giving their very best in return. Furthermore, their knowledge ought to be directed to the development of present and future industries in Ireland.

It is hoped during the next winter session to hold monthly meetings of the Central Branch, and members are desired to volunteer lectures or papers, so that a syllabus can be made out at an early date.

Society of Technical Engineers.—At the Industrial Conference, on Friday last, it was resolved that a National Industrial Council, representative of all industries, should be established, and the Minister of Labour, for the Government, warmly welcomed the proposal. On behalf of the Society of Technical Engineers, Mr. Norman Wyld urged that the Council should be instructed to consider how Unions composed exclusively of members of the technical management and administrative grades could be represented on Joint Industrial Councils. The matter was referred to the Joint Committee of the Conference.

According to the *Daily Dispatch*, the Society of Technical Engineers numbers 50,000 members, and, together with the industrial chemists, the bank and insurance administrators, and the learned professions, forms part of a movement towards a grand federation of the administrative grades of industry.

The Transport Bill.—On Wednesday, an amendment moved by Sir Eric Geddes, excluding municipal tramways from the scope of the Bill was agreed to; but Mr. Shortt stated that if a clause giving the Government a certain amount of control over such tramways were suggested, the Government would consider it very sympathetically.

Educational.—The Ramsay Memorial Committee has offered the University of London a sum of £25,000 towards the foundation of a laboratory of chemical engineering at University College. The Senate has gratefully accepted the offer.

Inquiry.—Makers of electric toasters stamped W.A.S.B. are asked for. A correspondent wishes to purchase, or to obtain the use of, an A.E.G. or other A.C. electrode furnace for hardening steel.

Appointments Vacant.—Switchboard attendant (60s. + 28s. 6d. + 12½ per cent.) for the Walthamstow U.D.C. electricity works; charge engineer (79s. 6d.) for the Stockton-on-Tees Corporation electricity works; shift engineer (£200) for the Accrington Corporation electrical engineering department; mechanician (£250 + £120) for the Posts and Telegraphs Department, Nigeria; electrical foreman (250 rupees per month) for the South Indian Railway Co., Ltd. See our advertisement pages to-day.

Super-Conductivity of Metals at Low Temperature.—The electrical resistance of perfectly pure metals disappears at the temperature of liquid helium, that is, at 1·9° F. absolute, or 490·1° below Fahrenheit zero. An article in *Zeitschrift des Vereines Deutscher Ingenieure* describes how it was not found possible to obtain gold and platinum perfectly pure, and their resistance in liquid helium did not decrease indefinitely, but remained at a very low constant value. Quicksilver can be obtained perfectly pure by distillation in a vacuum, and showed a decrease in resistance down to 7·55° F. absolute, which corresponded to $\frac{1}{500}$th of the resistance at the solidifying point of quicksilver. At this temperature there was a sudden drop that immediately reduced the resistance to one millionth part of the initial value, and at 3·25° F. absolute the resistance was barely one thousand millionth part of the initial. This condition the author called super-conductivity. Tin and lead were also brought to the state of super-conductivity, the critical temperatures being 6·85 and 10·8° F. absolute, respectively. It was found possible to send a current of 1,000 amperes per sq. mm. through an extraordinarily thin wire of quicksilver, and 560 amperes per mm. through a lead wire without observing any heating effect or any difference in electric potential between the ends of the super-conductors. Experiments to produce magnetic fields of greater strength than 50,000 Gauss by means of coils of super-conductive wire failed. The super-conductivity of a double wire coil at 3·6° F. absolute was lost when the strength of the magnetic field rose above 1,000 Gauss, and the resistance assumed a definite value. A lead coil with an exceedingly low resistance at a temperature of 3·24° F. absolute, was exposed to a magnetic field of 200 Gauss, and an induced current of 0·4 to 0·6 ampere was observed after the removal of the field. The current decreased 1 per cent. per hour, and lasted four days before it disappeared. The current in such a coil disappeared immediately it was taken out of the liquid helium.

Strike at Pretoria.—Our South African correspondent writes:—"The tramwaymen's and power station employés' strike came to an end on March 14th, when the agreement was signed as follows:—

"A 48-hour week, the pay to be £5 7s. 6d. per week for the first year, £5 15s. 3d. per week for the second year, and £6 2s. 9d. per week for the third year. Minimum wage to be £4 10s. per week.

"Above to be temporary settlement, subject to a Commission being appointed by the Government to inquire into the whole industrial position, time limit for Commission to report being three months.

"This temporary settlement is made so as to end the present strike, and on the distinct understanding that any inquiry by the Commission must be based on the pre-strike wage and the original demands of the men.

"The Commission's finding to be binding on either side, and the finding of the Commission to be regarded as retrospective from the time work is resumed.

"This temporary settlement is made on the distinct understanding that there shall be no victimisation of any nature whatsoever on either side."

The full lighting service was resumed the same night, and the tramway service on the following day. The settlement is based on the difference between the amended offer of the Town Council and the original figures proposed by the Provincial Administrator.

Belgian Reconstruction.—It is stated that Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., have entered into negotiations with the Belgian Government to assist very largely in restoring the productive equipment of the country, so as to put it again on a manufacturing basis.

Electric Furnaces in Uruguay.—For some time past the Compania Industrial de Electricidad has had two electric furnaces in successful operation at Monte Video.

The Johannesburg Strike.—A communication just to hand from our South African correspondent says:—"In connection with the strike in the building trade, it has been decided by the Strike Committee to call out all electrical apprentices, on the ground that contractors have been able, with their help, to carry out certain wiring work on a number of jobs."

Electric Vehicles in Germany.—Dr. E. Valentin, in *Der Motorwagen*, discusses the advantages and disadvantages of electric vehicles, more especially in relation to German conditions. Up to the time the war broke out, Germany had developed the electromobile industry, and was second in the list of countries using this type of vehicle, the United States coming first. The principal uses of electrically-propelled vehicles are summarised by the author as follows: Fire brigades (34 brigades use this type of vehicle in Germany. Berlin itself had 50 electrically-propelled engines); street-cleaning carts; cabs (of which 475 were plying on the Berlin streets); 'buses and hotel cars. For refuse carts this type of vehicle is very suitable, owing to the running being intermittent. In some designs of refuse cart a special steering wheel is fitted at the side of the vehicle, enabling the driver to operate it from the ground. Many delivery vans and lorries are in use in Germany, of a carrying capacity of from ½ to 5 tons. The Berlin postal authorities use electric vehicles to a large extent, including electrically-propelled tricars for clearing letter-boxes. For ambulance vans, the electric vehicle is peculiarly adapted owing to freedom from vibration. Six German firms are occupied in the manufacture throughout of electromobiles, and another eight firms with the manufacture of various components. The author estimates that these six firms, if properly organised, could easily attain an output of 100 vehicles a month at the end of from eight to ten months. The manufacture of electric cars is specially adapted to series production. In this connection a very thorough system of standardisation is desirable. At present many designs are on the market, but, provided the parts of each firm were interchangeable one with another, a considerable source of difficulty would be obviated. A proper system of charging stations should be established in the larger towns, where used batteries could be taken in for charging and fully charged batteries handed over in exchange. A scheme of this kind is outlined by the author for the city of Berlin. If standardised dimensions, &c., were adopted by all firms it would be possible for public charging-stations to hire out batteries.

Starting of Large D.C. Motors without Resistance.—In 1912 it was calculated by Trettin that it was possible to start up large direct-current motors without starting resistances, the motor being thrown directly on to the line. W. Linke, in *E.T.Z.*, criticises the arguments given, and produces oscillographic test records in support of his views. It appears that if i is the maximum current rush obtained in switching a motor on to the line, and c is the theoretical short-circuit current, obtained by dividing the applied voltage by the total resistance in circuit, then the ratio of i to c depends on the value of the line voltage, the moment of inertia of the motor, and the counter-torque of the load being started up. The value $x = i/c$ is obtained from oscillograms taken under the various conditions just referred to.

The motor under test was a 60-KW., 440-volt, 700-R.P.M. machine, with 4 per cent. armature voltage drop at 250 amp., which load corresponds to the heating limits given by the German Institution Rules. The generator was a 1,000-KW. machine. With the machine unloaded the values of x obtained with 220, 300, 370, and 440 volts were 0.54, 0.59, 0.65, 0.72 respectively, the values of i and c at 440 volts being given by $i = 2{,}050$ and $c = 2{,}850$ amps. Up to 300 volts, sparking at the commutator was absent, at 370 volts sparking was bad, and at 440 volts arcing over occurred. Further tests were made at 220 volts with various moments of inertia. The value of i was 10 per cent. greater than before owing to decreased resistance of the leads used. The values of x for moments of inertia in the proportions of 1, 2, 50, were 0.5, 0.61, and 0.85 respectively; the actual values of i being 855, 1,050, and 1,420 amperes respectively. The effect of the load counter-torque was studied by driving a dynamo with separate excitation feeding a constant resistance, and it was found that practically no effect was produced on the magnitude or duration of the initial current rush by varying the excitation of the dynamo. In all the tests referred to (except the test with 50-fold moment of inertia) the duration of the initial peak of current was about 0.15 sec.

In the concluding instalment of this article the author describes a series of experiments made in the starting-up of large motors. It is found that with current rushes of as much as four times the normal current very little sparking is produced. This result was attributed by Trettin to the short duration of the initial current rush. The author, however, considers that it should rather be ascribed to the low reactance voltage in the short-circuited coils resulting from the low speed of the armature during the period of maximum current.

As the previous results have shown, the application of the full voltage without resistance in series with the armature is permissible only under very limited conditions, and it is shown that in general much more satisfactory starting-up is obtained with a one-step starting resistance. This single resistance step need only remain in circuit for a very short time, and may be of very small dimensions. It is put into circuit by a single switch with a double contact, which causes the circuit to be closed in two steps. If the resistance is of such a value that the permanent short-circuit current would be equal to the normal current, the motor reaches a considerable speed in a small fraction of a second, and if the inertia of the motor is not excessive, neither of the two current peaks exceeds the normal current. The length of time during which the resistance should be left in circuit increases with the inertia of the masses to be started up, if the current peaks are to be limited to the full load current of the motor. Oscillograms showed the variation of the starting current of a 200-KW. motor, which was started up without any sparking under various conditions of loading. The starting resistance was small enough to fit into a cigar box, and yet showed only 11 deg. C. rise in temperature for one start. After 15 starts at intervals of half a minute the temperature rise was only 120 deg. C. It would be possible to start up with this resistance unit once a minute continually without exceeding this temperature rise.

The War and Belgian Electricity Supply Undertakings.—Some interesting information has reached us regarding the position of two Belgian electricity supply undertakings now that the Germans have been driven out of the country. In a report drawn up by the Société d'Electricitè du Brabant, it is stated that the war has left the undertaking in a difficult and serious position. As a result of refusing to supply current to a factory at Ruysbroeck which the enemy had seized for the manufacture of barbed wire, the undertaking of the electricity supply company was sequestrated by the Huns, who connected up the barbed wire factory with the sub-station at Ruysbroeck, and took the current that it needed. When the enemy retired in November last he took away all the books of the electricity undertaking, and all the money that was available. The generating station and the distribution system have suffered from neglect and also by the taking away of material. It has been found possible, however, to re-establish a supply of current, and the directors are taking all necessary steps to put the plant and system into proper working order in order to meet the current requirements of the district as soon as industry is re-established. The one bright spot in the outlook for the company is that during the war there has, owing to the difficulty of obtaining other lighting agencies, been a large increase in the number of electricity consumers who are expected to be retained now that the war is at an end.

The report of the Société des Centrales Electriques des Flandres states that when the declaration of war took place they were just on the point of completing their installations in Western Flanders. The generating station at Langerbrugge had just been put in operation, and they were actively engaged in extending power supply mains, and in connecting these up to the works of numerous industrial consumers. Owing to the calling up of men and the incertitude of the position, all this work had to be suspended. Later, when the supply of necessary materials became difficult, the question of the running of the generating station became a serious matter, and an arrangement was entered into with the municipal authorities of Ghent under which the company's plant was from time to time stopped, the necessary current for the company's purposes during those periods being supplied from the municipal plant, and this current being returned to the municipality when the company's station was running. This plan worked well for a time, and enabled both the company and the municipality to use the stock of coal on hand to the best advantage. When it became evident that the German occupation would be a long one, it was decided to continue the work of extending the installations, which enabled many villages entirely without light to be connected up, and also resulted in the company being able to prevent the requisition of its stocks of copper materials. On the eve of the armistice in November last, the generating station at Langerbrugge was systematically bombarded by the enemy; the damage done was severe, but the work of repair was promptly taken in hand, and the plant has again been put into operation. While owing to the scarcity of petroleum the number of current consumers from the company's plant increased from 1,665 at the end of September, 1913, to 10,407, in September, 1918, the demand for current for power purposes, to which the concern looked for its main development, had entirely been absent, and under this head the undertaking was fully five years behind in the position it had sketched out before the war.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Bradford War Wages Committee is recommending a schedule of increases in the salaries of principal municipal officers, including an increase of £250 to the electrical engineer (Mr. T. Roles), bringing his salary to £1,250; £25 to the assistant electrical engineer, bringing his figure to £478; and of £50 to the tramways traffic superintendent, increasing his salary to £478.

Burnley Corporation Electricity Committee has put into force the recent award to technical engineers. The effect of the award is to increase the salary of Mr. T. Nutter, chief assistant, from £200 to £330 per year. Other advances are: Mr. J. Bolton, assistant, from £3 to £5 6s. 6d. per week; Mr. T. Taylor, assistant, from £2 17s. to £5 3s. per week; Mr. T. Riley, junior assistant, from £2 7s. to £4 11s. per week; Mr. H. Leaver, junior assistant, from £2 2s. to £4 5s.; Mr. W. Baker, motor superintendent, from £2 7s. to £4 11s.; and the four junior shift engineers from £1 12s. to £3 13s. per week.

Burnley Council has adopted the Electricity Committee's recommendation to grant the engineer, Mr. J. E. Starkie, a bonus of £65 per annum. It was pointed out that Mr. Starkie was given an increase of £100 two months ago, making his salary £600. Coun. Nuttall said that Mr. Starkie applied for an increase some years ago, but at the wish of the committee, he postponed it until after the war.

Mr. Milnes, borough electrical engineer at Lancaster, having failed to obtain his release from the Army, has asked that his allowance from the Corporation may cease. The Council has decided to keep his position open.

Captain A. J. Beckett, borough electrical engineer at Bridlington, who has been serving under the Admiralty, is being demobilised, and will shortly resume his duties.

The salary of Mr. R. H. Campion, electrical engineer at Dewsbury, has been advanced to £525 per annum.

Mr. M. S. Mason has been appointed chief assistant engineer by the Buxton Borough Council, with a special increase of £25 in two months. For the past three and a half years he has been serving in the Navy.

Mr. O. G. Cook, who has acted as assistant engineer for some considerable time to H.M. Military Power Station, Ripon, has resigned.

Barrow Town Council Electricity Committee has again proposed an increase in the electrical engineer's salary. At the previous meeting a proposal to make the increase £200 was defeated and a resolution was submitted suggesting arbitration, in the following terms: "That it be a recommendation to the chairmen of Standing Committees Sub-Committee, that in the event of the Council not agreeing to increase the salary of Mr. H. R. Burnett, the borough electrical engineer, by £200 per annum, as recommended by such sub-committee, the question of the amount of salary to be paid to him be referred to arbitration, and that the Council be bound by the award given." After discussion, it was carried by 13 votes to 11 that the minute be deleted, although the Mayor had pointed out that if the matter was left for further consideration by a sub-committee they were not likely to adopt the proposal of arbitration.

Barrow Town Council on Monday approved the changes in the staff at the electricity works consequent upon the resignation of Mr. L. Sewell, one of the charge engineers. Mr. T. E. Turner has been appointed to the vacancy at £104 per annum, plus 20 per cent., plus £90; and Mr. T. Wilson, of Ruabon, meter tester, at a commencing salary of £110 10s. per annum, plus 20 per cent., plus £90, with £10 towards cost of removal to Barrow. A junior charge engineer is to be appointed at a commencing salary, including all war advances, of £199 4s. per annum.

General.—Sir Auckland Geddes has accepted the post of Principal of McGill University, Montreal, where he was Professor of Anatomy at the outbreak of war. He has accordingly resigned the position of Minister of National Service and Reconstruction. During the illness of Sir Albert Stanley, Sir Auckland is acting on his behalf at the Board of Trade.

Mr. H. N. Sporborg, of the British Thomson-Houston Co., Ltd., is a member of Rugby's War Memorial Committee.

The Bradford Corporation General Purposes Committee recommends the appointment of Mr. Fred Marsden, deputy city engineer, to be city engineer, at £700 per annum, rising to £800, in succession to the late Mr. W. H. Dawson.

Mr. A. E. Farrow, manager of the Windsor & Slough Electric Supply Companies, and his wife have, on their silver wedding, been presented by the staff with a silver épergne.

Manchester Education Committee has approved of the appointment, by the Municipal College of Technology Sub-Committee, of Mr. A. E. Clayton, A.M.I.E.E., as lecturer in electrical engineering, at £350 per annum.

Captain S. K. Watson, R.I.E., late selling engineer for the British Westinghouse Electric & Manufacturing Co., Ltd., and the General Electric Co., Ltd., and Lieut. W. A. Sycamore, late gas-engine selling engineer for the British Westinghouse Co., are joining the staff of the Keighley Gas and Oil Engine Co., Ltd., the former as salesman in the Yorkshire district, and the latter attached as selling engineer to the London office.

Sir Charles J. Stewart, K.B.E. (late Public Trustee), has been elected to a seat on the board of the Marconi International Marine Communication Co., Ltd.

Mr. Charles Wyatt, A.M.I.E.E., has resigned his position in the chief electrical engineer's department, R.A.F. (Air Ministry), having been appointed manager of the electrical department of the Globe-Wernicke Co., Ltd., 222, Kensal Road, W. 10. The company have opened the department for the installation of electric lighting, power, &c. Catalogues, lists, &c., are desired.

Roll of Honour.—Corporal R. Smith, R.A.S.C., who was formerly an electrician at Bentley Colliery, Doncaster, has received a testimonial from the City of Pavia (Italy), for saving the life of an Italian soldier, who was in danger of drowning in the Ticino river.

Sapper A. Willis, R.E., who has died from illness contracted on active service in Egypt, was formerly in the wireless department of Messrs. Johnson & Phillips, Ltd., of Charlton, S.E.

Private H. Richards, R.E., who was previously on the electrical staff at the power station of the Isle of Wight Electric Light Co., at Ventnor, has died from pneumonia at Tembi, Persia.

Lieutenant W. T. McKenzie, Glamorgan Fortress Engineers (Electric Lights Company), has resigned his commission owing to ill-health contracted on active service, and retains his rank.

Obituary.—Sir William Crookes, O.M.—By the death of Sir William Crookes, on April 4th, at the age of 86, electrical science has lost one of its most noted investigators, one whose name will for ever stand in the front rank of original researchers and fertile thinkers. He was by training a chemist, and at first confined his attention to industrial chemistry, but eventually became professor of chemistry at the Training College, Chester. In 1861 he discovered the new element, thallium, and incidentally invented that interesting little scientific toy, the radiometer; his continued researches in connection with high vacua led him into that virgin but fertile field in which he reaped his most noted harvest of discoveries, ranging from the familiar "Crookes tube" to the phenomena which laid the foundations—and indeed formed no small part of the structure—of the modern theory of the constitution of matter and the electron theory. Thus the work of Sir William Crookes in great measure paved the paths which have led later investigators to the development of X-ray apparatus, and of the three-electrode valve evolved from Dr. Fleming's invention, so that indirectly it had a material influence on the war. He must be credited with remarkable insight, almost amounting to prophecy, in expressing the view that the constituents of atoms might, under suitable conditions, move as free particles, and again in his presidential address to the British Association in 1898, when he discussed the fixation of atmospheric nitrogen, and foresaw a time when the world's store of natural fertilisers would be inadequate to meet the demands for food of an ever-increasing population.

During his long career he was awarded most of the honours of the scientific world; he had been president of the British Association, the Chemical Society, and the Institution of Electrical Engineers, as well as of the Royal Society, a member of the Order of Merit, and the holder of various medals and other distinctions. Active up to the last, he developed a series of special glasses for protection from ultraviolet rays last year; his "spinthariscope" has served to bring home to the public an inkling of the wonders of radium. He was a firm believer in the possibility of communicating with those who had passed through the veil, and was an earnest investigator of psychic manifestations.

Mr. G. R. Henley.—We regret to record the death, which occurred on April 1st, at the age of 56 years, of Mr. George Robert Henley, secretary to Messrs. W. H. Allen, Son and Co., Ltd., of Bedford.

Prof. H. J. G. du Bois.—The death is reported from Berlin, at the age of 56 years, of Henri Johann G. du Bois. Born at Velp, Gelderland, he studied at the Technical High School at Delft, afterwards spending three years, 1883-85, in Glasgow with Lord Kelvin, then Sir Wm. Thomson. Later he was at Stuttgart, where he devoted much time to research work in connection with electro-magnetism, was professor at the Berlin University from 1896 to 1902, later at Utrecht, and back at Berlin where he eventually established what is known as the Bosschal Laboratory.

Prof. Simon.—The death is announced, at the early age of 49 years, of H. T. Simon, Professor of Physics and Applied Electricity at the University of Gottingen.

Mr. John Shanks.—The death is reported of Mr. John Shanks, managing director of Messrs. Shanks & Co., Ltd., engineers.

NEW COMPANIES REGISTERED.

James Dawkins & Co., Ltd. (10,282).—Private company. Registered in Edinburgh, March 27th. Capital, £2,000 in £1 shares. To carry on the business of electrical engineers, armature winders, suppliers of electrical accessories, &c. First directors:—T. H. Muir, 67, Oxford Drive, North Kelvinside, Glasgow, cashier, 150 shares; J. Dawkins, 73, Manor Road, Motherwell, electrical engineer, 50 shares; J. Wardrope, 10, Woodside Walk, Hamilton, electrical engineer, 150. Registered office: Rosebank, Tollcross, Glasgow.

Dyson Wright & Co., Ltd. (154,013).—Private company. Registered April 1st. Capital, £1,000 in £1 shares. Electricians, engineers, &c. The subscribers (each with one share) are:—J. Dyson, 289, Toller Lane, Bradford; A. Wright, 94, Undercliffe Lane, Bradford. Registered office: 72, Market Street, Bradford.

Caldwell, Ford & Co., Ltd. (153,979).—Private company. Registered March 31st. Capital, £3,000 in £1 shares. To take over the business of electrical engineers, &c., carried on as Caldwell, Ford & Co. at 4a, McDonald's Lane, Corporation Street, Manchester. First directors: C. C. Headley, Oakdene, Derbyshire Lane, Stretford, Manchester; and J. Ford, 22, Parker Street, Levenshulme. Registered office: 4a, McDonald's Lane, Corporation Street, Manchester.

Portable Electric Motors (1919), Ltd. (154,099).—Private company. Registered April 3rd. Capital, £50,000 in £1 shares. To acquire the business of electric motor and cutter manufacturers and dealers now carried on by a company with similar title at 121, Victoria Street, S.W. The subscribers (each with one share) are:—G. Fryer, 252, Trinity Road, Wandsworth Common, S.W., electrical engineer; Baron Clifford of Chudleigh, 67, Madeley Road, Ealing. Registered office: 121, Victoria Street, S.W.

Ballymoney Light & Power Co., Ltd. (4,675).—Private company. Registered March 27th. Capital, £10,000 in £5 shares. To acquire the business of electricians carried on by the Ballymoney Gas Co. The subscribers (each with one share) are:—T. Taggart, Ballymoney, solicitor; J. Hanna, Ballymoney, house furnisher; W. McClure, Ballymoney, grocer; J. Young, Ballymoney, timber merchant; S. Agnew, Ballymoney, baker and grocer; J. T. Taylor, Ballymoney, draper; S. J. Crombie, Ballymooey, draper; S. Todd, Ballymoney, grocer. First directors: T. M. Green, T. Taggart, J. B. Hamilton, J. Haona, Sen., W. McClure, J. Young, R. McIlroy, G. Todd, and P. J. O'Kane. Solicitor: J. B. Hamilton, Ballymoney, Co. Antrim.

P. J. Driscoll & Co., Ltd. (154,045).—Private company. Registered April 2nd. Capital, £2,000 in £1 shares. To acquire the business of an electrical engineer carried on by P. J. H. Driscoll at 33, d'Arblay Street, London. The subscribers (each with one share) are:—P. J. H. Driscall and J. Kennelly, both of 33, d'Arblay Street, London. First directors: P. J. H. Driscoll, J. Kennelly, and S. Hall. Registered office: 33, d'Arblay Street, London.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Wiring, Ltd. (138,072).—Capital, £2,500 in £1 shares. Return dated December 31st, 1918. 100 shares taken up; £100 paid. Mortgages and charges: Nil.

Westminster Electric Supply Corpn., Ltd. (27,061).—Capital, £2,000,000 in 200,000 ord. and 200,000 4½ per cent. cum. pref. shares of £5 each. No annual return has been filed since March, 1918, but a list of allotments shows a further 37,982 ord. shares allotted, payable in cash, between February 19th and March 18th, 1919. (To March, 1918, 110,000 of each class had been issued and fully paid. £240,300 mortgages and charges were outstanding at the same date.)

CITY NOTES.

Waste Heat and Gas Electrical Generating Stations, Ltd.

Mr. G. S. Newall presiding at the annual meeting, on March 31st, said that the construction of the new power station at Horden was proceeding satisfactorily, and it should be in operation at the end of the year unless unforeseen delays occurred. The new gas engine at Weardale had been working from time to time for some weeks, but, owing to several adjustments having to be made, which were to be expected with an entirely new design of plant, it had not yet been put into commercial service continuously. The records up to the present of the performance of the engine showed that it would quite come up to expectations as regards efficiency, and would prove much more economical than the present steam-boiler plant. All the plant in the power stations had been maintained in good and efficient running condition; but owing to various causes arising out of the war, such as less efficient working of blast furnaces, they had not had so much waste heat placed at their disposal during the year, and this had caused a diminution in the electric power generated, with a consequent reduction in revenue. The plant at Teesbridge power station was out of commission throughout the year, but the repair was completed, and it was again in operation and working satisfactorily. With regard to the sum of £5,000 set aside last year for experimental work, the expenditure up to the end of the financial year was £2,278. The experiments had in view the more efficient utilisation of coal, and he was glad to say that, so far as they had gone, they were assured by their engineers and by the power company in conjunction with whom they were carrying the experiments out, they had proved satisfactory. Proposals were being considered with a view to trying the experimental plant on a large scale. He thought it was most important that the company should devote a sum of money each year for experimental purposes. For the experiments mentioned above, if carried out on a larger scale, they proposed to contribute a further sum; of course, anything which would tend to the better utilisation of waste heat would have their greatest support. Certain proposals had lately come before the directors for the installation of a further station for the utilisation of waste energy; they were being considered, but as no definite decision had been arrived at, he could not report on the matter in more than a general way. The profits for the year showed a reduction of £2,085, as compared with the previous year.

Chelsea Electricity Supply Co., Ltd.

At the annual meeting, on April 2nd, Mr. W. R. Davies, the chairman, said that the statement for 1918 was the least favourable that had been presented for a long time past. Compared with 1917 the sales of current had fallen by £2,573, and the profit on installation work by £896. On the other hand, property rental was £440 better, and meter rentals had risen by £126; on balance the receipts were lower by £2,904. The reduction in sales was due entirely to the onerous restrictions rightly imposed by Government, and was a matter which would right itself when restrictions were removed. No other electricity company had been so hard hit in this matter as they had. They supplied a high-class residential area, and had suffered as much from the almost total cessation of social events among the upper classes and the entire absence of a London season as from Government restrictions. With the return of anything like normal conditions the credit side of the revenue account would show a marked recovery. The expenses were principally responsible for the poor showing of the revenue account; they had risen by £5,840. Fuel had cost £280 more for a sale of about a quarter of a million fewer units; repairs were £2,690 higher, and wages and salaries were over £2,600 more; rates £412 more, and half-a-dozen other items had together increased by about £800. The total of these items was about £6,780, and after deducting a saving of £858 in income tax and other small reductions there was a net increase in working expenses of £5,840. The speaker was not anxious as to the future. Social life in London would in time renew most of its old activities; they could look for some amelioration in the cost of, at least, oil fuel; the charge of nearly £1,500 for allowances to employés on military service would disappear, and repairs, which had been high during the year under review, would become normal again. The principal danger, the continued increase in wages, which would show a further rise for 1919, had at last received a check, as recent demands for a still further increase had been refused by the Arbitration Board, and although 1919 might show no improvement over 1918, they might look for generally improved results at no distant date.

British Columbia Electric Railway Co., Ltd.

Mr. G. P. Norton presided at the annual meeting held last week. In the absence of the chairman, a speech which he had written was read. He said that the report before them was the most encouraging they had had since the outbreak of war. The total income was £91,755 better than for the previous year. The company's reserves were large and placed it in a strong position, but those funds for the most part, had been accumulated as a provision for depreciation, sinking fund, and renewals incidental to such a property. A very large proportion of the plant was erected during the four or five years immediately preceding the war, with the result that few actual replacements had been absolutely unavoidable during the past four years, and the provision for depreciation set aside each year had therefore accumulated. The replacements would be necessary now, and as time went on, and the reserves accumulated could not be considered as more than sufficient to provide for the regular wastage. The increase in gross earnings was attributable to the more prosperous conditions which existed in the cities served by the company resulting largely from the extensive programme of shipbuilding which was in progress during the year. Referring to the strike of July, the chairman said that the company was utterly unable to pay the wages asked for by the men unless revenue could be increased. The revision of fares was permitted, and the wages demanded were agreed to. After referring to the importance to the company of the decision of the Provincial Government to establish a Public Service Commission with powers to revise and fix rates, the chairman stated that if British Columbians desired to see the natural resources of their country developed, and new industries established, they must have capital by offering guarantees of safety and liberal inducements to investors.

German Companies.

The Kabelwerk Duisburg A.G., of Duisburg, records net profits of £45,000 for 1918, as contrasted with £80,000 in the previous twelve months. Notwithstanding this reduction the dividend recommended is at the rate of 16 per cent., as in 1917, together with a bonus of 9 per cent., as in the preceding year.

The directors of the *Ver Isolatoren Werke A.G., of Berlin-Pankow*, report that a substantial part of the stocks suffered depreciation through the sudden cancellation of Army orders, and the financial results in 1918 would have been further diminished if abundant allowance for depreciation had not been made formerly. After setting aside £3,000 for depreciation, as compared with £15,000 in 1917, the accounts show net profits of £6,300, as against £12,000 in the preceding year, and the dividend is at the rate of 10 per cent. on the share capital of £50,000, this contrasting with 20 per cent. in 1917.

The Hamburger Hochbahn A.G., of Hamburg, reporting on the past year, refers to the conclusion of an agreement with the State of Hamburg in July, 1918, whereby the latter transferred its rights in the superstructure of the railway to the company in return for "B" shares of the nominal value of £2,431,000, with a share in the profits as from July 1st in that year. The company had also absorbed the undertaking of the Hamburg Tramways Co., but the transfer of the Alster shipping services to the company had not yet been carried out; nor had that of the Hamburg-Altona Railway Co.; whilst the working of the Waldorfer (steam) line had not yielded any profits. After transferring £30,000 to the renewal fund, as against £20,000 in 1917, the amounts exhibit net profits of £114,000, as compared with £47,000 in the preceding year. A dividend at the rate of 6 per cent. has been declared on the £750,000 of "A" shares, and at the rate of 5 per cent. on the "B" shares for six months.

The Grosse Berliner Strassenbahn A.G., of Berlin, which absorbed the company's four subsidiary tramway undertakings in Greater Berlin in 1918, experienced a considerable increase in revenue from this fact, and from the higher fares introduced last May and the reduced transport facilities on the city railway. The total receipts amounted to £5,005,000, as compared with £3,064,000 in 1917, and the total expenses were £3,096,000, as against £1,970,000, or 61.89 and 64.38 per cent respectively. After apportioning £660,000 for renewals, as contrasted with £440,000, and writing off £92,000 for depreciation, as against £44,000, and making other allocations, the accounts show net profits of £476,000, as compared with £211,000 in the preceding year. The directors recommend a dividend at the rate of 7½ per cent., as against 4 per cent. in 1917. It is calculated that the introduction of the 8-hours' day, and further increases in wages, will involve an additional charge of £2,000,000 in the present year.

The report of *Voigt & Haeffner A.G., of Frankfort-on-Main*, referring to the year 1918, states that the transfer from war to peace work took place comparatively easily. It would have been possible further to have increased the production if the scarcity of coal and of other raw materials had not imposed limits on the output. After allocating £24,000 to depreciation, as compared with £34,000 in 1917, the accounts indicate net profits of £103,000, as against £170,000, and a dividend of 18 per cent. has been declared on the share capital of £250,000, as compared with 25 per cent. in 1917. At the general meeting on March 26th, it was mentioned that it was difficult to continue manufacturing owing to the lack of raw materials and transport difficulties, whilst the increased demands of the workmen and staff raised further obstacles. The prospects were very dark and considerably less favourable than had appeared from the volume of orders on hand, so that a heavy decline in the results would have to be reckoned with, especially as sale prices could not keep pace with the growing burdens, and the company had to adhere to the prices prevailing in the world's markets.

Northern General Transport Co., Ltd.—The gross traffic receipts for 1918 show a considerable increase, but operating costs advanced substantially, due to rises in wages and materials, and fares had again to be raised. The company has a fleet of 26 motor omnibuses, and others are on order for re-opening certain routes. The company's holdings in the Gateshead, Tynemouth, and Jarrow electric traction companies stand in the books at a cost of £398,982, and the dividends and interest for 1918 were £26,825. These three concerns set aside for reserve and renewals during the year £22,667, bringing the funds up to £219,738. The traffic receipts (less working expenses) of the Northern General Co., and the dividends and other revenues, were £45,863, against £37,555 for 1917. After providing for administration expenses, £3,327 for loan and debenture interest, £5,189 to renewals, and adding £6,624 brought forward, £1,584 is put to debenture redemption fund, 6 per cent. is paid on the preference shares, and 8 per cent. on the ordinary, leaving £12,565 to be carried forward.

West India Electric Co., Ltd.—The report for 1918, which was adopted at the meeting held at Montreal on March 12th, showed that notwithstanding strenuous war conditions and high costs of wages and material and of freight rates from New York to Jamaica, there had been improvement over 1917, owing to the returning confidence of the public and the greater prosperity of the island. Gross earnings, $294,725, an increase of $7,513. Total operating expenses $155,238, decrease $3,952. Net earnings $139,487. Net income $89,602, or 11.20 per cent. on the capital stock, transferred to credit of surplus account. The receipts for current sold for lighting and power showed a healthy state prevailing in that part of the business, in which there was still room for expansion. Four quarterly dividends distributed amounted to $40,000. The lighting system at Kingston, St. Andrew, and Spanish Town had been extended, and new passenger car equipment and gates had been installed in Dam. The hydraulic station gave satisfactory service throughout the year in consequence of a steady rainfall.

Marconi International Marine Communication Co., Ltd.—At an extraordinary meeting called for April 16th, a resolution will be submitted increasing the capital by the creation of 900,000 new shares of £1 each. This will make the capital £1,500,000. The directors wish to provide for probable requirements consequent upon the growth of the business and contemplated capital outlays. It is proposed to offer to the shareholders 600,000 shares at par in proportion to their holdings. The remaining 300,000 shares will be for issue at some future time. "The directors contemplate that at the ordinary general meeting which will be subsequent to the issue (if approved) they will be in a position to recommend upon the then issued capital the payment of the same dividend as was recommended by them and approved by shareholders at the last ordinary general meeting."

Folkestone Electricity Supply Co., Ltd.—The profits for 1918 have been seriously affected by the continued advance in fuel and labour costs. Though the charges for current have been further increased the receipts from sales show a decrease due to the heating and fuel restrictions. 168,497 lamps (8 C.P.) supplied at December, an increase of 3,190. Including the receipts from hired installations, the profit on revenue for the three undertakings was £11,402. After adding £2,643 brought forward, also interest on investments, and allowing for debenture and preference interest, £4,572 is put to depreciation, and 5 per cent. dividend (less tax) on the ordinary shares is to be paid, leaving £965 to be carried forward. Units generated, 2,164,096; units sold, 1,493,941; used on works, 369,872; not accounted for, 300,280

Lima Light, Power & Tramways Co.—Dividend 1½ per cent

Bombay Electric Supply & Tramways Co., Ltd.—Dividend on the ordinary shares at the rate of 14 per cent. for the half-year ended December 31st, together with a bonus of 2 per cent. for 1918.

Wood & Cairns, Ltd. (Edinburgh).—Dividend of 10 per cent. on both the ordinary and preference shares for the past year.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

International Light & Power Co., Ltd.—£396,200 5 per cent. first mortgage debentures of £100 each, within Nos. 1 to 4,000.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—500,000 additional ordinary shares of £1 each, fully paid, Nos. 797,682 to 1,297,681.

General Electric Co., Ltd.—80,000 additional 6½ per cent. cumulative preference shares of £10 each, fully paid (Nos. 70,001 to 350,000).

Marconi International Marine Communication Co., Ltd.—600,000 shares of £1 each, fully-paid (Nos. 1 to 600,000).

Telegraph Construction and Maintenance Co., Ltd.—37,350 additional shares of £12 each, fully-paid (Nos. 37,351 to 74,700).

New York Telephone Co.—The report for the seven months ended July 31st last, from which date the Government assumed control, states that the telephone revenue amounted to $38,606,799 and telephone expenses to $31,741,945, net telephone earnings being $6,864,854; dividend and interest yielded $3,202,367 and miscellaneous earnings $421,339, making total net earnings $10,488,561; interest absorbed $2,916,782, there being a balance of $7,571,778. Dividends of 8 per cent. required $5,000,000, so that the balance to surplus was $2,571,773. On December 31st there were 1,522,720 stations in the system directly operated by the company and its local connecting companies, an increase of 79,332. Including the associated and their connecting companies, constituting the Eastern group or division of the Bell system, there were in service at the end of the year 2,706,459 stations, an increase of 140,546 stations.—*Financial Times.*

American Telephone & Telegraph Co.—The report for 1918 states that the net earnings were $54,293,016. Interest charges were $10,391,694, and the dividends at the regular rate of 8 per cent. per annum were $35,229,698. Of the resulting balance $5,000,000 was appropriated for contingencies and $3,671,622 added to surplus. Investment in associated companies increased $33,084,043, and permanent plant increased $11,300,037, current assets increased $5,165,696, and cash increased $8,611,501. The total indebtedness increased $43,285,851 during the year. There was a total increase in assets of $58,161,278, against which was a net increase in capitalisation and indebtedness of $49,574,465, showing a net improvement in the company's financial position of $8,586,813 which is represented by the increase of that amount in surplus and reserves.—*Financial Times.*

Wycombe (Borough) Electric Light & Power Co., Ltd.—The report for 1918 shows that the connections increased by 113 kw. to 2,842 kw. The demand for power for munitions necessitated running the whole plant at its fullest capacity. Repairs have therefore been impossible, and serious breakdowns have occurred, and the supply has had to be largely given from the older and less efficient plant. This has largely increased the working costs, and entailed large reduction in profit. Additional plant is to be installed at an early date. Profit for 1918 £4,152, against £6,944 for 1917. Interest on debentures and outstanding accounts, £3,012; adding £747 brought forward, £1,888 is available. Of this, £1,500 is to be placed to reserve for renewals, and £388 is to be carried forward.

Montevideo Telephone Co., Ltd.—Resolutions are to be submitted to increase the capital from £160,000 to £220,000 by the creation of 60,000 new ordinary shares of £1 each, and to capitalise £57,963 of the undivided profits and distribute it by the allotment of one new ordinary share for every four preference shares held and one new ordinary share for every two ordinary shares held; and to convert the preference shares into ordinary shares.

Minehead Electric Supply Co., Ltd.—The difficulties of the year reduced the lighting units, and added to all costs, but power units sold satisfactorily increased. Profit after paying debenture interest £826, plus £39 brought forward. Preference dividend, £482; 5 per cent., less tax, on ordinary, £93; depreciation and reserve, £253 (making it £6,300); carried forward, £37. Units generated 298,431; units sold, 216,420; used on works 25,185; not accounted for 56,826.

Bromley (Kent) Electric Light & Power Co., Ltd.—During 1918 connections increased from 4,771 to 4,854 kw. Profit on trading was £7,744, against £9,645 for 1917. Debenture interest, &c., absorbs £2,938. There was brought forward £1,599. Dividend 4 per cent. for the year; £2,000 to renewal reserve; £1,404 carried forward.

Eastern Telegraph Co., Ltd.—Though the accounts cannot be ready at the usual time, data so far received shows that the net earnings for 1918 justify the usual distribution. A further payment on the ordinary shares of 1½ per cent. and a bonus of 2 per cent., making 8 per cent., free of tax, are announced

Eastern Extension, &c., Telegraph Co., Ltd.—Fourth dividend payment of 3s. per share, and a bonus of 4s. per share, making 8 per cent., free of tax, for the year.

Middleton Electric Traction Co., Ltd.—Dividend of 5 per cent (5s. per share) on preference shares, bringing the dividend up to July, 1918; £4,560 for repairs and maintenance; £5,000 as provision for renewals; £1,000 to reserve; £2,429 carried forward.

Fuller Accumulator Co., Ltd.—Interim dividends on both the preference and ordinary shares at the rate of 8 per cent. per annum.

Fullers' Carbon & Electrical Co., Ltd.—Interim dividend on ordinary at rate of 8 per cent. per annum.

Fullers' Wire & Cable Co., Ltd.—Interim dividend on preference and ordinary shares at rate of 8 per cent. per annum.

W. T. Henley's Telegraph Works Co., Ltd.—Final dividend on the ordinary shares 2s. 6d. per share, less income tax, making with the interim dividend of 6d, per share paid in September, 3s. per share for the year.

Indo-European Telegraph Co., Ltd.—Final dividend for 1918 22s. 6d. per share, making a total of 7 per cent. for the year, also a further distribution of 30s. per share, free of tax.

Mirrlees Watson Co., Ltd.—Dividend 10 per cent., and a bonus of 2½ per cent., both less tax, £20,000 to reserve, £8,141 carried forward.

Sir W. G. Armstrong, Whitworth & Co., Ltd.—Dividend on ordinary shares for half-year 1s. 6d. per share, making 2s. 6d. per share for the year, free of tax up to 5s. in the £.

STOCKS AND SHARES.

Tuesday Evening.

"Strength in idleness" would form a very fair description of many of the markets round the Stock Exchange. Rises in War Loan and gilt-edged stocks have assisted the general tone not a little. More satisfactory news from Russia helped to put a brighter complexion upon matters in that chaotic country. Relief from fears of dearer money have encouraged investment. A little flood of new issues is held back until after Easter; those which have recently been made received in most cases a distinctly favourable reception.

Now that the Treasury Regulations are being relaxed in various directions, it may be expected that various share-splitting schemes—hung up during the war—will make their appearance. This may have something to do with the strength of General Electric ordinary, the price of which has moved up to 17⅞. It is well known that the directors are willing to split the shares into a denomination more marketable than £10 nominal. Possibly, too, the Telegraph Construction Co., with its unusual £12 shares, will propose something of the same kind. Without a doubt, the £1 share makes for popularity and is more easily handled than one of £10, or even £5, and a ready market in its shares is a useful asset to most industrial companies.

Amongst new issues of the near future will be that of 200,000 8 per cent. participating preference shares in Fuller's United Electric Works, Ltd., and rumour hints at a possible new issue of ordinary shares in the Edison Swan, details of which may be expected before long. The new preference shares offered last week by the Midland Power Distribution Co. were quoted ⅛ to ⅜ premium before the allotments came out. Dealings could not take place, naturally, but there was a declared buyer before the market started in the shares. Vickers novel plan of offering shares in "blocks" may be followed in other cases if it should prove popular with the shareholders, to whom it is addressed. In passing, it may be observed that if Vickers were to amalgamate with, or absorb, all the companies that gossip links it with, the electrical manufacturing industry would soon hold but a single name.

Electricity Supply shares are a quiet market, and for the next two or three months it can hardly be supposed that conditions will alter much from week to week. How the companies fared during the war period can be succinctly shown by tracing the dividend record over the past six years. A brief table brings out these interesting figures:—

Ordinary Share.	1913.	1914.	1915.	1916.	1917.	1918.
Brompton	10	10	10	9	10	8
Charing Cross	6	5	5	5	4	4
Chelsea	5	5	4	3	5	3
City	10	9	8	8	8	8
County	7	7	7	7	7	7
Kensington	9	9	7	6	7	6
London	3	4	3	0	0	0
Metropolitan	4½	3½	3	3	4	5
St. James's	12	10	8	8	9	10
South London	5½	5	5	5	5	5
South. Met.	0	0	4	4	6	6
Westminster	10	9	7	7	9	8

Out of the dozen companies, the Metropolitan and the South Metropolitan are the only two which have advanced their dividends since 1913. The County of London has maintained a regular 7 per cent. throughout the six years. The other nine show declines ranging from ½ per cent. in the case of South Londons to 3 per cent. in Kensingtons and Londons, though it should be added that the latter has just paid its full 6 per cent. on the preference, against 5 per cent. in 1917. Seeing what all the electric supply companies have had to put up with during the war, the above record can hardly be regarded as aught but satisfactory. No chance for profiteering in electric light, anyway.

The telegraph market keeps firm, the feature here being the boomlet in Marconis. At length the Marconi Marine secret is out of the bag, and the company is recommending an increase in the capital that will give share for share, at £1, to proprietors. A dividend of 15 per cent.—the same as before—is declared. Upon this handsome bonus, Marines jumped to 4 13/16, and Marconis to 5, the preference also rising to 4¼. Profit-taking reduced Marines to 4 9/16, but the market remains hard. Americans are neglected at 29s. 6d., but Canadians, on a widespread tip to buy for 20s., improved to 16s. 3d.

Home railway stocks are inclined to brace up a little in sympathy with the strength of investment securities. Districts, however, have lost a point at 23½. The City & South London Railway is proposing to enlarge its tunnels, and to borrow up to one and a half million pounds, the latter by the creation of second debenture stock, carrying 5 per cent. interest. During the extended period of construction, the company also asks for power to make up to 5 per cent. per annum until 1924 dividends on the preference capital issued prior to the passing of the Act of 1913. Foreign issues are quiet; some demand has occurred in Anglo-Argentine Tramways 5 per cent. debenture stock. Various Indian tramways shares are better. United Electric of Montevideo debenture stock at 74½ is 1½ to the good. Mexicans remain quiet, and Brazil Tractions eased off a trifle after the recent rises.

British Aluminiums have weakened 1/16, and Siemens are ⅛ lower at 6⅝. Telegraph Constructions have also gone back. British Insulated ordinary, on the other hand, are strong at £2, and other manufacturing shares show a firm front. The rubber market is dull in consequence of a fall in the price of the raw product to a shade below a florin per lb. The armament group keeps steady, and the lifting of the Labour cloud has had a strengthening effect upon iron, coal, and steel varieties.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Dividend 1917.	Dividend 1918.	Price April 6, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	10	8	7½	—	£6 8 0
Charing Cross Ordinary	4	4	3½	—	5 14 4
do. do. do. 4½ Pref...	4½	4½	3⅜	—	6 13 4
Chelsea	5	3	3¾	—	4 1 1
City of London	8	8	11⅞	—	6 14 8
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅝	—	6 11 0
do. do. 6 per cent. Pref.	6	6	9¾	—	6 3 1
Kensington Ordinary	7	6	4⅞	—	6 2 2
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref...	6	6	3⅞	—	7 14 10
Metropolitan	4	5	3⅛	—	7 18 10
do. 4½ per cent. Pref. ..	4½	4½	3¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	5	5	2⅞	—	6 19 4
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	8	8	6⅝	—	6 0

Telegraphs and Telephones.

	Dividend 1917.	Dividend 1918.	Price April 6, 1919.	Rise or fall.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	99½	—	6 0 7
do. Def.	1½	83/6	21⅞	—	7 13 0
Chile Telephone	8	8	7⅜	—	6 8 6
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10¼	—	6 14 8
Great Northern Tel.	22	22	81	—1½	7 2 0
Indo-European	13	13	67½	—	6 18 0
Marconi	20	20	6	+ ⅛	4 0 0
Oriental Telephone Ord.	10	16	2⁷⁄₁₆	— ¹⁄₁₆	6 3 0
United R. Plate Tel.	8	8	7⅛	—	*5 1 7
West India and Panama	1/3	1/3	1⅝	— ¹⁄₁₆	*3 17 0
Western Telegraph	8	8	16¾	—	*4 16 10

Home Rails.

	Dividend 1917.	Dividend 1918.	Price April 6, 1919.	Rise or fall.	Yield p.c.
Central London Ord. Assented ..	4	4	62½	—	6 8 0
Metropolitan	1	1¼	26¼	—	4 14 7
do. District	Nil	Nil	23½	—1	Nil
Underground Electric Ordinary..	Nil	Nil	8¼	—	Nil
do. do. "A" ..	Nil	Nil	9/3	—	Nil
do. do. Income ..	4	5	94½	—	*5 5 10

Foreign Trams, &c.

	Dividend 1917.	Dividend 1918.	Price April 6, 1919.	Rise or fall.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	3¼	—	—
do. do. 2nd Pref. ..	—	—	3¼	—	—
do. do. 6 Deb... ..	6	5	67½	+1	7 8 5
Brazil Tractions	—	—	56	— ½	—
Bombay Electric Pref.	6	6	10¾	—	6 11 7
British Columbia Elec. Rly. Pfce.	5	5	62	—	8 0 0
do. do. Preferred	Nil	Nil	40	—1	Nil
do. do. Deferred	Nil	Nil	41	—	Nil
do. do. Deb. ..	4½	4½	61	—	6 19 4
Mexico Trams 6 per cent. Bonds..	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	52	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	68	+1	—

Manufacturing Companies.

	Dividend 1917.	Dividend 1918.	Price April 6, 1919.	Rise or fall.	Yield p.c.
Babcock & Wilcox	16	16	3¾	—	4 0 0
British Aluminium Ord.	10	10	1²³⁄₃₂	— ¹⁄₁₆	5 16 3
British Insulated Ord.	25	12½	2	+ ⅛	6 5 0
British Westinghouse Pref. ..	7½	7½	2½	+ ¹⁄₁₆	6 3 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	8¼	—	6 8 1
Edison-Swan, "A"	—	—	1¹⁄₃₂	+ ³⁄₃₂	7 6 6
do. do. 5 per cent. Deb. ..	4	5	75½	+1	6 12 8
Electric Construction	10	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6½	10⅝	—	6 5 4
do. Ord.	10	10	17⅞	+ ½	*5 12 0
Henley	25	25	2⁷⁄₁₆	—	5 8 2
do. 4½ Pref..	4½	4½	4	—	6 12 6
India-Rubber	10	10	16¾	— ½	*5 19 3
Siemens Ord...	—	10	6⅝	— ⅛	*7 11 0
Telegraph Con.	20	20	24	— ½	5 0 0

Dividends paid free of Income Tax

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 9th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£78	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£48	..
a Copper Sulphate	"	£42	£5 dec.
a Potash, Chlorate	per lb.	1/9	..
a " Perchlorate	"	1/9	..
a Shellac	per cwt.	£11	30s. dec.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	"	£31	£2 dec.
a " Lump	"	£23	£2 dec.
a Soda, Chlorate	per lb.	11d.	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	11⅝d.	..
c " Tubes (solid drawn) ..	"	1/2¼ to 1/2½	¼d. inc.
c " Wire, basis	"	1/-	..
c Copper Tubes (solid drawn) ..	"	1/4	½d. inc.
g " Bars (best selected) ..	per ton	£114	..
g " Sheet	"	£114	..
g " Rod	"	£114	..
d " (Electrolytic) Bars ..	"	£84	30s. inc.
d " " Sheets ..	"	£161	..
d " " Wire Rods	"	£94	30s. inc.
d " " H.C. Wire	per lb.	11¾d.	½d. inc.
f Ebonite Rod	"	8/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	2/5¼	½d. inc.
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	9d. to 4 6	..
e " " " medium	"	5/- to 10/-	..
e " " " large ..	"	12/6 to 25-/ & up.	..
d Silicium Bronze Wire	per lb.	1/4	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	£236 to £238	..
n " Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Water Softening.—In his memorandum for the year 1917-18, Mr. C. E. Stromeyer, chief engineer to the Manchester Steam Users' Association, gives special attention to the subject of water softening, from both the chemical and the physical aspects. He considers that owing to the incompleteness of the chemical reactions, the ordinary softening processes cannot reduce the real hardness below 2·4 degrees. The "time factor" is of importance; the reaction is not instantaneous, and the necessary intimacy of mixture can only be attained if sufficient time is allowed, though it may be hurried up by mechanical agitation. The reaction is also facilitated by heating. For rapidity of filtration, it is desirable that the particles of sediment shall be as large as possible, so that a coarse filtering medium can be used; coarseness is secured by slowness of reaction, high temperature, and violence of agitation. Eddying currents in settling tanks should be avoided as far as possible, and methods are described with this object in view. In one case the water is passed at a very low velocity across a wide tank, the effluent from the surface being free from particles of sediment. The Association's chemist has examined a number of water softeners used by the members, and finds that in most cases the chemical reaction is not completed until the water reaches the settling tank, or even the boiler. In some softeners the flow of the water is 10 times as fast as in others, with the result that in the former the quantity of sediment carried over with the treated water is about a million times as great as in the latter.

The combination of salt and soda, together with dissolved air, tends to cause pitting of boiler plates; good preventatives are a slight excess of soda, or the addition of tannin solutions, but the tannin must be added to the feed *after* the softening process. The use of barium aluminate is almost as effective as distillation, leaving no residual hardness; but the barium salts are poisonous. What may happen to a boiler when the water supply is neglected, was exemplified during 1917 by the collapse of the furnaces in two boilers through overheating; it was found that sulphate of soda had accumulated to such an extent that the boilers had been working with melted Glauber salts—a bucket of boiler water when cold turned to a solid mass of crystals.

External corrosion, a furnace fracture due to working steel at a "blue" heat, and the failure of screw bolts owing to excessive stresses set up by slight differences in pitch between the nut and bolt threads, are also dealt with in the memorandum.

THE PRESENT ELECTRICAL OUTLOOK IN CANADA.

By A. S. L. BARNES, A.M.I.E.E.

(Concluded from page 390.)

If the Dominion is to make the rapid strides that are being predicted for her by so many prominent men, then her people will be prosperous, and will require many things which British manufacturers should be able to supply if they would go the right way about it.

Proper representation over here is necessary, and stocks of spare parts will be, in many cases, essential; firms at home must not forget that there are two powerful and firmly-established competitors here, viz.:—The Canadian General Electric Co. and the Canadian Westinghouse Co., with large works in Canada itself and with means of obtaining or quoting or practically anything electrical through their connections with the immense works bearing similar names in the U.S.A.; besides this, there are other firms manufacturing all kinds of electrical devices and fittings specially adapted to the Canadian markets.

So far as generators, motors, transformers, &c., go, as well as meters, instruments, switchgear, &c., British manufacturers will not find Canadian buyers restrict them specially to any particular type, but care should be taken that the ratings of generators, motors, and the like are stated in terms comparable with those of the American Institute of Electrical Engineers, which are taken as the standard here.

For example, if the British rating for an electric motor be such that a greater temperature rise is allowable than is the case here, resulting in what is called a 7½-H.P. motor here being rated at, say, 10 H.P. in England, then, if a manufacturer desires to succeed here, he must conform to the standards obtaining here, and not to those in England; in other words, his 10-H.P. motor must be sold as a 7½-H.P. motor, which will put it on the same basis as motors made on this continent. This will deprive the enterprising salesman of an apparent advantage, but will undoubtedly pay in the long run, as, if the motor be rated at the higher figure, the user will certainly overload it, as he has been accustomed to do with the American 7½-H.P. motor, with disastrous results for the motor, and worse for the reputation of its maker. The writer has been informed on what he believes to be very good authority that the foregoing represents actual experience in the case of at least one British firm.

So far as fittings and materials for wiring generally are concerned, the market for these is standardised by the specifications and requirements of the National Electrical Code (the book of rules of the Fire Underwriters), and manufacturers will find it practically essential to comply with the code before entering the market at all.

All fittings, materials, &c., permitted for use under this code must be tested at the Underwriters' Laboratories in Chicago; there are, however, in London representatives to whom British firms can apply for information, and, to some extent, for approval.

In the Province of Ontario the Hydro-Electric Power Commission of Ontario has jurisdiction in such matters; and although at present all fittings, devices, and materials approved by the Underwriters' Laboratories, receive the general approval of the Commission, yet the right to approve of things not accepted by the Underwriters, and to reject things approved by them, is vested in the Commission, to be exercised at its discretion.

The Commission maintains a large and efficient laboratory, the equipment of which is constantly being added to, for carrying out all manner of mechanical, electrical, physical and chemical tests, and at the present time large numbers of new devices and fittings are being submitted for test by manufacturers, before being put on the market.

British firms wishing to enter the Ontario market should certainly have their products definitely approved by this Commission before going far with their plans, otherwise they are liable to find themselves shut out of the part of the Dominion having the greatest trade possibilities.

It may not be generally known that the British Board of Trade has comparatively recently appointed Imperial Trade Commissioners and Imperial Trade Correspondents in the Overseas Dominions.

Canada has two of the former, one in Montreal and one in Toronto, and several of the latter in various parts of the country.

The writer, some little time ago, discussed the marketing of United Kingdom electrical goods in Canada with Mr. F. W. Field, the British Government Trade Commissioner in Ontario. Mr. Field, who reports to the Department of Overseas Trade (Development and Intelligence) in London, has his headquarters at central and commodious offices in Toronto.

The following gives Mr. Field's views:—

"Except in isolated cases, United Kingdom firms making electrical appliances and equipment do not appear to have made a careful survey of the Canadian market, or any serious attempt to compete with their aggressive competitors here, chiefly the United States."

"After the war, there will undoubtedly be a substantial demand for electrical goods in Canada, and particularly in Ontario, the area in which I represent the British Government's Department of Overseas Trade. The extensive programme of the Hydro-Electric Power Commission of Ontario is a significant omen of the probable demand."

Four of the outstanding points with regard to the United Kingdom in this market are:—

"(*a*) Quality of the goods.
"(*b*) Style and finish.
"(*c*) Service and spare parts.
"(*d*) Selling.

"The quality of the United Kingdom goods sold here, speaking generally, has been excellent."

"The style and finish of electrical appliances has been, in the majority of cases, decidedly inferior to those of United States goods. This market demands attractive styles and finishes for appliances, and the United States manufacturers do everything possible to cater for the demand.

"The conditions and requirements of this market must be carefully studied and followed if success is to be achieved here. The Canadian purchaser must be able to know that if United Kingdom goods are bought, the manufacturers thereof will give the necessary service afterwards from time to time. This applies particularly to machinery, in connection with which arrangements must be made by the United Kingdom manufacturers for supplies locally of spare parts and repairs."

"In short, if the United Kingdom electrical industry will regard seriously the keen competition to be met here, will study the local requirements, and supply what is wanted, then with an aggressive selling organisation, with reasonable prices, and the well-known reputation of United Kingdom goods, there does not appear to be any good reason why British trade in electrical appliances and equipment should not, in due course, make notable strides in this market."

It will be of interest to know that Mr. Field, in his official capacity as British Trade Commissioner in Ontario, visited the ground of the Chippewa power development of the Hydro-Electric Power Commission of Ontario last spring, addressed the convention of the Canadian Association of Municipal Electrical Engineers at Niagara Falls in June, with regard to the origin and purpose of the Trade Commissioner Service, and attended a convention in October, at Toronto, of the Ontario Association of Electrical Contractors and Dealers, in addition to making various reports to his department of interest to the industry.

The business prospects in Canada from all present indications are excellent; some authorities are cautious enough to say that they think that trade will be dull for a little while, but even these men are quite optimistic about the future.

There is much railway work to be done, not only on new lines: during the war, maintenance and repair work have not been carried out on anything like an adequate scale, and a great deal of such work will now be undertaken.

Government and municipal works of all kinds have been held up by the war, and many of these will be started soon, one notable instance being the construction work on the new Willand Canal,* which runs from Lake Erie to Lake Ontario—this is being recommenced now; many industrial concerns have likewise held over a good deal of work of all kinds during the war; shipbuilding, as already indicated, seems to be assured of a good time, and, with food so much needed in Europe, the farmers are practically certain to be fairly prosperous for some time to come.

While no definite electric railway schemes are known to the writer, which are likely to be undertaken immediately, it is hardly to be doubted that there will be a good deal of activity in this line in the next few years.

With the great water power developments now in course of construction at Niagara Falls, Ontario, and the possibilities for immediate extension at Shawinigan Falls, Quebec, it is more than likely that great electrochemical and electrometallurgical industries will be established at such centres, where power will be cheap, and transportation facilities, by either land or water, are good.

The writer heard a criticism from a professor of one of the great Universities here, the other day, regarding British firms; this gentleman remarked that frequently, before the war, when machinery was ordered by the University, the British manufacturer demanded payment before his products left England. This may seem to be good business from the other side of the Atlantic, but it has the decided disadvantage that a University dislikes being treated as if it would not, or could not, pay its bills; and the chances are great that the professors of engineering will speak more sympathetically to the graduates about machinery obtained without difficulty from the U.S.A. than about that obtained from England.

British firms have quite enough handicaps in trading over here, as compared with the United States, without making things worse by creating a bad impression amongst young engineers at the very commencement of their profession; practically all of these men when they leave college go the States to complete their initial training, and thus know next to nothing about British firms and what they can do.

If the responsible heads of some firms at home imagine that the Universities at Montreal and Toronto are only fit to be treated like some petty concern with no standing, the sooner they pay a personal visit to this country, and (to use an Americanism) "get acquainted," the better; there is no more reason for such an attitude towards these great institutions than there would be towards, say, the University of Manchester. No doubt many matters of this kind will be far different now from what they were five years ago.

This is somewhat of a digression. To return to a discussion of business prospects, the different works mentioned above, though mostly not such as would affect electrical manufacturers directly, will undoubtedly do so indirectly, as many electric motors and appliances will be needed for the carrying out of such work, while the general prosperity resulting, will undoubtedly give rise to demands on the part of householders for all manner of electrical goods—this is on the assumption that the good time predicted for Canada in the near future is realised, and there seems no reason to think that it will not be. Some of the Canadian banks are opening branches in South America with a view to extending the country's trade there, and a Government Commission has been sent over to England to secure for Canada as much as possible of the business arising from reconstruction work in Europe; the British Government, according to the daily papers, is placing an order for an immense quantity of timber in Canada, all of which points to a certain degree of prosperity for the country.

The policy of the Institution of Electrical Engineers regarding Canada is rather hard to understand; before the war attempts were made by quite a number of men over here to form a Canadian Section, but the attitude of headquarters in London was very luke warm. Most of such men find it to their interest to join the American Institute, which has several Sections in Canada, and thus gradually lose touch with the Institution at home. If English firms want Canadian business, and surely our Institution would wish to see such business grow, nothing should be done by any section of the electrical community which would jeopardise that trading which Britain should have with this country, but which at present is all too largely in the hands of the United States (see figures *re* imports of electrical apparatus given on page 359).

It is to be hoped that, now the war is over, the Council of the Institution will take a different view of the situation, and that one or two strong "Sections" may be formed over here. The Society of Chemical Industry manages to keep a very active Canadian Section in existence, which is doing very good work indeed. Why the electrical engineers cannot do the same, if suitable steps be taken, is not altogether apparent, unless it be that already it is too late, seeing that the American Institute is firmly established.

In the opinion of the writer, the B.E.A.M.A. also should get its representatives over here to join together for concerted action.

As showing the possibilities of trade in electrical appliances in Canada, the following recently published list is of decided interest.

In Windsor, Ontario, a city of some 20,000 inhabitants, the local Hydro-Electric Department (which purchases power in bulk from the Hydro-Electric Power Commission, of Ontario), sold appliances as shown below :—

	1916.	1917.	1918.
Lamps...	27,833	34,268	29,111
Irons	989	908	1,491
Toasters	164	234	301
Grills	64	109	101
Percolators	21	40	36
Warming pads ...	14	8	13
Vacuum cleaners ...	67	78	79
Washing machines ...	16	44	43
Cooking ranges ...	68	87	95
Fans	132	204	152
Heaters	51	261	253
Hot-plates	16	56	66
Motors, single-phase...	12	11	10
Motors, three-phase ...	9	16	26

In 1915 the merchandise sales were worth $11,050; 1916, $24,931; 1917, $44,793; 1918, $66,243. In addition, it is reported that local retail dealers are also increasing their sales.

No-one, of course, is quite sure what the future holds in store for this country, yet the tone of many of the manufacturers is decidedly cheerful, and, if labour troubles can be avoided, there seems to be no reason to suppose that they will be seriously disappointed.

The personal opinion of the writer is that there is a good opportunity for British electrical trade over here, but advantage should be taken of every possible means of promoting intercourse in electrical matters—the Institution of Electrical Engineers, the B.E.A.M.A., and the firms themselves must all take decisive action tending to the same end—that of keeping up a close connection between electrical men here and at home; furthermore, many existing standards cannot be altered, for they are fixed by common practice, not only in Canada, but in the United States, and nothing but disappointment can be expected if an attempt be made to alter or dodge these standards. It would be a good thing, too, if the English technical journals could find some means of making themselves better known; it is very easy to buy their American contemporaries here, but the average Canadian engineer knows nothing—hardly even the names—of the English ones. One drawback to the English papers from the point of view of the native-born Canadian who has never been to England or to any part of Europe, is that he takes no particular interest in what is going on so far from his own country. In order to attract and hold his attention, it would seem to be essential that there should be frequent, good, descriptive articles of work being done in Canada, and possibly in the United States as well, and other matter with which he may be expected to be familiar. Firms with agencies or branches in this country, advertising in the English papers, should make the fact stand out for the Canadian reader.

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* Electrical Review, April 26th, 1918.

Means should also be established whereby at not too great expense materials or machinery might be tested in England by some accredited body satisfactory to Canadian purchasers before shipment; for example, if a large batch of high-tension insulators be ordered, say, from the Ohio Brass Co. in the U.S.A., it is an easy matter to send a man from Canada to watch the manufacture and supervise the tests, in order to ensure that none but good insulators shall leave the factory to fill that particular order; but if these insulators were ordered from England matters would not be so simple, hence the natural tendency here to send such an order to the States, even though sentiment is in many cases in favour of sending it to Britain.

All persons interested in the development of British electrical trade with Canada, in both countries, should be induced to do their utmost to further it, and no feelings of professional aloofness or any kind of jealousies should be allowed to interfere with the carrying out of any practicable, dignified, and honourable scheme which promises any reasonable degree of success; each section of the electrical community must endeavour to do its part, otherwise the whole will suffer, and the present immense disparity between the electrical trade of Canada with England, and that with the United States, will grow even greater, until British manufacturers will have no chance at all here.

THE DETERMINATION OF THE EFFICIENCY OF THE TURBO-ALTERNATOR.

At Newcastle-upon-Tyne, on March 24th, Dr. S. F. Barclay and Dr. S. P. Smith's paper (an abstract of which appeared in our issue of March 7th) was read and discussed before the North-Eastern Centre of the Institution of Electrical Engineers.

Mr. Rosen opened the discussion, and spoke of the importance of ascertaining the actual efficiency of a turbo-alternator including load losses; they wanted to measure the magnitude and also to locate the position of the losses.

Mr. E. Fawssett said he knew a case where the stray losses greatly altered according to the load at which the machine was running. Referring to the curves plotted from Pitot-tube readings taken at the opening of a temporary discharge trunk, he said it made him prefer the calibrated method, for there seemed to be serious chances of error in the former method.

Mr. L. H. A. Carr thought the term "stray loss" was rather unfortunate, because there were two types of losses to be considered, one stray loss on no load, and the other only occurred on load, the latter being an incremental loss. Apparently this latter stray loss was different from that in an ordinary turbo-generator, where they had not got so much distortion in the field. It seemed it was possible to overcome some of the loss. It was suggested that anemometer readings of one minute each should be taken; that seemed rather a difficult problem.

Mr. J. R. Beard made some suggestions as to methods of measuring losses. With the calibrated air-temperature method, he did not see why it was not possible to put some cheap resistance in the inner duct and measure the amount of energy that was put in. He suggested that the air might be kept in a closed circuit, and the heat abstracted could be measured. He thought there were more accurate methods of measurement than those described in the paper.

Mr. Carnegie said from personal experience he had been forced to the same conclusion as the authors, namely, that the anemometer was the only convenient instrument available, and suggested the use of an orifice in connection with it. The anemometer had to be used carefully, for if it were subject to any rough usage the results might vary 20 per cent. either way.

Dr. Smith, in reply, said some of the points mentioned would enable them to improve some of the details. The problem of loss was still a very difficult one, and Dr. Barclay and himself were making investigation, but their work was not yet complete.

At Birmingham, on March 5th, the same paper was read and discussed before the South-Midland Centre of the I.E.E.

Mr. R. Orsettich said that three firms at that time were experimenting with measurements of the cooling air as the only reliable method of determining the losses, and that this method was recommended for further investigation. Great credit was, therefore, due to the authors for being the first to publish the result of their inquiries, and for the great accuracy shown in the results of the experiments. A striking fact was the very large figure representing the stray losses. These losses had not been ascertained by direct measurement, nor was it yet quite clear where they took place or to what peculiarity of construction they were due. They seemed to share the nature of copper losses in so far as they were dependent upon the load, but they appeared to be taking place mainly in the iron portions of the machine, and were therefore really iron losses. Some engineers usually put down these stray losses as a multiple of the copper losses, but Mr. Hobart, in the last edition of the "Standard Handbook," stated that a probable and fairly accurate value was obtained if they were taken as equal to one-half of the iron losses.

Mr. R. G. Jakeman thought that the most noticeable feature of the paper was the extreme care that the authors had used in obtaining their results. In fact, it was doubtful whether most people would be able to use such care, and no doubt that was the reason that the accuracy of the anemometer was generally regarded with so much suspicion. The anemometer had improved much of late years, and makers now guaranteed them within 1 per cent. The calibrated air-temperature method appeared to do away with all instruments of precision. As far as it went, however, the paper was not of much use to the manufacturer. It only enabled him to find out the value of the losses after the machine had been built, but did not inform him how to predict those losses so that the manufacturer could guarantee the efficiency in the tendering stage. He hoped the authors would continue their experiments and determine how the stray loss varied with the load, voltage, and speed. One of the slides shown by Dr. Barclay showed that in two machines of the same output the stray loss was 23.5 per cent. and 40.3 per cent. Perhaps by means of the tests mentioned some relation could be found between the stray loss and the stator copper loss.

Dr. M. L. Kahn fully agreed that the most satisfactory method evolved at present to determine the efficiency of turbo-alternators was by measuring the total loss by the air heating method. One precaution seemed not to have been specifically mentioned in the paper. It was essential to run the machine for some time at each particular load on which the efficiency was to be ascertained, so that the temperature could become fairly steady. There seemed to be sometimes a misconception with regard to stray losses; they were often classed with the copper losses in the stator, and expressed by adding a certain percentage to those losses, while they were really to a large extent increased iron losses. That these losses had no fixed relation to the stator copper losses could easily be seen if one considered that by decreasing the copper weight of the stator winding, the stator losses were practically unaffected. If the stator copper losses were based on the ohmic resistance measured on the test bed with direct-current instruments, when determining the efficiency by a summation of separate losses, the actual losses in the stator copper with full alternating current flowing, would be higher, due to the uneven distribution of the alternating current in the conductors. This difference accounted only for a small part of the stray losses, and the difference could be greatly reduced by using stranded conductors for the whole of the windings without affecting the total stray losses in the machine materially. Investigations of these stray losses would be of great value.

Mr. C. V. Peake said that if it were possible to convert the steam consumption of the turbine when running light into actual brake-horse-power, and thus into kilowatts, then the alternator efficiency might be determined by taking the following steam consumptions: (1) Running light and uncoupled. (2) Running light but coupled to alternator, the latter being unexcited. (3) Running light with the alternator over-excited by an amount necessary to balance the drop due to resistance and reactance on the specific power factor. The results obtained by subtracting (1) from (2) would give the windage friction and alternator-bearing losses, and subtracting (2) from (3) would give iron losses.

Mr. F. J. Moffett explained that for many years he had taken an interest in anemometers, and had used an instrument which was calibrated at Kew, and found accurate within 2 per cent. It appeared to him that the method adopted in the paper for measurement of the alternator losses was capable of being adapted to provide a continuous record of a turbo set when in service. If recording instruments to measure the air velocity, air-temperature rise, electrical output of alternator, and steam input to turbine were arranged to all record on the same drum, the various losses could be ascertained at any time by drawing a vertical line on the drum. The Kent steam meter which worked on the Venturi principle, gave fairly accurate readings. From such a combination of records valuable information could readily be obtained as to the condition of the turbine and alternator. Air did not appear to him to be the most effective cooling medium to use for removing the heat due to the various losses. If a gas or liquid were used it would be necessary to conduct the cooling on a closed circuit system. The cooling medium after passing through the air passages of the alternator would need to be cooled by passing through a feed-water heater or similar arrangement. This alone would somewhat increase the total efficiency of generation, as the heat due to the losses would be returned to the boilers in the feed water.

ELECTRIC TRANSPORT VEHICLES.

By C. TUNSTILL OPPERMAN.

(*Abstract of paper read before the* Institution of Automobile Engineers.)

The object of this short paper is to assist in popularising the use of electricity in the transport of goods and thereby saving labour.

Electricity at 1d. per unit, in view of what it can be made to accomplish, bears a remarkably small proportionate cost when compared with the present-day labourer at twenty pence per hour. It will be agreed that in view of the state of the coal industry in the country at the moment, it behoves everyone, from the station engineers down to the man or woman who drives an electric vehicle, to do the utmost in their power to exercise the strictest economy, assisting in the great effort to save both labour and coal.

In the author's opinion there is very little to choose between the vehicles in general use from the point of view of mechanical and electrical efficiency. From tests made some years ago with both front and rear driven wheels, he was unable to find any marked difference in the amount of current required, neither does he find in any of the vehicles on the market much room for improvement.

One point to which attention should be given is the design of a simple change speed gear, to enable vehicles to negotiate hills more readily, for notwithstanding the mechanical loss which this would entail, by such an arrangement the motor would always run at or about its normal speed instead of dropping to about half as is commonly the case now. The saving here alone would go a long way towards compensating for the loss in the gear, and what is of far greater importance, excessive discharges from the batteries would be prevented.

The author feels sure that if central stations were to use electric vehicles more than they do, it would encourage their customers to do the same. The time has not arrived when the author can confidently recommend the use of lighter vehicles for pleasure purposes. The limited distance over which they can be used so often leads to disappointment, and inexperienced persons would run the battery to a standstill.

The crux of the whole question is the type of battery to be used. The author's experience of the ordinary pasted type of battery proves that it is not altogether satisfactory. It is really not a commercial proposition.

Of the pasted type of cells, the Exide is the only one which is being used with any degree of success. It is stated that these batteries have run as much as 25,000 miles before requiring renewal. Further, the manufacturers are prepared to guarantee the life of the battery under certain conditions.

There remains only one other class of battery which could be considered at all useful for the purpose, and that is the Edison nickel and iron battery, which seems to have a very long life.

From the point of view of lightness there is nothing to be gained, whilst the space occupied by the iron battery is very considerably more than that required for the lead one, and the lead battery requires less attention. One very objectionable feature of the alkaline battery is that the salts creep, causing surface leakage and short-circuiting. This deposit has to be removed by steam, and takes much time. Men handling batteries find contact with diluted acid far less objectionable and harmful than contact with caustic potash. Another serious objection to the iron battery is the low electromotive force given. This objection has, the author believes, been removed on the later types. The lead accumulator appears to have considerable advantages in charging.

In the lead cell, material gradually detached from its supporting frame, falls to the bottom of the container and causes a certain amount of short-circuiting, whilst the amount of active material available for useful purposes in the cells becomes daily less, so that in general the number of charges and discharges which the cell is able to stand, is limited to about 150, whilst in the case of the Exide cell already mentioned, they might amount to as many as 300. In the Edison battery the reversibility of the chemical reactions is practically complete, and as far as the author has been able to investigate the matter, the only loss arising is that due to the electrolysis of the water.

In order to increase the distance over which an electric vehicle can be used a boosting charge can be given with advantage. The only trouble is whether the central stations would care to provide a large number of vehicles with a "boosting" charge if called upon to do so at one time.

The author has found it very difficult to obtain detailed figures of actual running costs, but there is no doubt whatsoever that where the journeys made are regular and over known routes from day to day, there is no means so economical as that provided by electricity, and it is quite possible for the user to know within very close limits what his cost per ton-mile will be, and this can be absolutely maintained under guarantee from the makers both of the vehicle and of the battery.

The comparative costs of electric and horse traction used on dust collection by the Croydon Council showed that the work done by the electric wagon was equal to that of three horses. In this case an Exide Ironclad battery was used, but if an Edison battery were to be installed the cost would be reduced, owing to the decrease in the charge for depreciation.

A well-known firm using the Edison battery; and a fleet of nearly a hundred electric vehicles of 15 cwt., 1 ton, and 2 tons capacity, states that the costs are as follows: battery maintenance, tires, repairs, 2.9d. and electricity 0.775d. per mile run. A large railway company gives the following figures: per annum, 30-cwt. (Edison battery), parcels van, £178 5s., or 4.28d. per mile; 1-ton (Edison battery) parcels van, £159 15s., or 3.84d. per mile; 1-ton (lead battery) parcels van, £199 5s., or 4.78d. per mile; based on 10,000 miles per annum, with current at 1d. per unit, tires at 18,000 miles, and standing charges, with Edison battery, at ten years, and lead battery at 2½ years.

To the user who confines his operations to a large city and its immediate surroundings, there is no method of transport which offers the advantages of the electric system. From an economical point of view it is cheaper than either horses or petrol vehicles.

As an example of the reliability of electric vehicles, the Midland Railway Co. states that out of a fleet of nine 30-cwt. parcel vans, four ran throughout the year 1917 without losing a single day's service, and by the end of the year the machines were two years old and had run 30,000 miles each. It is no uncommon occurrence to find that a set of tires will last upwards of 30,000 miles.

To the user who has long journeys to make, the author can only say that petrol is the only satisfactory form of power to adopt.

In the course of inquiries which the author made in the United States regarding electric vehicles, he was particularly struck with a system of providing batteries in general vogue there, called the battery service system.* By this system the user of the vehicle contracts with the electric supply company for the use of the battery and the supply of energy, payment being made on mileage rate and for the battery service.

A well-organised battery service system would undoubtedly be the best means of providing a big day- and early-morning load for the power station, and would have an enormous influence on the sale of electric vehicles, because it would simplify matters for the user and reduce running costs to a definite known basis.

As to the relative costs of carrying goods by means of petrol or electric vehicles, the author does not think that there can be the slightest doubt that if the routes are regular and well-known, particularly in cities, the cost of carriage by electricity is far and away cheaper than that by petrol.

In conclusion, the author is sure that if central-station engineers will give all the encouragement and assistance in their power to popularise electric vehicles by bringing to the notice of their customers the advantages obtained by their use, they would become far more general, and should more nearly approach the numbers used in America.

Opening the discussion, Mr. F. Ayton (city electrical engineer, Ipswich) congratulated Mr. Opperman, as a pioneer in the development of the electric vehicle, on seeing it brought to a successful issue. The electric was not a competitor of the petrol vehicle; there was room for both. The electric was a short-distance, moderate-speed vehicle, with an immense field of utility in towns; it had had a better chance in the United States, where three years ago there were over 70,000 in use, and fleets of over 100—up to 375, and even 610—were met with. In 1916 the U.S. annual sales were: private, 4,000; commercial, 2,500; industrial, 1,500. The demand for petrol was increasing, and before long the United States would have none to spare for export; it was doubtful whether benzol would be available in sufficient quantity to take its place, and they could conserve the supplies by using electricity. While the electric was a moderate-speed vehicle, experience showed that on the average in traffic it was quite as speedy as the petrol vehicle. In rural areas the mileage range of the electric was uncertain, owing to the widely varying resistances of the road surfaces. As a pleasure vehicle it was very popular in the United States, in urban districts, and electric taxicabs had been successfully adopted at Detroit, the home of the petrol vehicle, Chicago, and Berlin, being much cheaper to run than petrol cabs. There was no trouble nowadays with dust in the gears. After a few years' service there was nothing to choose between the Exide and the Edison batteries; he had 12 heavy-duty vehicles fitted with Exide batteries, and one of them ran for two years and ten months under severe working conditions without renewal. A suitable meter on the vehicle afforded a safeguard against over-discharge of the battery.

Mr. E. W. Curtis (General Vehicle Co., Ltd.) said the petrol men had been too busy to investigate the merits of the electric vehicle, but now was the time to do so. The electric vehicle made friends, and kept them; renewals could be effected overnight, giving 365 days' service a year, and electrical energy at 1d. a unit was equivalent to petrol at 6d. a gallon. Recuperation had been tried, but introduced undesirable complications. The central-station engineers had done heroic work for the electric vehicle, with the help of the Electric Vehicle Committee.

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* Elec. Rev. Oct. 5th, 1917, and Aug. 9th, 1918.

Mr. W. Worby Beaumont said that Mr. Opperman as a pioneer had suffered from the too optimistic claims that were made for the electric vehicle in the early days; whereas it was then a failure for light loads, it was now a success for heavy loads, and was going to do a great deal more than the public realised. The best results were obtained in slow, heavy work with many stops; it did not suit a one-horse man, but gave good results where there was plenty of work for it. Enclosed gears were now available. Change-speed gears should be avoided. There were hundreds of charging stations in this country. The long life of electric vehicle tires was due to the low speed.

Mr. R. A. Chattock (city electrical engineer, Birmingham) said that central station men had to wait for satisfactory vehicles before they could do anything—now they were getting busy, and there would have been big developments but for the war. From 200 to 300 charging stations were available, and they were ready to supply any quantity of energy that might be required. There was no hope for the battery service system until the use of electric vehicles was very much more general; interchangeability was necessary, and the Electric Vehicle Committee was busy with the standardising of batteries and boxes. The lead cell was damaged by short-circuiting, while the Edison cell actually benefited by it; however, in practice there was nothing to choose between them.

Mr. P. A. Mossay (Ransomes, Sims & Jefferies, Ltd.) said that the attitude of petrol vehicle makers had changed as they got better acquainted with the electric vehicle. The gear question had been entirely solved, and no clutch was necessary. A 7-h.p. motor running at 1,800 r.p.m. had an efficiency of 89 per cent., and at 600 r.p.m. it gave 16 h.p. with an efficiency of 80 per cent.; it was suitable for a 3½-ton vehicle.

Mr. Hales (Edison Accumulators, Ltd.) said the electric vehicle had made more rapid progress in the United States than here simply because the Edison battery was introduced there seven years before it came here in 1911; since that date the electric had been successful here also. The Edison guarantee was 60,000 miles or eight years, and the battery had the advantage in weight compared with the lead type. The author's reference to creeping and leakage must have been due to some mistake, as steel containers were used; there was no harm in the deposit, which should be cleaned off with steam once in two months. Mr. Ayton was an expert in the care of lead batteries—what would happen to them in unskilled hands?

Mr. G. C. Conradi (Midland Railway Co.) said there was a great future for electrical transport. In hilly towns a change-speed gear offered distinct advantages, but not elsewhere; the series-parallel controller was preferable. In a fleet of 76 vehicles in his charge, he found that there was no difference between the lead and Edison batteries, provided that the battery was chosen to suit the conditions—the Edison had a higher internal resistance, whilst the lead battery required more skilled attendance. After four years' running, last year eight of his vehicles did not lose a single day. The depreciation of the petrol vehicle increased much faster than that of the electric, and the chance of exhausting the charge of the battery was shown by experience to be about 1 in 2,500.

Mr. C. N. Good (Chloride Electrical Storage Co., Ltd.) said that the author mentioned 300 discharges as the life of the Exide battery; this should be 600, under the two-year guarantee, as was proved by the mileage given, and was probably nearer 1,000 in practice. Whilst a life of two years was guaranteed, it often reached three and a half or four years.

Mr. Ayton, replying to Mr. Hales, said that the battery attendants at Ipswich were quite unskilled, but had no difficulty in attending to the lead battery. Both types of battery were good.

Mr. Mitchell suggested that the scope of the Institution of Automobile Engineers should be broadened to cover all methods of transportation. The electric, like the steam, vehicle had had to force its way to the front; it offered colossal possibilities for the future—all town transport ought to be electric. It was now realised that first cost was not so important as maintenance, and they should employ first-class material and workmanship in the manufacture of electric vehicles. All motor vehicles now appealed primarily to the mass of the public; pleasure was a secondary matter, but still there was a great future for pleasure vehicles.

Mr Opperman briefly replied to the points raised.

Erith National Kitchen.—The Erith Urban District Municipal Restaurant was to be formally opened yesterday by Mr. T. G. Jones, Director of National Kitchens of the Ministry of Food. The Kitchen is equipped with "Carron" electrical cooking apparatus, and has been constructed on most modern and hygienic lines.

NATIONAL ELECTRICITY SUPPLY.

The report (dated October 14th, 1918) of the Chairmen of the Advisory Council to the Ministry of Reconstruction, upon certain administrative aspects of the electric power supply question, was published last week. The chairmen of the different sections of the Advisory Council in question constituted an informal committee which met each week during the past year to advise the Minister on the most practical methods of approaching the large commercial administrative questions which came before the Ministry to review. They included prominent business men in Sir Henry Birchenough, Messrs. Herhert Gibbs, Lionel Hichens, Ernest Husey, Sir Clarendon Hyde, and Sir Charles Metcalfe, well-known Labour leaders in Messrs. E. Bevin and J. H. Thomas, and experts in rural and local government questions in Messrs. Arthur Allen, Henry Hobhouse, and Leslie Scott.

In the present instance Dr. Addison laid before the chairmen a number of committee reports upon different aspects of the electric power supply question, and asked them to advise whether electric power should be generated on a national system, and, if so, whether energy should be supplied at a uniform rate for all areas, whether distribution should be nationally controlled, and, if so, to what extent, and what form of administrative machinery would be appropriate to a national system. The report is signed by Sir Henry Birchenough (President), Mr. Arthur Allen, Sir Clarendon Hyde, Sir Charles Metcalfe, and Mr. Leslie Scott; and Mr. Lionel Hichens attaches a dissentient memorandum.

The chairmen were strongly of opinion that electric power should be generated on a national system, but they took the point that the administrative system recommended by the Williamson Committee was too complex (particularly in regard to the methods of finance proposed) to operate with the celerity and uniformity necessary to take advantage of the opportunity of promoting a comprehensive system of electric power supply throughout the United Kingdom on the termination of the war. It seemed to them essential that the creation of large generating stations should be taken in hand at once, and that adequate provision for the development of backward areas, especially having regard to the desirability of increased use of electric power for agricultural purposes, should be made upon a national scale forthwith.

They accordingly came to the conclusion that any efficient system for the development of electrical generation and main-line transmission in the United Kingdom must not be only a national system, but a single unified system under State regulation, in the financing of which the State would participate on a large scale. It should, however, be framed and administered throughout upon a definitely commercial basis, and not in any sense upon Civil Service lines. They believed that upon this footing it should be possible to supply energy in different areas at rates highly favourable to consumers of power in comparison with present rates, and at the same time to provide for interest upon capital, and for renewals of plant and amortisation, and to allow of a balance being carried to a reserve fund.

Whilst fully sensible of the necessity of limiting to the utmost extent any further capital commitments of the State, the chairmen laid stress upon the vital importance of a full development of electric power for productive purposes. They pointed out that the development of such power in the United Kingdom was at present in its infancy, and that high authorities had estimated the loss incurred by the nation through failure to take full advantage of electrical progress at not less than £100,000,000 a year. On the other hand, the capital value at present invested in electric generation (as distinct from distributing) plant in the United Kingdom did not apparently exceed £45,000,000. Moreover, as most of this represented up-to-date plant, the dead-weight capital for the amortisation of which the State would have to provide on taking over all existing plant under a national scheme would not exceed £11,000,000.

The chairmen were therefore strongly in favour of the nationalisation of generating plant, and the working of such plant in all districts on a national system, though they recognised that it would not be commercially practicable to supply energy at a uniform rate in all areas.

As regards distribution, while holding that the State should control main transmission lines, the chairmen were of opinion that in many cases the Electricity Board (whose constitution is explained below, and who should have full discretion in the matter) would find it convenient to leave distribution in the hands of existing agencies, where such agencies were efficient and progressive.

They recommended that the Electricity Board should consist of six members, selected from men of proved business capacity and experience. The chairman should be appointed for a term of five years, and should receive an honorarium sufficient to attract the services of a first-class man, and the remaining members (certain of whom should retire annually) should receive the equivalent of directors' fees on a high scale. Adequate measures should be taken to preserve Parliamentary control over the financial operations of the Board, and regulations necessary to ensure that the undertaking was managed with due regard to the interests and requirements of the public should be made by the responsible Government Department.

The first duty of the Electricity Board would be to plan out a comprehensive scheme for the whole country, and by degrees to secure the development of electric power over the whole of the United Kingdom by such methods as it might find suitable to the requirements of different areas.

In order to give effect to its schemes, it should be empowered to create an "Operating Executive," to which full executive authority and responsibility for the technical management of the scheme or schemes should be entrusted. The men appointed should have the highest qualifications from the technical and business points of view, with salaries (or salaries supplemented by commissions) appropriate to the necessary standard of practical experience. Proper capital, and profit and loss, accounts should be kept. The staff should be, in all its branches, organised upon commercial and not upon Civil Service lines. The Operating Executive would no doubt appoint a manager and staff for each area or central station, and it was to the emulation between these managers that they would look for that stimulating rivalry and competition which was generally absent from the undertakings of public bodies.

The chairmen concluded by saying:—"We are fully alive to the intricacies of the subject and to the practical difficulties of putting into operation any comprehensive scheme on the lines which we have indicated, but we think that these difficulties can, and will, be overcome by intelligent co-operation between the State authority and the various sections of the community concerned."

THE FUNCTIONS OF THE ENGINEER: HIS EDUCATION AND TRAINING.

At Edinburgh, on March 11th, the paper by Bt.-Lieut.-Col. W. A. J. O'Meara (an abstract of which appeared in our issue of February 21st) was read and discussed before the Scottish Centre of the Institution of Electrical Engineers.

Prof. Hudson Beare said a difficulty would be to find room for the proposed new classes in the already overcrowded curriculum of the young engineer. If the three years' term were extended to four years, other important branches could be introduced. He was doubtful if in a course covering 36 hours they could convey an adequate knowledge in the subjects specified by Col. O'Meara. In Edinburgh they hoped to do something in the way of lengthening the course through the establishment of a degree of commerce, which would include training in accountancy, business methods, administration, &c. As soon as the scheme got to work he would endeavour to get the Professor and Lecturer on Commerce to give a course to students who were going to be technical men, and who required a knowledge of the side branches of commercial work. That, of course, would necessitate the extension of the present three years' course. The young engineer should be made to realise that the extra subjects now proposed were not put in for window-dressing purposes. The engaging of young engineers without a premium did not affect Scotland, but in London the difficulty was to secure a start for lads fresh from college. He hoped there would soon be a remedy, and that firms would not insist on premiums for lads who had finished their curriculum. As to simultaneously working the practical and theoretical training, he thought they might have an arrangement for six months at the university in winter and six months at the workshops in summer, extending the training to five years, with half of it practical and half theoretical. The matter was one for discussion between professors of science and employers.

Capt. Scott Maxwell said the ratio of engineering students in the United States to population was higher than in this country, and when they came to the Continent the difference was more marked. The continental engineer had a much broader education than the British engineer, and in foreign competition higher respect was paid the continentally-trained man. While we led in the past, we might not lead in the future when the empirical method was of less value than the scientific. In America a man had a better technical training, though his general education might not be any better. Here the possession of a B.Sc. degree was often a handicap on a man asking for a job from an old-fashioned firm. Lads now training for the positions of "captains of industry" should in the first place take the Arts course, which in Scotland would start at 16. At 19 he would have taken his M.A. degree and have had a fair training in mathematics, chemistry, and other more or less important subjects, so that when he went up for the next three years for the B.Sc. he would be able to give most of his time to technical subjects. A poorer lad could be so educated if the training were arranged for six months at the university and six months at the workshop, with decent pay in the latter. It would be possible for a lad to help to support himself for at least half the year, and be in possession of two degrees, with three years' practical training, at 22. He would study commercial subjects in his Arts course, and in the Science course deal entirely with science and engineering. Another year's commercial course might be given, and, if possible, a year abroad. By the time that man was 30 he would be worth £2,000 a year to any fair-sized company.

Mr. Buchanan said the chief difficulty lay in the already overcrowded state of the usual college curriculum. His own experience had been that many students failed to do as well as they ought in certain classes from sheer inability to accumilate knowledge at a rate exceeding their own critical speed. In such a case the student commonly let one subject slide—it might be the very subject he was weakest in. He considered that there were serious objections to the inclusion of the new subjects in the college course unless the duration of the latter was extended. He protested most emphatically against the suggestion of curtailing the teaching of design, and he believed that Col. O'Meara took too narrow a view of the benefits to be derived from instruction in this subject. The engineer could not make full use of his technical knowledge unless he could reduce it to figures whenever the need arose. Ability to do this, and an almost fatherly understanding of the inner nature of his own particular kind of machinery or structure, were the things which were learned in a peculiar degree in the design class. He suggested that the necessary instruction in commercial subjects might be arranged during the term of apprenticeship or pupilage. He saw no serious reason why the management of the firm should object, and he believed that the weekly hour or two spent amongst different surroundings and mental atmosphere would be welcomed by the student. He also suggested that there was need for the improvement of the average engineering student's command of the English language.

Mr. J. W. Taylor agreed with Prof. Beare in suggesting the necessity of a conference between practical engineers and professors of engineering to find some solution of the training problem. This was a matter in which the Institution should take an active part.

Prof. Bailey, while not agreeing with all the proposals in the paper, pointed out that he would more willingly meet employers in conference if they had their own sons, and not their apprentices, in their minds. If it was the employers' sons' interests which were affected the matter might be more expeditiously settled.

Mr. A. Page concurred in the suggestion that business and commercial training should, if possible, be made to form part of the curriculum at the technical colleges, and the new Education Act might provide some channel along which this desire could be effected. There should be no slurring over of technical education, but they did not want a hybrid between an engineer and a chartered accountant. Engineers should have less suspicion and more frankness. He endorsed all Col. O'Meara had said with regard to general education.

Mr. D. S. Munro did not favour a longer course except for those whose abilities or ambitions impelled them to continue varied studies when their formal engineering training was completed. He noted that the author wisely stopped short without attempting to express (even as a negative quantity) the financial element in the modern workman.

Col. O'Meara, in reply, said he was not proposing that the subjects which he was suggesting should be taught in the wide sense some of the speakers seemed to think. He suggested that the principles only could be taught. He suggested curtailing some of the training in design, though he could understand there might be difficulties. He had found American engineers at Kimberley, and German engineers on Government work in Canada. He did not know the reason for the preference. He might have been wrong in concluding that it was due to the breadth or shallowness of our education. In the principles of administration and commercial subjects a start should be made at once. He thought the situation was one for compromise, and it was with compromise in view that he made the suggestions in the paper.

BRITISH CANALS.

In a report on the subject of canals, approved by the Main Transport Committee, the Federation of British Industries expresses the opinion that the report of the Royal Commission on Canals, issued in December, 1909, upon which no action has been taken by the Government, amply demonstrated the need for the unification and development of our inland waterway systems.

In France, Belgium, and Germany, as in England, in the period following the advent of the railway era, canals and waterways were for a long time neglected. With the exception of the Manchester Ship Canal and some improvements to the Aire and Calder and Trent Navigations, there had been no capital outlay upon canals in this country.

In 1879, however, France embarked on the improvement of 2,500 miles of river and 2,250 miles of canal, and the construction of 870 miles of new canals, at a cost of £28,000,000, out of which by 1900 £25,817,211 had been spent. Belgium between 1871 and 1900 spent £8,272,159.

In the opening years of this century in France a fresh programme was laid down at a cost of £8,242,800, all of which was spent before the outbreak of the great war, and other large schemes were initiated. It is useful to note that the canals and not the rivers of France carry the major part of her inland water traffic.

In Germany, by the law of April, 1905, an expenditure of £16,728,750 was initiated on condition of local contributions.

With the report of the Royal Commission still awaiting the attention of Parliament, the Federation is of opinion that no further detailed investigation is necessary as a preliminary to the appointment of a Waterways Board, the appointment of which was the first step recommended by the Commission.

The cost of the acquisition of the system of canals known as "the Cross," with the smaller tributary canals adjacent, may, on the basis of 25 years' purchase of income, be taken at about £6,000,000, whilst the development of the main routes to the 100-ton standard was estimated at £17,533,910. Post-war figures would, however, be largely increased. Sir Maurice FitzMaurice, chairman of the Canal Control Committee, in his evidence before the Select Committee on Transport last autumn put the figure at £28,000,000 plus an approximate amount of £10,000,000 for the provision of facilities for dealing with the traffic.

After two years' experience of controlling all the principal canals save those railway-owned, Sir Maurice FitzMaurice's opinion confirmed the findings of the Royal Commission as to the absolute need for unification of management, improvement to permit of mechanical haulage, larger boats, increase of speed, and the freeing of those now in railway hands of that control.

Through the action of the Waterways Association, a very large number of typical local authorities have passed resolutions generally approving of the recommendations of the Royal Commission, and accepting the principle that, where the Government undertakes the improvement of a canal benefiting their area, they will contribute to the cost.

It is urged that steps should immediately be taken for development by sections where local authorities are prepared at once to shoulder a portion of the cost. If need for the development of waterways existed prior to the war, it is now an absolute necessity.

The immediate employment of labour necessary in the reconstruction of the canals would find just the kind of employment required whilst the industrial population changes from munition and other war work to the production of wealth.

The Federation is convinced that, under private ownership, improvements to our canals are impossible, and that their development by the State must be one of the first schemes in national reconstruction. Without this it will be impossible to meet new conditions upon equal terms in competition with countries already in possession of the cheap transport provided by inland waterways, whose Governments are already planning their further extension.

TRADE STATISTICS OF EGYPT.

The following statement, showing the imports of electrical and similar goods into Egypt during the year 1917, is taken from the recently-issued trade statistics. The figures for 1916 are added for purposes of comparison, and notes of any increases or decreases are given:—

	1916. £E.	1917. £E.	Inc. or dec.	£E.
Electrical machinery.—				
From Great Britain ...	5,000	5,000		—
,, United States ...	—	3,000	+	3,000
,, France	3,000	1,000	–	2,000
,, Italy	1,000	—	–	1,000
,, Switzerland ...	—	3,000	+	3,000
Total	9,000	12,000	+	3,000
Steam engines, including boilers, &c.—				
From Great Britain ...	32,000	20,000	–	12,000
,, Switzerland ...	3,000	—	–	3,000
,, United States ...	1,000	6,000	+	5,000
,, France	2,000	—	–	2,000
,, Other countries ...	1,000	1,000		—
Total	39,000	27,000	–	12,000
Petrol and benzine motors.—				
From Great Britain ...	26,000	10,000	–	16,000
,, France	1,000	—	–	1,000
,, Italy	1,000	—	–	1,000
,, Switzerland ...	36,000	49,000	+	13,000
,, Other countries ...	—	1,000	+	1,000
Total	64,000	60,000	–	4,000
Copper, manufactured.—				
From Great Britain ...	7,000	10,000	+	3,000
,, Germany	—	2,000	+	2,000
,, United States ...	2,000	9,000	+	7,000
,, France	6,000	1,000	–	5,000
,, Italy	1,000	—	–	1,000
,, Other countries ...	1,000	—	–	1,000
Total	17,000	22,000	+	5,000
Lamps of all kinds.—				
From Great Britain ...	6,000	7,000	+	1,000
,, Germany	1,000	—	–	1,000
,, France	6,000	9,000	+	3,000
,, Italy	6,000	2,000	–	4,000
,, Holland	—	6,000	+	6,000
,, Switzerland ...	—	4,000	+	4,000
,, United States ...	—	1,000	+	1,000
,, Japan	—	7,000	+	7,000
,, Other countries ...	15,000	3,000	–	12,000
Total	34,000	39,000	+	5,000
Scientific instruments.—				
From Great Britain ...	19,000	15,000	–	4,000
,, Germany	1,000	1,000		—
,, United States ...	4,000	4,000		—
,, France	11,000	4,000	–	7,000
,, Italy	3,000	—	–	3,000
,, Switzerland ...	1,000	—	–	1,000
,, Other countries ...	1,000	—	–	1,000
Total	40,000	24,000	–	16,000
Other machinery (except agricultural).—				
From Great Britain ...	48,000	37,000	–	11,000
,, United States ...	9,000	12,000	+	3,000
,, France	13,000	11,000	–	2,000
,, Italy	3,000	4,000	+	1,000
,, Switzerland ...	4,000	12,000	+	8,000
,, Sweden	1,000	—	–	1,000
,, Holland	1,000	—	–	1,000
,, Other countries ...	2,000	3,000	+	1,000
Total	81,000	79,000	–	2,000
Electric, telegraphic, and telephonic apparatus.—				
From Great Britain ...	45,000	18,000	–	27,000
,, Japan	1,000	1,000		—
,, United States ...	1,000	3,000	+	2,000
,, France	16,000	7,000	–	9,000
,, Italy	15,000	16,000	+	1,000
,, Sweden	4,000	2,000	–	2,000
,, Switzerland ...	4,000	3,000	–	1,000
,, Other countries ...	2,000	2,000		—
Total	88,000	52,000	–	36,000

£E = £1 0s. 6¼d.

THE UTILISATION OF WATER-POWER ON THE RIVER DUERO.

[FROM OUR SPECIAL CORRESPONDENT IN SPAIN.]

The vast amount of water power available on the river Duero and its tributaries has been receiving the attention of engineers for some time past, and last year a company was inaugurated by several Bilbao capitalists to utilise at least a part of the 350,000 H.P. now running to waste. A capital of 150,000,000 (£6,000,000) was proposed, and the company was formed under the title of "Saltos del Duero" In view of the fact that the river forms the boundary between Spain and Portugal for over 60 miles, and this in situations where waterfalls are most abundant, it was found necessary to make the company international, and the promoters were successful in interesting the Portuguese Government, and also the Bank of Portugal.

The name of the undertaking has now been changed to "Sociedad Hispano-Portuguesa de Transportes Eléctricos," and it is proposed to supply electrical energy for lighting, power, and traction in both countries. It will be necessary, first, to construct a railway to bring building and other material to the various sites, and the company is trying to get under way at the earliest possible moment, in order to give employment to the many engineers and workmen who are at present unemployed throughout the peninsula.

As a beginning the company has now placed before the Ministerio de Fomento plans for the utilising of two falls on the River Tera, in the N.-W. region of the Province of Zamora, whereby some 26,000 H.P. can be harnessed. At these falls, Ribadelago Fall and Cobreros Fall, the flow of the river can be very simply and effectively regulated by utilising the natural lakes of Sanabria and Lacillo.

Ribadelago Fall.—A dam 3 metres high and 30 metres long, will be necessary, and also a canal 6,400 metres long, of which the greater part will be in tunnels through a mass of very hard granite. The penstock will be 2,400 metres long, and this also will be constructed within a tunnel cut through the granite.

Cobreros Fall—For the utilisation of this fall a dam 6 metres in height, and 40 metres long, is required. The proposed canal is 7 kilometres long, of which 2·5 kilometres are in tunnel, while the penstock will be placed within another tunnel 2·6 kilometres in length, piercing a rock of quartz and granite.

In its report to the Ministerio de Fomento, the company gives the following figures relating to the construction of the two power houses :—

	Ribadelago Fall.	Cobreros Fall.
Area of watershed in sq. kilometres	50	275
Average height of watershed above sea-level. Metres	1,800	1,700
Annual rainfall. Millimetres ...	1,800	1,800
Dam. Height above sea-level. Metres	1,650	1,026
Flow of water. Litres per second ...	2,000	12,000
Net head in metres	575	107
Power at turbine shaft. H.P. ...	12,700	14,000
Cost per H.P. developed. Pesetas ...	173	317
Power available, low-tension, at 50 km. from power house. H.P. ...	10,500	—
Power available, low-tension, at 65 km. from power house. H.P. ...	—	11,500
Cost per H.P. available. Pesetas ...	469	623

The distances given of 50 km. and 65 km. respectively refer to supply in the town of Ponferrada, but the company is contemplating supply to other towns in the Asturian mining district, as far as Oviedo, which is about 200 km. distant from the generating stations.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

7,251. "Induction coils for radio-telegraphy or radio-telephony." F. J. Chambers. March 24th.

7,252. "Production of electrical oscillations." F. J. Chambers. March 24th.

7,271. "Telephone transmitters." S. G. Mason. March 24th.

7,278. "Electric choking coils." Alloy Welding Processes, Ltd., & E. H. Jones. March 24th.

7,287. "Ignition devices for internal-combustion engines." F. C. M. Cesbron. March 24th. (France, March 23rd, 1918.)

7,288. "Electromotor." W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. March 24th.

7,289. "Electric relays for railway signalling apparatus, &c." W. R. Sykes Interlocking Signal Co. & R. W. Tarrant. March 24th.

7,292. "Controlling devices for electric starters for internal-combustion engines." F. J. Gill. March 24th.

7,294. "Automatic coin-operated telephone calling apparatus." T. M. Fletcher. March 24th.

7,316. "Swivelling brackets for mounting electric generators on aircraft." F. J. Hooper. March 24th.

7,323. "Electric heaters for apparatus for synthetic production of ammonia, &c." H. C. Greenwood & W. R. Tate. March 24th.

7,333. "Electrically-heated soldering bits." P. Marchiaro. March 24th.

7,336. "Electric lamps." L. S. Vello. March 24th. (Spain, March 23rd, 1918.)

7,343. "Electric lighting, heating, and ventilating systems for railway carriages, &c." H. D. Rohman. March 24th.

7,345. "Radio-oscillation generators." W. J. Mellersh-Jackson (A. Taylor). March 24th.

7,370. "Electric arc welding." A. Smith. March 25th.

7,408. "Pedestal for tramcar trolleys." T. H. J. Thomas. March 25th.

7,419. "Joints for sparking plugs, &c." C. Plattier & D. Zimmerman. March 25th.

7,456/7. "Telegraphic receiving apparatus." F. G. Creed & Creed & Co. March 25th.

7,460. "Electrolyte for copper deposition." J. F. Bates & T. F. Newman. March 25th.

7,464. "Means for controlling searchlights from distant station." P. W. Willans. March 25th.

7,478. "Means for ensuring ignition of working charges and preventing carbonising of sparking plugs of internal-combustion engines." Autoniters, Ltd., F. W. Hudlass & H. D. Smith. March 25th.

7,498. "Radio-telegraphic transmission systems." W. J. Mellersh (A. Taylor). March 25th.

7,501. "Automatic switching apparatus for telephone exchange systems." Western Electric Co. March 25th.

7,504. "Tramcar trolley heads." R. Heywood & S. Smith. March 26th.

7,537. "Ignition devices for internal-combustion engines, &c." W. Pickard. March 26th.

7,545. "Electric heating apparatus." C. H. Archer & Automatic Telephone Manufacturing Co. March 26th.

7,557. "Electric signalling systems." H. Green. March 26th.

7,578. "Non-acid mixture for charging accumulator cells." E. T. Grove. March 26th.

7,583. "Regenerative control of electrically-propelled vehicles or trains." A. Raworth. March 26th.

7,598. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co. U.S.A.) March 26th.

7,606. "Cooling high-speed dynamo-electric machines." M. Gruber. March 26th.

7,620. "Coils for electromagnets." British Westinghouse Electric and Manufacturing Co. & H. N. Cunliffe. March 26th.

7,624. "Magneto-electric generators." S. G. Brown. March 26th.

7,652. "Automatic reversing and stopping contrivances for electric motors." Soc. Anon. des Etablissements L. Bleriot. March 26th. (France, December 13th, 1918.)

7,642. "Telegraphy." E. S. Heurtley. March 27th.

7,650. "Electrically-driven vehicles." H. J. Carey. March 27th.

7,672. "Sparking plugs." F. W. Baker. March 27th.

7,675. "Device for taking X-ray, &c., photographs." W. C. Oram. March 27th.

7,685. "Alternators." M. W. W. MacKie. March 27th.

7,704. "Railway signal operating and controlling apparatus." McKenzie, Holland & Westinghouse Power Signal Co. & B. H. Peter. March 27th.

7,705. "Railway signal operating and controlling apparatus." McKenzie, Holland & Westinghouse Power Signal Co. March 27th.

7,722. "Electric arc apparatus for generation of oscillating currents." W. S. Entwistle. March 27th.

7,727. "Grainwood poles, &c., for electrical purposes, &c." H. Nors. March 27th. (Switzerland, March 27th, 1918.)

7,749. "X-ray apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 27th.

7,763. "Electric lamps." J. H. Hall. March 28th.

7,781. "Electrically-driven rotary pumps." J. W. W. Drysdale, Drysdale & Co., & J. Young. March 28th.

7,795. "Sparking plugs for internal-combustion engines." A. V. Terry and H. Terry & Sons. March 28th.

7,799. "Trolley heads for electric tramcars, &c." S. K. Kirkland & H. R. Tidswell. March 28th.

7,804. "Spark plugs for internal-combustion engines." S. Fisher & W. Priddey. March 28th.

7,806. "Electric motors for continuous current." A. E. Bazan. March 28th.

7,815. "Diaphragms for sound boxes for gramophones, telephones, &c." A. T. Collier. March 28th.

7,830. "Quartz mercury-vapour lamps." H. George. March 28th. (France, April 24th, 1918.)

7,831. "Telephone systems." T. Pettigrew and Siemens Bros. & Co. March 28th.

7,833. "System of electric power distribution for trains." P. Dawe. March 28th.

7,841. "Mercury lamps." H. George. March 28th. (France, August 8th, 1918.)

7,848. "Electromagnetic separation or concentration of minerals." W. M. Mordey. March 28th.

7,851. "Electron discharge apparatus." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 28th.

7,862. "Regulating device for maintaining constant voltage in dynamos working with great variations of output." L. Rouzet. March 28th.

7,879. "Electric switches." S. W. Hamlyn. March 28th.

7,895. "Electrical condensers." G. F. Mansbridge. March 29th.

7,904. "Method of changing frequency or alternating currents." F. S. Carter. March 29th.

7,906. "Magneto machines for internal-combustion engines." C. Greenald. March 29th.

7,960. "Manufacturing electric incandescent lamps, &c." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 29th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

9,912. Reception and transmission of sound or compressional waves. Brown. July 7th, 1915.

11,333. Marine signalling apparatus. Allen. August 5th, 1915.

12,869. Microphonic sound and vibration detectors. Western Electric Co. & Nash. September 8th, 1915.

13,973. Sound detecting and measuring systems. Western Electric Co. and Nash. October 2nd, 1915.

1918.

1,387. Ignition systems for internal-combustion engines. Splitdorf Electrical Co. May 18th, 1917. (116,492.)

3,670. Electric fuses. F. A. Ross. March 2nd, 1918. (123,807.)

3,846. Electric switching devices. British Thomson-Houston Co. (General Electric Co., U.S.A.) March 5th, 1918. (123,812.)

3,848. Electric switches. F. B. Holt & British Westinghouse Electric and Manufacturing Co. March 5th, 1918. (123,813.)

4,073. Sparking plug. C. R. de Tassigny & J. Puerto. March 17th, 1917. (115,809.)

4,428. Control of electric furnaces. W. J. Howard. March 13th, 1918. (123,845.)

6,327. Signal device for motor vehicles. Benjamin Electric Co. June 18th, 1917. (116,883.)

6,562. Gas or electric cookers and solid-fuel or refuse burning stove adapted to be used in combination. F. J. Jenkins & A. S. Smith. April 18th, 1918. (123,878.)

6,910. Vents for electric accumulators and batteries. H. Ramsbottom and Lithanode, Ltd. April 24th, 1918. (123,882.)

9,021. Windings in electrical apparatus. Brush Electrical Engineering Co. & P. W. Schonfield. May 31st, 1918. (123,906.)

10,674. Sparking plugs for internal-combustion engines. B. Hopps, A. M. Lodge & Lodge Sparking Plug Co. June 28th, 1918. (123,917.)

12,490. Electrical internal tube heaters. H. Gutzwiller. August 8th, 1917. (118,615.)

16,819. Electric controllers. R. W. James (R. W. Stanley). October 15th, 1918. (123,939.)

18,585. Dynamo-electric machines. British Westinghouse Electric & Manufacturing Co. November 23rd, 1917. (120,911.)

20,605. Apparatus for the electrical protection against corrosion, pitting, and the like of the tubes, ferrules, doors, and other parts of surface condensers and the like. L. J. Kettle. December 11th, 1918. (123,961.)

1919.

2,507. Manufacture of electric accumulators. H. Leitner & W. H. Exley. March 14th, 1918. (Divided application on 4,530/18.) (123,969.)

Electric Smelting in British Columbia.—Dr. Stansfield, of McGill University, has prepared a report on the commercial feasibility of electric smelting of iron ores in British Columbia. He considers that smelting is metallurgically feasible, there being sufficient supplies of ore and of the requisite fluxes for carrying out the process. The present cost of electric power, however, makes the profitable production of pig-iron impossible. The ores are chiefly magnetites, and contain 50 per cent. to 55 per cent. Fe., are practically free from phosphorus, titanium, and copper, and the proportion of sulphur could be kept as low as 0·1 per cent. Although British Columbia has ample water supplies which could be harnessed, this would take a long time to carry out. The author considers the possibility of utilising the surplus power supplies of local electric railways, and points out the abundant supply of timber at hand from which charcoal for the electric smelting could be easily obtained.—*Engineering and Mining Journal.*

THE
ELECTRICAL REVIEW.

VOL. LXXXIV. APRIL 18, 1919. No. 2,160.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.
Published every FRIDAY, Price 4d.
The Oldest Weekly Electrical Paper. Established 1872.
TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE:—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "Ageebay, Cent., London." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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WELLINGTON, N.Z.: Gordon & Gotch, Cuba Street.

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EXHIBITIONS ABROAD AND AT HOME.

WE do not suppose that there is any great keenness among those responsible for the control and management of British electrical and allied industries for occupying their heads and hands with the organisation of a big electrical and engineering exhibition in this country at a very early date. Preparations for such events, however, have to be commenced a long time in advance, and it is not too early to begin to consider the matter.

We fully approve the efforts of those who are devoting themselves to exhibitions which are being held in France and are in process of organisation for Greece, Spain, &c. The manufacturers who have had the foresight and enterprise to enter these fields, where the demands of reconstruction trade must be enormous, will, we are confident, be abundantly rewarded. It will not be overlooked that the possibilities of certain countries, which a few years ago British manufacturers did not find it worth while to trouble about, have been altogether changed, so far as we are concerned, by the course of events. Those who are present there at this juncture, when the disposition to re-open connections with Germany and Austria is probably as weak as it ever will be, will find a ready *clientèle* if they are able to meet requirements. The future attitude of such markets toward us as a manufacturing and export people will be shaped, to some extent, by what we do to-day. Indifference now may damn us for years to come, if not for ever, and give others a chance. On the other hand, if we gain a footing at once, and place on the ground, in the daily operations of the industrial and general life of the people, working examples of our products, we shall be sowing for future reaping. The carrying-out of a certain amount of export manufacturing for such markets seems to us to be a measure of urgency; to be last on the ground, when so many are alert and active, would be a most deplorable occurrence. An early foothold is of supreme value. We shall begin to secure such a foothold by co-operating in any substantial exhibition schemes that may be developed by those in authority in such countries. But we shall be doing the right thing if we remain there after such exhibitions close. We may gain great prestige by the display of typical examples of what we are able to supply, and by availing ourselves of the face-to-face transactions that officials of co-operating organisations can conduct on our behalf. But such influences will not last long if we do not watch the field at close quarters or if we permit a penetrating enemy to come and sow tares while we are asleep. Therefore, the decision of associating firms to leave behind more or less permanent commissioners is a most reasonable one, and if they are able to point to actual installations or materials which have been "made in England," and have been executed to definite contract locally, we shall have made a substantial beginning. We shall have given a proof of our desires, of our manufacturing ability, and of our good intentions.

We are sure that such considerations as these are very prominently in the minds of those of our manufacturers who are looking ahead, and who see beyond the present period of unrest, uncertainty, and export restriction. We are not going to be too optimistic because there is a lull in industrial trouble, but we venture to hope that the nation, as a whole, will shortly recognise that if we handicap ourselves as producers for export, we are laying up for temporarily better paid and more leisured industrial workers an inevitable period of ill-fortune. We have all got to pull together, and the manufacturers who have had the courage to look beyond the present situation, and begin missionary campaigns, co-operatively and otherwise, in new fields, are helping the future prosperity of the race. They are doing such things because they have confidence that British common sense will prevail, and that the workers and the Government, too, will lend a hand.

The "new" markets, however, are only a part of the whole matter of export activity. We have our pre-war connections in the Colonies, and in many other parts of the world, which, under war-time conditions, we were compelled to leave in a state of suspense. Some of them were lost, and they have to be recovered; those which were only deferred have to be satisfied and rejuvenated. These matters should not, of course, be neglected now, however the industrial barometer may predict stormy weather or taxation sirocco. We cannot afford to leave even our oldest and most nearly related markets to yield orders spontaneously, nor to leave new markets to others because we suppose that the vast requirements of the world will be sure to bring us as much as we can handle. The observations of our Canadian correspondent respecting exhibitions, appearing on another page of this issue, merit the careful attention of British manufacturers. With our increased productivity consequent upon war-time advances in method and added capacity, there is, practically speaking, no limit to the business we can handle, and we must pursue our efforts in that conviction. All of which leads us to repeat our observation that present organised co-operative exhibition effort in European countries is the outcome of a most reasonable and proper policy which should be widely supported. This can be done without neglecting the Colonial situation.

We are prompted, however, to return to the suggestion with which we began this article, and to ask whether the time has not arrived when our responsible manufacturing authorities should seriously consider whether a big electrical and engineering exhibition should not be organised somewhere within the United Kingdom. Large numbers of buyers will be travelling to England during the next year or two. Delegates may, in small groups, be able to make tours of selected British manufacturing districts and works, as has been happening during the past 12 months, but we cannot organise visits of all the numerous inquirers, buyers, and students, arriving at different times, nor can we pilot them round even these selected works, let alone the hundreds of others that we should also like them to see. The next best thing to do is to bring together a vast collection of representative manufactures at some fairly central place, let all the world know about it, and keep it in existence for a sufficiently lengthy period to give a large number of visitors in different parts an opportunity so to time their visits that they shall profit by it.

One other matter must not be forgotten in touching even in this general way upon the subject of exhibitions. We are uniting, up to a point, in a grand scheme of electrical propaganda which shall impress the people of these islands with the advantage that accrues from doing everything electrically. The new Commercial Electrical Development Association has the matter in hand. We are convinced from experience that popular electrical exhibitions in different localities are a most successful means of appealing to and educating the public. Such exhibitions have been impossible during the war; they would have been, in some respects, worse than useless, because they would have encouraged a demand for materials and for energy that we could not supply. The position is now altered, and the public are ready for anything of the kind. The Association Director will not be blind to this opportunity.

Electricity Supply Development.

On Friday last we were privileged to share in an interesting but informal function, at which Mr. A. F. Berry, chairman of the Electrical Development Association, supported by many members of the Committee, introduced to them and to the technical Press the newly-appointed Director of Development—Mr. J. W. Beauchamp. Apart from his new functions, of course, Mr. Beauchamp needs no introduction; we have in the past been favoured with valued contributions from his pen, while as quondam deputy manager under Mr. S. E. Fedden (who was present at the ceremony), as electrical engineer to the borough of Tunbridge Wells, and for the past six years borough electrical engineer of West Ham, he has acquired a large circle of friends in the electrical industry. That Mr. Beauchamp will "make good" in his new post, we have no doubt, and in congratulating him on the appointment, we gladly extend to him a cordial welcome also.

But the occasion was memorable not merely from the personal point of view; it marks a new era in the history of the electricity supply industry—an era to which we have long looked forward. Hitherto there has been no organisation charged with the promotion of an active propaganda directed towards the development of electricity supply in this country; the industry has just "growed," making its way purely by virtue of the merits of the commodity which it supplies, without the aid of any organised stimulus or purposeful cultivation. In view of this fact, and of the many restrictions under which it laboured and still labours, the remarkable development which the supply industry attained before the war was a splendid testimonial to those merits by which it lived. But the latent possibilities which it possessed were not really revealed until the nation was called upon to pass through the fiery ordeal which is now drawing to a close—which in less than five years has led to an increase of 80 per cent. in the annual output, and has awakened, not only the nation, but even the Government, to a realisation of the wonderful capabilities of the agency at their disposal. Singular that it should be left to the Huns to administer this gigantic impulse to the industry!

It is true that there have been sporadic attempts to hasten progress from within the industry. In 1911, Dr. Ferranti drew a fascinating picture of what might be effected by the scientific organisation of a variety of apparently discrete interests, and out of his inspiring influence the Industrial Committee of the Institution of Electrical Engineers—which was not confined to membership of the Institution—was born; but the forces of reaction were too powerful, and it perished in infancy. The Incorporated Municipal Electrical Association took up the movement, and formed a somewhat similar organisation—but then came the war, and that good intention failed to mature. We must not forget, either, the Electric Supply Publicity Committee, which made fitful efforts to fill the need, but it was a whole-time job, and honorary services could not be expected to achieve success—they made no appreciable impression on the field that was to be cultivated. Due credit must, however, be given to a number of managers who by means of showrooms, exhibitions, and other means carried out very successful publicity campaigns within their own areas.

To our readers this is no new story; for years we have pointed out the urgent necessity of action to develop the sale of electrical energy, and to counter the efforts of that very active and formidable body, the British Commercial Gas Association, whose propaganda has invaded every town and village where gas supply is available, and is about to become more active and more lavish of expenditure than ever. Financial resources are the lifeblood of any such campaign. We have cited the example of our American friends, whose Society for Electrical Development, with a colossal membership and vast resources, has accomplished wonders in disseminating amongst the public a true appreciation of the possibilities of electricity in the home, the shop, and the factory. Almost every week we receive from the Society leaflets summarising its activities, and the facilities which it places at the disposal of its members for promoting the development of the sale of electricity, not only by informing and encouraging existing consumers, but also by inducing new customers to come on the mains. Statistics are given showing the harvest reaped by the Society's campaigns, which culminate in an "electricity week" of some kind or other every autumn. There is no limit to the scope of such an organisation; but, as we pointed out when the Board of Trade scheme was promulgated, while it was proposed to develop enormously the supply side of the industry, there was no sign of any intention to develop the consuming side, which was the necessary corollary to the former scheme.

We have pointed out, too, that most station engineers are primarily technical men—intensely interested in the plant which they control and extend, but little inclined to go into the highways and byways in search of new customers. Engineers, not salesmen—but the good manager knows that it is his business to be both, and it is significant that some of our most successful undertakings are in the hands of men who insist on styling themselves "managers" rather than "engineers" of their concerns. Enthusiasm for the sales department has been conspicuously lacking, and, as we have said, electricity supply has advanced purely on its merits. Now, the first essential to success in selling is to have a good thing to sell; we have it. The next essential is to know how to sell it: this is where the Development Association will come into action. And lastly, there must be the desire to sell—not merely for the sake of profit, but for the love of the game, in the true sporting spirit. This is the part of the central-station managers: and we earnestly hope that they will whole-heartedly support Mr. Beauchamp in the strenuous task which lies before him, while he will provide them with the munitions of war.

Funds must, of course, be provided; establishment charges must be met, and there must be ample resources for working capital, though we believe the efforts of the Association will soon make it largely self-supporting. Here there will, no doubt, be difficulties to overcome: companies can deal with the matter as they please, and probably this fact has much to do with the success of the kindred Society in the United States, where nearly all the supply undertakings are in private hands; but our municipalities have to consider the views of the L.G.B. However, difficulties were made to be overcome, and we have no doubt that the authorities, in their present enlightened frame of mind, are open to conviction with regard to the necessities of the case. It is not only the supply undertakers that will benefit by the Development Association's exertions; contractors and manufacturers equally stand to profit by its efforts, and we confidently anticipate that they will heartily support the movement.

At present the country is unsettled; nerves are on edge, and progress is hindered by uncertainty as to what the future will bring forth. But the British people is sound at heart, otherwise it would never have achieved the impossible as it did so often in the Great War, and we are confident that all will come right in the end. Now is the time to get ready for the boom which we anticipate in the near future. With Mr. Berry at the helm, the organisation of the Association has made rapid progress without courting publicity, and already embraces, we believe, practically all the technical and commercial societies connected with the electrical industry, except the Provincial Electric Supply Committee of the United Kingdom—which will, no doubt, endorse the policy of the Association; it is, of course, most desirable that the campaign should have the support of the whole of the industry.

Paralysing Uncertainty.

The speech of Mr. W. L. Hichens, chairman of Cammell, Laird & Co., Ltd., of which a summary appears in our "Business Notes" to-day, brings to mind a parable told of a certain rich fool who was so obsessed with the possessions that he had secured, that he resolved to wallow at ease in the mire of selfish gratification, utterly indifferent to the ultimate issue of such course of action. The sequel to the parable is that nemesis with its accustomed inevitability cut short the career of the short-sighted reveller. What is happening at the moment is that prevailing agitations are having a paralysing effect upon industrial activity, and we are consequently losing trade in foreign markets "at a time when every effort ought to be made to increase it." Our position is being weakened instead of being strengthened to carry the heavier burden. Mr. Hichens shows that if capital is deprived of a reasonable return in order that labour may take more than its fair share, capital which makes industry, as at present conducted, possible, will take wings and fly away to less troublesome spheres of usefulness, and the means for affording employment will be jeopardised. Inequitable distribution of reward, if it occasion unemployment at home by assisting our competitors in their efforts to secure our trade, may bring to our industrial structure, which will depend more than ever on foreign trade in future, the fate of the house built upon sand. A high rate of wages but little or no work to do, at all events for some. It is frequently argued that labour is out to ensure security or continuity of employment. How we are to achieve that result by hampering industry with burdens which prevent its expansion, it is impossible to see. It is profoundly to be hoped that the workers' organisations will speedily realise the imperative necessity of banishing the prevailing paralysing uncertainty if the interests of the entire industrial sections of the community are to be safeguarded.

Municipalisation of German Electricity Works and Tramways.

The next step after the projected nationalisation or control by the Republic of the large supply works in Germany, to which reference was made recently in these columns, is the suggested municipalisation of transport undertakings and of works for the supply of water, light, and power, &c. According to a report published on March 19th, the Socialisation Commission has prepared the draft of a Bill relating to the "communalisation" of economic works. The Commission takes up the standpoint that a great need exists for socialisation on a communal basis, and that if the communes are to satisfy this requirement they must be invested with monopoly rights. The draft Bill proposes to confer this right on the communes by placing the obligation on the various States to issue legal regulations for facilitating municipalisation in this form. As a consequence, the draft Bill proposes to authorise the towns and communes to take over transport undertakings in their respective districts, together with works for the supply of water, light and power, pharmacies, the production, provision, and storage of food products and luxuries, the erection of dwellings, &c. Certain combinations of local authorities—Communal Unions, as they are termed—have already existed for a number of years past for the joint production and supply of gas and electricity, the electricity works concerned having received the name of overland central stations. It has only been possible to form these Communal Unions in the past on a unanimous decision of all the local authorities concerned. Now, however, the draft Bill proposes that such combinations shall be constituted in the future, even if opposed by some local authorities, if one or several communes possess at least one half of the total population concerned, or if the supervising or higher authorities make such a recommendation. The monopoly right is also to prevail in the case of undertakings for the establishment of which the communes have granted concessions which have not yet expired.

The new problems which will arise from the projected law will render necessary a fundamental alteration in the law of expropriation, and the Socialisation Commission considers it to be essential for a uniform law for the whole of the country to be prepared in relation to the expropriation of property. Until such a law has been passed, it is held that the States individually should legislate in the direction that expropriation should take place on the basis of the common value, that is to say, the normal trade value, and not according to the full value which has had to be paid hitherto. The full value is interpreted to be the speculative value which includes all future possibilities. Apparently this means that the undertakings would be taken over at a valuation made on behalf of the communes, and without any compensation for goodwill. The appreciation which some undertakings have experienced during the war is to be left out of consideration in arriving at the compensation to be paid, and the monetary value of the "advantages arising to the owners through the expropriation" is to be deducted from the total amount to be paid. By a coincidence it was reported on the following day (March 20th) that the Republican Cabinet had decided the previous day to commission the Economic Board to prepare a bill to bring about the Socialisation of the gas and electricity works, and the tramways.

FAULT LOCALISING: A FEW HINTS.

By H. BUJAMA.

Although the majority of mainsmen agree that fault localisation in theory is simple, the use of fault-localising sets is often dispensed with, and sets are labelled as inaccurate through some trifling error in calculation or faulty connection in the testing set—more often the latter defect. The old method of cutting and testing a faulty cable requires so little brainwork, and the rapidity with which the repair has to be effected plays so great a part in mains tests, that engineers are apt to think that the actual manual work is speedier than what appears to an outsider a comparatively simple test. Then again, one finds oneself up against an entirely different proposition to laboratory tests, weather conditions and public interest being excluded; one has still to consider the gang of men wating until one's deductions are complete, and the risk of some detail cropping up, hitherto unforeseen, that would give a faulty measurement. All these things weigh against the use of fault locaters, and we come to the conclusion that what is required is a simple, accurate, and quick means of fault localising, and some means whereby one can keep one's hand in, in quiet times. I have known mainsmen who appear to think that the only means of trying a new set is to wait until a cable breaks down, and when a main does actually place itself at their disposal for that purpose, they find that their anxiety to get the job through is greater than their interest in the accuracy of the new set.

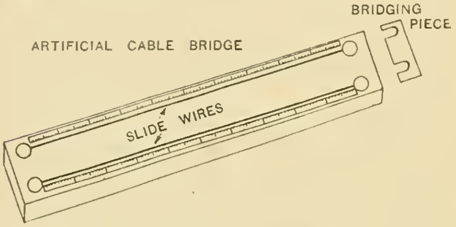

Fig. 1.—Double-slide Wire Bridge.

I myself, some time ago, was faced with the same problem, and I got over the difficulty by constructing a double-slide wire bridge, as shown in fig. 1: by this means I was able to imitate the majority of faults that mainsmen are troubled with. By using the bridging piece and attaching a wire to a measured length along one slide wire for use as an assumed earth, any loop test or fall of potential test can be tried. By this means one is not only able to check the accuracy of one's set, but one is also able to acquire quickness and precision in the use of it.

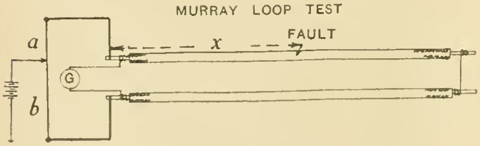

Fig. 2.—Connections for Murray Loop Test.

With the usual bridge tests the trouble always met with is the resistance of leads and connections, and unless this point is thoroughly understood before commencing tests considerable errors are likely to be incurred.

In the Murray loop test, errors due to leads can be reduced to a minute degree by connecting the galvanometer leads as shown in fig. 2, and using leads of equal resistance to connect the cable to the bridge; this leaves the leads as an addition to each side of the slide wire, and thus if they are of equal resistance the point of balance is not affected. A good many sets are made where the galvanometer is connected across the bridge, and in these sets an unwieldy formula is given to convert the resistance of the leads into equivalent lengths of cable. In my opinion, there is nothing better for quick and accurate tests than the Murray bridge, and combined with the usual switch for interchanging battery and galvanometer it is very largely used. The other bridge test, the Varley bridge, is not so widely known, and is not made up in any form suitable for low-resistance cable tests; for long lengths of E.H.T. or high-resistance lines it is more suitable than the Murray bridge, but it is open to a larger error due to resistance of leads, and usually the correction necessary to counteract this defect forms a large part of the test. But even with this bridge this error can be cancelled by keeping the ratio arms $a/b = 1$, as in fig. 3. Calling the resistance of the leads y, and making them of equal resistance, we get—

$$a/b = (R + y + x)/(y + L - x).$$

If $a/b = 1$, then—

$$x = \tfrac{1}{2}(L - R). \quad L = \text{total resistance of loop.}$$

x being in ohms, it is necessary to know the resistance of the cable before the length to the fault can be obtained. Another advantage of the Varley bridge is that its usefulness is not confined to earths only. This form of bridge can also be used for locating short circuits, the procedure being to take the resistance of the short, as in No. 1, fig. 4; call this resistance $R = x + y + z$, now reconnect as in No. 2, fig. 4, then—

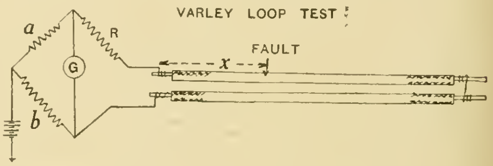

Fig. 3.—Connections for Varley Loop Test.

$$a/b = (R_1 + x)/(y + z),$$

$$\text{and } x = (aR - bR_1)/(a + b.)$$

As in the case of the earth test, if $a/b = 1$, the resistances of the leads, provided they are equal, cancel out, and we are left with the practically simple formula—

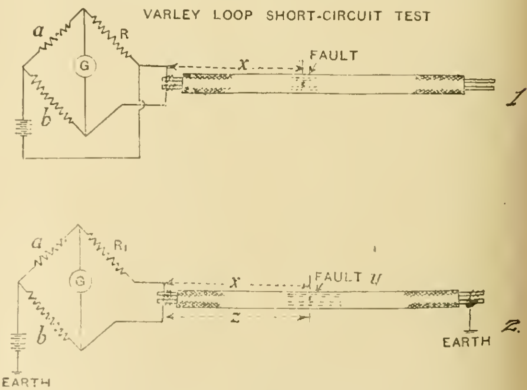

Fig. 4.—Connections for Varley Loop Short-circuit Test

$$x = \tfrac{1}{2}(R - R_1).$$

This x is also in ohms, and it is necessary either to refer to a previous test record, or else obtain the resistance from makers' catalogues.

I am of the opinion that Varley loop sets would be more used, if it were not for the fact that makers do not make the third arm of sufficiently low resistance, so that one could test low-resistance cables, by using a one-to-one ratio on the ratio arms. This would mean that for low-resistance cables, running, say, to 0·1 ohm for the complete loop, it would be necessary to have a third arm divided up into 0·001 sections; that would mean one ten-contact unit of 0·01 ohm per contact, and another of 0·001 ohm per contact, making a minimum of 0·001 ohm, and a maximum 0·1 ohm in the third arm. The secret of accuracy of all bridge tests is to get all the arms of nearly equal resistance, and for low-resistance tests to use low-resistance galvanometers and low voltages.

I suppose one of the most difficult faults that a mains engineer comes up against is the case of a short where the cable has also gone to earth, for unless he has a loop cable handy, or is able to run an artificial loop, there is no well-known test that will satisfy him. I have found that this kind of fault can be dealt with fairly well by taking two ordinary resistance tests, one at either end of the faulty cable. Then if the resistance of the short = z, fig. 5—

$$R = 2a + z,$$
$$R_1 = 2b + z.$$

Then we can cancel out the resistance of the short z, and leave—

$$2a - 2b = R - R_1.$$

If total resistance of faulty cable = x,

then $2a + 2b = x$,

and $R - R_1 = -4b + x$,

$$b = \tfrac{1}{4}(R_1 - R + x) \text{ ohms.}$$

I do not consider this anything like as good as the previous tests, but failing other means, it certainly is a good last resource, and with proper attention to obtaining good connections, and deducting the resistance of leads from tests, it is workable. There is one serious drawback due to the resistance of the short circuit varying between tests, but by rechecking tests at either end, this can be verified.

A good deal of thought is necessary to obtain the right kind of set for the job, for where the Murray loop test is capable of great accuracy on short lengths of low-tension cable, the Varley loop is better suited for long lengths of high-resistance or E.H.T. lines. Again, where 1 per cent. error in a 5-mile line represents 88 yards, the same percentage error in 200 yards only represents 2 yards, which means that in short-distance tests accuracy is not so important. Then, again, there has to be considered the value of the resistance of the fault; for while in E.H.T. lines it might be necessary to localise a fault of 20,000 ohms to earth, it is unlikely on low-tension cables that one would have to deal with a higher resistance than a few ohms. What usually outweighs all these points in the selection of any set is the price of the set, the Murray loop sets being considerably cheaper than Varley loop sets; but however expensive a set might be, with proper attention to the details mentioned, and time given to obtaining precision by the use of the double-slide wire bridge, it would require a saving of only a small amount of expensive navvy work to repay the cost of the set.

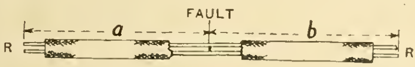

Fig. 5.

Employment of British Labour Overseas.—The Minister of Labour informs the Department of Overseas Trade that numerous inquiries are received in the Employment Department of the Ministry from individual workmen and from Trade Unions as to the conditions and manner of obtaining employment abroad. The Minister understands that the work of reconstruction on the Continent will be controlled by the Governments of the countries concerned; but it is probable that British firms will be afforded an opportunity of participating. The Minister would be glad to be informed from time to time of contractors who may be expected to employ British workmen abroad, and the type of work upon which they will be engaged, in order that workmen who wish to obtain such work may be put in touch with the contractors.—*Board of Trade Journal.*

EXTRAS IN ENGINEERING CONTRACTS: AN IMPORTANT DECISION.

[By our Legal Contributor.]

The case of Nott *v.* The Mayor, &c., of Cardiff, in which the House of Lords recently gave judgment reversing the decision of the Court of Appeal, decided certain questions of very great importance to all who are concerned with contracts for works.

It is important for two reasons—first, because it involved the discussion of a vital point which arises upon a form of contract in common use, and in the second place it appears to establish quite a new principle—or to establish a point which, so far as the writer is aware, is not covered by judicial authority.

The material facts may be very briefly stated. In 1910 the Cardiff Corporation was minded to contruct a reservoir, and entered into a contract with that object. The contractor undertook to complete the works according to a specification in the usual way. There was a large sum involved—the contract price was £201,077 7s. 4d. The dispute arose about a claim for extras which was eventually referred to arbitration. The Corporation declined to admit the claim, on the ground that the engineer had given no certificate in writing as required by the contract. An arbitrator found for the contractor, awarding him £11,933, but stated his finding in such a way that it could be reviewed by the Court. Eventually it reached the House of Lords, when the arbitrator's decision was upheld.

This being a brief outline of the facts, it is desirable to look at the matter a little more closely. It was common ground (1) that in order to justify a claim for extras, the certificate of the engineer was a condition precedent; (2) that in the present case no certificate had been given. How, then, was the contractor able to substantiate his claim?

The contract expressly provides (by Clause 3) that "no extra charges in respect of extra work or works will be allowed unless they are clearly outside the spirit and meaning of the specification, nor unless such works shall have been ordered in writing by the engineer." Then there was an arbitration clause, which was substantially the same as that which appears in the common forms of contract. The material words are:—"In case any dispute or difference shall arise between the Corporation or the engineer on their behalf and the contractor, either during the progress of the works or after the determination, abandonment, or breach of the contract . . . as to any objection by the contractor to any certificate, finding, decision, requisition, or opinion of the engineer, then either party shall forthwith give to the other notice of such dispute . . . and it shall be referred to . . . arbitration."

The clause goes on to provide that in the event of the parties not agreeing to arbitrate, the arbitrator may decide whether the dispute or difference shall be immediately determined, or whether it shall await the completion of the work.

Another clause provides:—"It is to be distinctly understood that the Corporation shall not be liable to the payment of any charge in respect of such additions, alterations, or deviations, unless the instruction for the performance of the same shall have been given *in writing* by the engineer, with other ancillary provisions for the protection of the Corporation."

Disputes arose at an early stage. The engineer gave various orders, which the contractor said involved the execution of extra work, while the engineer said they were covered by contract prices, and the Corporation took the point that in any event the absence of a certificate was fatal to the claim of the contractor. The Arbitrator found as facts that the resident engineer, with the concurrence of the engineer, improperly requested the contractor not to make claims for extra work under Clause 3 *(supra)*; that the engineer required the contractor, without extra payment, to execute work and supply materials extra to the contract; that the contractor objected to such requirements; that disputes arose which the engineer decided against the contractor; and that he improperly refused to give written instructions in respect of work which the Arbitrator said was extra.

The Lord Chancellor, in the course of his judgment, pointed out that the dispute really turned on the meaning of Clause 128, as to which he said :—" The effect of this clause with regard to a dispute as to the refusal of the engineer to give an order in writing for any item as an extra is, in my opinion, this : The clause provides for any dispute on such a point being arbitrated at once, if it is decided on a preliminary arbitration that it ought to be decided at once. If the arbitration is forthwith held, it appears to me that the award by the Arbitrator that the item in dispute is an extra, and therefore ought to have been ordered in writing, takes the place of the order in writing. The arbitration is an appeal from the refusal by the engineer to give such an order, and the meaning of the provision is that in that case the contractor may go on with the work, relying on the *interim* award as putting him in the same position as if the engineer had given an order in writing.

" On the other hand, on the preliminary arbitration it may be determined that the decision shall await the completion of the work. What the contract contemplates is an order in writing before any extra work is done ; and if the arbitration stands over, either as the result of a preliminary arbitration or by consent, till the completion of the works, it seems to me that the meaning of Cl. 128 is that the award then to be made, if in favour of the contractor, shall have the same effect as if an order in writing had been given. This is indeed an *a fortiòri* case as compared with the case of arbitration before the work had been done."

Applying that principle to the case before him, Lord Finlay pointed out that the arbitrator had found, as a fact, that there were disputes as to whether certain items were extras, and that those disputes were allowed to stand over by agreement. Those disputes were settled by the arbitrator in favour of the contractor.

He also pointed out that the Corporation had relied on a clause in the contract which provided that any instructions given verbally were to be deemed as instructions for the proper execution of the works not involving extra charges. Dealing with this he said : " The dispute that arose was whether the engineer was entitled to give merely verbal orders in respect of these items. It is an appeal from the decision of the engineer, and if the contractor succeeds, he must be in the same position as if the engineer had given the order."

The other members of the Court (with the exception of Lord Sumner) delivered judgments agreeing that the appeal should be allowed, and in the result the contractor had judgment.

Thus it has been decided, and, so far as my knowledge extends, decided for the first time, that the refusal of an engineer to grant a written order, may (even in the absence of fraud or conduct which is improper in the legal sense) be reviewed by an arbitrator. How far is this a principle of general application ? That question can best be answered by inquiring whether it would apply in a case where the parties were bound by the ordinary form of contract.

That form (*e.g.*, the R.I.B.A. form) usually provides that subject to certain exceptions " in case any dispute or difference shall arise between the employer or the architect on his behalf, and the contractor either during the progress of the works or after the determination, abandonment, or breach of the contract as to . . . . any matter or thing arising thereunder," the same shall be referred to arbitration.

Now, it is very usual to provide that extras must be ordered in writing ; but if there is a dispute between the architect (or engineer) and the builder (or contractor) as to whether a particular piece of work is an extra, it seems clear that upon the authority of Nott's case, this could be referred to arbitration. In a legal text-book published in 1913,* the following opinion was expressed :—" Suppose there is a dispute as to whether a particular piece of work ordered to be done is extra or not, the contractor should at once give notice in writing that the question is in dispute."

To sum up, a general conclusion which may legitimately be drawn from the case under notice is that, no matter how stringent the provisions of a contract may be in the direction of providing for written orders for extras, the decision of the engineer not to give a written order may be reviewed by arbitration.

This is an important and far-reaching result ; and it is difficult to see how it can be avoided in any future contracts, unless contractors are willing to allow the question " extra or not " to be submitted to the final decision of the engineer.

It is very common for certain questions to be finally decided by the engineer—*e.g.*, a question as to discrepancy in the drawings or the removal of improper materials—but there is no form of contract in common use whereby contractors have submitted to be bound hand and foot by the decision of the engineer as to what is or is not an extra. If by refusing to give a written order the engineer could, in effect, secure to himself the right to decide this question, a reference to arbitration would be without any value—inasmuch as the claim of the contractor would immediately be met by the answer, " You have no written order."

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The daily papers here recently reported that it was probable that, with the return of Peace, the idea of utilising the power of the tides at Cape Split, on the Minas Channel, a branch of the Bay of Fundy, would be revived. It is said that the project was first undertaken by Dr. George B. Cutten, president of Acadia College, Wolfville, Nova Scotia, and Prof. R. P. Clarkson, an American professor of engineering at Acadia, and that it has been endorsed, both from the engineering and commercial standpoints, by a New York firm of consulting engineers.

At the spot referred to above, the tide rises from 35 to 45 ft., and runs with remarkable rapidity ; a test of the plant which it is proposed to use is reported to have been made last year by the chairman of the American Society of Mechanical Engineers. An initial development of 5,000 electrical H.P. is proposed, but it is estimated, apparently, that much more than this can ultimately be generated.

Two gentlemen (Messrs. E. T. Brandon and E. V. Buchanan) recently left Canada to visit several European countries on behalf of the Hydro-Electric Power Commission of Ontario.

The writer has reason to believe that this Commission is, other things being equal, favourably disposed towards doing business with Great Britain, and, as it is probably the largest purchaser of electrical supplies in the world, opportunities of securing a favourable business connection with this body should not be ignored. The Commission buys all kinds of electrical goods in bulk, and sells them to the municipalities, and its requirements in the way of transformers, switchgear, electricity meters, high-tension insulators, &c., are very large, and are steadily on the increase. It is natural that a supply authority serving territory about the size of England, and meeting the electrical needs of a population of over a million persons, needs supplies on a big scale.

Several American firms here are making great efforts to sell farm-lighting sets, and they have apparently met with a good measure of success ; the sets consist of a low-voltage (about 20 volts) generator, driven by a gasoline engine, and this unit charges a battery which is part of the complete set.

The Imperial Trade Commissioner at Toronto recently reported that disappointment is expressed locally that arrangements are not more generally being made for selling organisations here. (This was in reference to British manufacturers generally.) He added that their principal competitors had already taken steps in this direction.

The writer recently approached one of the professors of Toronto University, on the subject of engineering graduates going over to England to get at least a portion of their engineering training there. This is a matter which has been advocated several times in these notes—practically every Canadian-born engineer is an American engineer under present conditions; he knows nothing, and cares little about British firms or British methods, as a rule.

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* The " National Form of Building Contract," by Valentine Ball and Hope, at p. 68.

The professor referred to above was very sympathetic towards this idea, and went so far as to mention the matter to the Council of the University; the Council apparently would welcome any efforts that might be made to enable engineering graduates to obtain some experience in England. It is believed that the Council would willingly recommend some of its best graduates to English firms, and it is more than likely that McGill University at Montreal would be favourable to such a policy, although no definite information has been obtained.

The idea of the writer is that it should be made easy for engineering graduates to go to Britain and get some training there. There is no doubt that the influence of a native-born Canadian engineer, with strong leanings towards Britain, due to a familiarity with the country, its people, its methods, and its splendid engineering works, would be greater than that of the British engineer who comes out here. At the same time, the engineering works at home should familiarise themselves with conditions and requirements over here as much as possible; the employment of a few men who had had several years of experience in this country would probably be an advantage.

Is this not a matter which the B.E.A.M.A. might consider?

The Canadian National Exhibition will, as usual, be open for two weeks in August and September.

This is an exhibition which has been held annually at Toronto since the year 1879; it has grown steadily in popularity, and during the last few years almost a million people have visited it each year, coming from all parts of Canada and the United States.

Exhibits shown undoubtedly have an effect over a very wide field, which embraces a very large potential market.

The writer has for several years held the opinion that Great Britain should be particularly well represented at this exhibition.

The following extracts from the Reports of the Dominions' Royal Commission, which sat in Canada in the early part of 1917, are worth quoting at length now that the world is striving to return to normal conditions, as they have special reference to this subject:—

> Extracts from Fifth Interim Report of the Dominions' Royal Commission.
>
> We received evidence from several quarters in Canada with regard to exhibitions. There is a general agreement that the Toronto Exhibition, which has been held annually since 1879, has proved itself to be well worthy of support. Covering some 165 acres, and possessing permanent buildings, which are worth about $3,000,000, it is practically self-supporting, and is able to give about $18,000 per annum in prizes for live stock, no other money prizes being awarded. In recent years nearly a million visitors have attended in the fortnight, during which the Exhibition is open, and by their entrance fees pay practically all costs. No floor charge is made, but a small fee is levied for show cases.
>
> For some years efforts have been made to induce your Majesty's Government to erect a permanent building sufficiently large to admit of an adequate display of the produce and manufactures of the United Kingdom; but hitherto these requests have been without result. As this Exhibition has justified its existence by the large numbers of visitors who patronise it, and by the approval and co-operation accorded to it by the Dominion and Provincial Governments, the Manufacturers' Association of Canada, and the Boards of Trade, we consider that a grant might well be made, so as to show United Kingdom goods in a leading centre in Canada, where the produce and manufactures of the United States are now given undue prominence compared with those of Canada's Mother Country.

The reports were signed by Lord D'Abernon, chairman; Sir H. Rider Haggard; Mr. T. Garnett; Mr. W. Lorimer; Mr. J. Tatlow; Sir Alfred Bateman; Sir George Foster (Canada); Mr. J. R. Sinclair (New Zealand); Sir J. W. S. Langerman (South Africa); and Sir Edgar Bowring (Newfoundland).

It is not clear from the above extracts what kind of an exhibition this is, but it may be stated that besides agricultural, mining, and forest products of all kinds, there are shown all varieties of manufactured goods, including electric fittings and accessories, motors and appliances, telephones, lamps, besides electrical accessories for motor-cars, &c.; there are also many different kinds of machinery in actual operation, many of them motor driven, in fact, it is like a very good sample of its kind that one might see in Great Britain.

A British Isles building, with suitable exhibits, would be sure to attract a great deal of attention, and could hardly fail to result in the firms of the "old country" becoming better known and patronised, especially where it could be shown that prices were reasonable.

SOME NOTES ON POWER-FACTOR INDICATORS.

By G. W. STUBBINGS.

The attention that has been given in recent years to the regulation of the power factor of alternating-current circuits has brought about a widely increased field of application of the power-factor indicator. The use of this instrument is also extending in test rooms for alternating-current meters, the use of a power-factor meter in conjunction with a phase-shifting transformer for varying the phase angle of the voltage applied to the pressure circuit of the meter with respect to the current in the main coils being extremely convenient for testing meters of this class. The principle of action of a power-factor meter is by no means as obvious as that of an ammeter or a wattmeter, and a few words on this subject may be of interest to engineers who have been unable to find the time to look into this matter.

The power-factor meter is an instrument of which the moving system has no control—that is, it is free to take up any position when disconnected, apart from unavoidable friction. In the single-phase instrument this moving system consists of two coils arranged at right angles, the planes of these coils intersecting on the axis of rotation. Both these coils are connected across the supply voltage; the one in series with a non-inductive resistance, and the other in series with a reactance. The moving system is placed symmetrically between two coils which carry the current of the circuit. If the voltage at any instant be $\mathrm{V}\cos pt$, and if the field produced by each of the coils of the moving system be equal, the combined effect of these two fields will be to produce a rotating field proportional to the voltage, whose angular speed is pt. In the diagram, fig. 1, let O A be the direction of the field due to the current coils, and O B the direction of the axis of the coil of the moving system connected to the non-inductive resistance; it is clear that if at any instant the field due to the fixed coil is proportional to $\mathrm{C}\cos(pt - \phi)$, the angle between this field and the rotating field will be $pt + \alpha$, where α is the angle B O A. The torque acting upon the moving system will be,

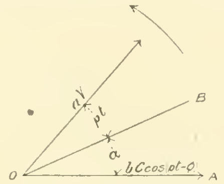


Fig. 1.

therefore, $a\mathrm{V} \times b\mathrm{C}\cos(pt - \phi) \times \sin(pt + \alpha)$. As the moving system is without control, it will take up such a position that the average value of this torque is zero. This condition is fulfilled when the average value of $\cos(pt - \phi)\sin(pt + \alpha)$ is zero.

$$\cos(pt - \phi)\sin(pt + \alpha) = \sin(pt - \phi + \alpha) + \sin(\phi + \alpha),$$

the average value of which is evidently $\sin(\phi + \alpha)$.

The given condition, therefore, becomes $\sin(\phi + \alpha) = 0$, or $\alpha = -\phi$; the angle α, measured in the opposite direction to that of the rotation of the field due to the moving system, will, therefore, give the angle of lag. It is easily seen that with a leading current the condition for zero average torque is $\alpha = \phi$, the deflection of the pointer being in the opposite direction. As the scale of the instrument is graduated to show the power factor, or $\cos\phi$, the law of the instrument will give an open scale in the neighbourhood of unity power factor.

It will be noticed that the equation $\sin(\phi + \alpha) = 0$ is also satisfied by $\phi + \alpha = \pi$, giving $\alpha = \pi - \phi$. It is easy to show that such a position of the moving system is unstable. Consider the moving system in such a position displaced by a small angle β. The resulting torque will be $\sin(\phi + \pi - \phi + \beta) = -\sin\beta$. This torque is, therefore, negative, and will increase the angle of deflection β, till the moving system takes up a position represented by $\alpha = -\phi$.

Power-factor meters for balanced two or three-phase circuits can be constructed on lines similar to single-phase instruments. The rotating field in this case can, however, be obtained from the actual circuit without any phase-splitting device. The action of the instrument will be precisely similar to that of the single-phase type.

Three-phase power-factor meters for unbalanced circuits have three current coils, carrying currents proportional to the line currents, symmetrically arranged.

The resultant magnetic effect of these three coils will be to produce a rotating magnetic field which, however, will not be constant in magnitude or uniform in velocity. The moving system will produce a rotating field proportional to the voltage, which can be considered as constant in direction and angular velocity. In view of the general lack of uniformity of the field due to the current coils, it will be convenient to consider the instrument as a combination of three single-phase instruments. The average torque acting on the moving system, due to the action of each current coil, will be proportional to $C\,V\sin(\phi + \alpha)$. The total torque will therefore be—

$$K_1 C_1 V_1 \sin(\phi_1 + \alpha) + K_1 C_2 V_2 \sin(\phi_2 + \alpha) + K_1 C_3 V_3 \sin(\phi_3 + \alpha),$$

C_1, V_1, ϕ_1, C_2, V_2, ϕ_2; C_3, V_3, ϕ_3 being the currents, voltages, and phase angles of the three phases respectively. If $V_1 = V_2 = V_3$, this can be written—

$$K\,V\,\{C_1 \sin(\phi_1 + \alpha) + C_2 \sin(\phi_2 + \alpha) + C_3 \sin(\phi_3 + \alpha)\},$$

$$= K\,V\,\{(C_1 \sin\phi_1 + C_2 \sin\phi_2 + C_3 \sin\phi_3)\cos\alpha + (C_1 \cos\phi_1 + C_2 \cos\phi_3 + C_3 \cos\phi_3)\sin\alpha\}.$$

This expression can be written: $K\,V\,\{M\cos\alpha + N\sin\alpha\}$, and equating this to zero gives the condition for equilibrium of the moving system: $M\cos\alpha + N\sin\alpha = 0$, therefore $(M\cos\alpha + N\sin\alpha)/\sqrt{M^2 + N^2} = 0$, and $\sin(\alpha + A) = 0$, where $A = \tan^{-1} M/N$; therefore $\alpha = -A$, and $\cos\alpha = (C_1 \cos\phi_1 + C_2 \cos\phi_2 + C_3 \cos\phi_3)/\sqrt{M^2 + N^2}$.

This expression, it will be noticed, differs from the usually-accepted definition of the power factor of an unbalanced three-phase circuit as being the ratio of the watts to the voltamperes or—

$$(C_1 \cos\phi_1 + C_2 \cos\phi_2 + C_3 \cos\phi_3)(C_1 + C_2 + C_3).$$

It has also been proposed to define the power factor of a three-phase circuit as the ratio of the actual watts to the maximum watts produced by relative rotation of the current and voltage vectors. If the angle of rotation of the voltage vectors be θ, the watts produced by such rotation will be—

$$C_1 \cos(\phi_1 + \theta) + C_2 \cos(\phi_2 + \theta) + C_3 \cos(\phi_3 + \theta),$$

since θ will be negative, to increase the power in a lagging circuit. Differentiating this expression with respect to θ, and equating to zero, as the condition for maximum power we obtain—

$$C_1 \sin(\phi_1 + \theta) + C_2 \sin(\phi_1 + \theta) + C_3 \sin(\phi_2 + \theta) = 0.$$

This is a condition precisely similar to that obtained for the equilibrium of the moving system of the three-phase power-factor meter. The angular deflection of this instrument will give the phase rotation of the voltage vectors required to give maximum power in the circuit since $\theta = \alpha$, and the condition for maximum power will be $\theta = \alpha = -\tan^{-1} M/N$; the power factor as defined will then be—

$$\frac{C_1 \cos\phi_1 + C_2 \cos\phi_2 + C_3 \cos\phi_3}{C_1 \cos(\phi_1 + \alpha) + C_2 \cos(\phi_2 + \alpha) + C_3 \cos(\phi_3 + \alpha)}.$$

The denominator of this fraction can be written—

$(C_1 \cos\phi_1 + C_2 \cos\phi_2 + C_3 \cos\phi_3)\cos\alpha - (C_1 \sin\phi_1 + C_2 \sin\phi_2 + C_3 \sin\phi_3)\sin\alpha = (C_1 \cos\phi_1 + C_2 \cos\phi_2 + C_3 \cos\phi_3)\cos A + (C_1 \sin\phi_1 + C_2 \sin\phi_2 + C_3 \sin\phi_3)\sin A$, where $A = \tan^{-1} M/N$

$$= (M^2 + N^2)/\sqrt{M^2 + N^2} = \sqrt{M^2 + N^2}.$$

The expression for the power factor becomes, therefore—

$$\frac{C_1 \cos\phi_1 + C_2 \cos\phi_2 + C_3 \cos\phi_3}{\sqrt{M^2 + N^2}} = \cos\alpha.$$

The cosine of the angle of deflection of the three-phase power factor indicator will, therefore, indicate the power factor as defined by the ratio of actual watts to the maximum watts produced by rotating the voltage vectors relatively to the current vectors.

ELECTRIC-ARC WELDING.

At Glasgow, on March 18th, Mr. H. M. Sayers's paper on "Regulations for Arc Welding" (an abstract of which appeared in our issue of December 20th, 1918) was discussed before the Scottish Centre of the Institution of Electrical Engineers.

Major James Caldwell, who opened the discussion, showed lantern slides descriptive of electric welding applications both in this country and in America. He briefly referred to recent advancement in the resistance processes, more particularly the development in joining thick plates by means of spot welding. For this purpose it had been found essential to provide correct current pressure, time interval, and type of electrode. For this purpose it had been determined even greater success was achieved than in the joining of thin sheet metal by these means. It was most important that operators should receive intensive training, and thereafter be retained as welders when proficient. It was now possible to secure successful welding of any class of steel, and examples of alloys so treated and shown at the meeting included a sample of the welding of a high-speed cutting edge on a mild steel tail shank. As regards electric cutting edge on a mild-steel tail shank. As regards electric supply conditions, 60 volts on open circuit with D.C. or A.C. connected through a resistance, choking coil, or constant-current transformer was sufficient. There was no notable difference in the mechanical characteristics of welds made with either D.C. or A.C., although certain electrodes were much more suitable for one form of current than others. The quantity of current employed in making a weld was of great importance. Important results were obtained with increased current provided that the speed of working was greater, although more expert manipulation was required. With the extensive application of electric welding to ship construction it was considered of the utmost importance that the work should be controlled, not only in its broad outlines, but also in all its details, by men thoroughly acquainted with the factors essential to success. On the other hand, in order to extensively employ electric welding in ship work it might be necessary to cut loose completely from many of the traditions of conventional practice. Special progress would therefore be obtained in a shipyard specially designed and equipped to employ welding methods wherever these had been demonstrated to be the most appropriate.

Mr. Flood said that up till now they had been placed more or less in the hands of hawkers of electrodes—people who had studied the subject from the purely electrode point of view. It was not until quite recently that he had found a firm of electrode makers which could give satisfactory electrical data on which plant could be ordered as an efficient commercial proposition. He felt that if A.C. welding could be developed there was a big future for the A.C. side. For some years, however, it would probably be necessary to use D.C. owing to the nature of the work. With regard to rules and regulations, it was premature to decide anything definite beyond those for the safety of the operator. There they should try to arrive at some standard recognised protection for the eyes.

Mr. R. B. Mitchell said that testing electrically-welded ships after completion would be an extremely difficult matter, and he did not think that the petroleum test would be sufficient. Single-phase supply from three-phase transformers would prove quite satisfactory in most cases when a number of welders were in use, and there was no reason to anticipate trouble from any slight out-of-balance which might occur. The protection of the operators' eyes might be easily got over, but it was more difficult to safeguard the workers in the vicinity. Some sort of movable enclosure in which the welder would work might be provided. He agreed that the conditions were not favourable for D.C. supply from the mains of a supply undertaking. It could only be for comparatively small requirements that such a supply could be allowed, while on grounds of economy it would not be worth while except for occasional work, and then would not be welcome to the supply authorities on account of the disturbance to pressure which would be caused. Safeguards must be introduced to limit the current on striking the arc, and if the work itself was to be earthed, the B. of T. would require to alter its rules, but this difficulty would only arise when the welding current was taken direct from a supply authority's mains. He did not know of any case where electric welding had been carried out regularly without the introduction of a motor generator or transformer.

Mr. **Serrod** said that electric welding had rescued the Glasgow T.C. tramways department from a predicament. Castings which had formerly been scrapped were sent to the welder, and made as good as new. So far as maintenance work was concerned, electric welding would be a valuable adjunct to any big concern.

Mr. A. **Page** said it seemed that the only justification for talking about electric welding in shipbuilding was that it would cheapen construction. The shipbuilder was presumably not taking up the matter too enthusiastically. Given good operators, he did not see why they should not soon have the same opinion of electric welding as they had of the product of the blacksmith. When power station engineers had faced the load for electric furnaces he did not think that anything put on their mains for electric welding would seriously affect the voltage.

Major **Caldwell**, who replied on behalf of the author, said that in Government work they had to use electrodes that were available, as they could not stop operations and start a technical discussion In spare time, however, they carried out tests, and satisfied themselves that 60 volts with any electrode, and with any current was good enough to give satisfactory results without any resistance at all. As regards A.C. they had to consider the type of the electrode, and the more current they could use and the lower the voltage, the better the weld. For testing, several attempts had been made to test by means of the resistance of the welded parts and also by X-rays, but so far the petrol and hammer tests were the most successful. With a low voltage of, say, 60 volts, visual inspection might be sufficient. For the protection of men in shipbuilding, his department had had staging erected outside the hull, with canvas partitions between each operator. He suggested the advisability of instituting investigations into the loss of metal deposited, which he found on experiment varied from 1 to 40 per cent. In repairs electric welding had certainly a great future. As to labour, the shipyards had taken up the matter to a certain point, but it broke down when they came to labour. They had over 1,000 men at electric welding during the war, and it would be a pity if they could not be used pending the training of others. The supply of current was one of the handicaps to advancement latterly.

HYDRO-ELECTRIC POWER IN CANADA.

Reporting on the power possibilities of the St. Lawrence River, the Consulting Engineer to the Commission of Conservation of Canada says there is a shortage of hydro-electric power which is being keenly felt both in Canada and the United States, and strong efforts are being made by private interests to obtain control of the enormously advantageous power in, and adjacent to, the international boundary waters.

It had been hoped that power would have been available from the large development at the Cedara Rapids on the St. Lawrence River, but this power, although conveyed through the territory of the municipalities requiring power, was taken *en bloc* to the works of the Aluminium Co. of America, situated at Massena, N.Y. Notwithstanding the suggestion that the needs of Canadian municipalities might be supplied by power brought back from Massena to Canada, this has not been done, but, instead, it is being sold to municipalities in the northern part of New York State. Great industrial advantage has followed the utilisation of this power generated in Canada and exported to the United States. There is very strong opposition, especially throughout Ontario, to any policy which permits the exportation of electrical energy required for use in Canada.

As never before, the public interest has been aroused respecting both its fuel supply and its increasing dependence upon hydro-electric energy. The central portion of Canada depends upon the United States for its coal, and war conditions are driving home to Canadians the tremendous gravity of their position. The extent to which electrical energy will be available for heating has been much over-rated. Where large blocks of power are available at low rates, some will doubtless be so used. The availability of such power accounts for the establishment of large electrochemical industries at Niagara and other centres, but when the demand for power for municipal and small manufacturing purposes becomes more urgent, such works will probably be forced to leave present sites. Manufacturers and others who are ready to pay from 50 to 100 dols. per electrical horse-power year will not readily submit to industries utilising the coveted power at rates of from 10 to 20 dols. per horse-power.

The low-water power of the international portion of the St. Lawrence River is estimated at about 800,000 H.P., of which Canada is entitled to one-half. The estimated low-water power on the portion of the river which lies wholly within Canada would be about 1,400,000 H.P. This makes an estimated total for Canada of 1,800,000 continuous H.P.

The Hydro-Electric Power Commission of Ontario, by taking into consideration the diversity factor, can, with a power capacity of 250,000 H.P., supply contract requirements of 320,000 H.P.; therefore, assuming such a basis for the St. Lawrence River powers, Canada's 1,800,000 H.P. would take care of a power demand of some 2,400,000 H.P.

The 65,000 H.P. now being exported to the United States from the Cedars would, if retained in Canada, supply, at cheap rates, all the lighting and power required by a manufacturing city of 300,000 inhabitants. If distributed to Canadian municipalities, it would supply light and power to some 35 manufacturing cities of 10,000 inhabitants each. A comparison of the benefits resulting from power thus widely distributed, with the localised benefits from the same power utilised in bulk, as in the electrochemical industries, demonstrates that the former contributes in a much greater degree to the upbuilding of communities and to the growth of the country at large.

In a second report the Consulting Engineer deals with the power shortage in the portion of South-Western Ontario which is served from the Niagara Falls. The growth of the system directed by the Hydro-Electric Power Commission of Ontario is described. The yearly loads of the municipalities supplied have risen from 8.000 H.P. in 1910 to 250,000 H.P. (estimated) for 1918. The present available supply of power for the 200 municipalities served by the Commission is exhausted, and the shortage is acute. In October, 1917, the Secretary of the Commission sent an official notice to municipalities advising that no further contracts be entered into for a supply of power, nor for an increase in the load of the present power users.

Undoubtedly, much power and light is absolutely wasted. Not very long ago the vendors of electrical energy were offering special inducements to encourage consumption, and customers were invited to use new electrical devices as rapidly as such could be invented. The public has responded to these invitations, and now, assuming that there is no setback to industrial activity, Ontario is faced with a power shortage which, until relieved, must constitute a serious check to her industrial growth. The time is at hand when drastic action must be taken to curtail the use of electrical energy now employed on luxuries, and thus make it available for necessary purposes.

The Hydro-Electric Power Commission of Ontario is moving as rapidly as possible to have additional equipment, including pipe-line, installed, so as to have available in about 10 months an additional 50,000 H.P. from the plant of the Ontario Power Co.

The new Chippawa project which the Hydro-Electric Commission has started will, with the surplus water available, provide about 200,000 H.P., but cannot be available for approximately three years. The proposed size of the individual units, namely, 50,000 H.P., is larger than in any other hydraulic development in the world. Considerations of efficiency and desirable operating characteristics which it would be impossible to obtain with smaller units have prompted the adoption of such large units. Power is to be produced at considerably lower cost than 9.00 dols. per H.P. per year, which the Commission has been paying the Ontario Power Co. for the 100,000 H.P. covered by the original contract.

As the Hydro-Electric Power Commission of Ontario now controls the Ontario Power Co., the unused water allotted to the Ontario Power Co. will be diverted to augment the water supply available for the Chippawa project. If so, the capacity of the new Chippawa plant will be about 300,000 H.P.

Preliminary work upon this project, embracing surveys and other engineering activities, has been carried on during the last three years. Plant equipment and tools for carrying out the work of construction were purchased some time ago, and much of this equipment is on the ground ready for operation.

Details are given of the capacity of the large power plant in Canada at Niagara Falls, and it is shown that the shortage a year ago of power for present customers and firm contracts was 69,500 H.P. The total power generated on the United States side of the Falls is 265,000 H.P., and on the Canadian side 388,500 H.P. Since Canada exports 125,000 H.P. to the United States, the power used by the two countries is: United States, 390,000 H.P.; Canada, 263,000 H.P. If the power were equally divided, Canada would have 63,250 H.P. more than she retains at present

In the course of a report on the heating of houses by coal and electricity, the Hydro-Electric Power Commission of Ontario points out that the climate of the greater part of the country is so severe in the winter that even the immense potentialities of its water powers, if fully developed, would be altogether inadequate to cope with the demand for power for electric heating if this were fostered to any considerable extent.

The difficulties in the way of utilising electrical energy for the purpose are: (*a*) The enormous amount of energy that would be required, and which could be more efficiently applied to other purposes; (*b*) the high cost of electrical energy for heating as compared with other sources of heat energy.

For example, there are about 80,000 homes in the city of Toronto; if each of these is to be heated, and a demand of, say, only 12 H.P. per home must be met (probably a very conservative figure as an average for large and small homes), no less than 960,000 H.P. must be supplied for heating homes alone.

The 6,000,000 H.P. which represents the estimated total possible development of Ontario water powers is not sufficient to supply merely the existing *homes* of Ontario with electrical energy for heating alone, exclusive of all other domestic, commercial, and industrial requirements.

All the heating is required in the winter only, and assuming that a maximum demand of 1,000,000 H.P. had to be met for supplying a city like Toronto, the load on the plant required for this purpose, throughout the summer months, would be practically nothing. In other words, for five months every year this enormous plant would be idle. Suggestions have been made that use might be made of it to supply certain industries which could be operated mainly during the summer months, but here there are two difficulties: (1) What are the industries on a large enough scale to be of any use? (2) How could such enormous undertakings afford to lie idle during the winter months when power was unavailable? The situation in this case would be just about as bad for the industries in the winter as for the electrical stations, without the industries, in the summer.

Figures and statements such as the foregoing, which are based on incontrovertible facts, should once and for all answer the question in the negative as to whether the great water powers of Canada will ever entirely solve the fuel problem in a climate such as that of Ontario and Quebec.

The Commission sums up as follows:

It can be readily demonstrated that, of the total energy in fuels, under the most favourable conditions a maximum of 12 to 15 per cent. is obtainable in the form of mechanical power; this is only about one-third of the percentage obtainable in the form of heat in the average house furnace. This fact leads to the conclusion *that, so far as is practicable*, fuels should be used for heating, and electrical energy for mechanical power.

True conservation, therefore, lies in using, to the fullest practicable extent, water power for the generation of mechanical power and fuels for heating. Where no water power is available, then the fuels must, of necessity, be used for mechanical power purposes, but this will preferably be done in large electrical generating stations, the electrical energy from which will be converted into mechanical power by means of electric motors, and again the fuels should preferably be used directly for the purposes of heating without converting their energy first into electricity and then into heat.—*Board of Trade Journal.*

WIRELESS DEVELOPMENT DURING THE WAR.*

Major-General G. O. Squire, chief signal officer of the U.S.A. Army, reviewing in a recent address before the A.I.E.E. the development of military aeronautics in the U.S. up to the armistice, said that in the question of the engineering achievements of the Signal Corps during the war, the development of wireless apparatus formed a large part, in which the vacuum tube occupied a prominent *rôle*. In his opinion the application to wireless intercommunication of the vacuum tube is one of the most interesting developments in the whole field of applied science. For not only has it made possible what has been justly heralded as one of the most spectacular achievements of the whole war—the airplane radiophone—but the confidence growing out of the extensive experience with the vacuum tube in warfare, coupled with its extreme adaptability, has resulted in a rapidly increasing amount of wireless development involving its use.

In addition to acting as detectors and amplifiers, vacuum tubes can function as oscillators, in properly designed circuits containing inductance and capacity they will act as high-frequency generators, for use in transmitting or receiving wireless signals; and as modulators, by suitable connection to an oscillator circuit or antenna, they can be made to vary the power radiated so that the envelopes of the waves transmitted shall have any desired wave form, as, for example, the speech waves from an ordinary telephone transmitter.

When the United States entered the war, vacuum tubes already were in use by the Allied forces for various signalling purposes. The French particularly had been quick to recognise the military value of vacuum tubes, and had, previous to June, 1917, developed very creditable tubes and apparatus. In America the total production, however, did not exceed three or four hundred a week.

Early in the American participation in the war, it became evident that vacuum tubes would be required in very large quantities. Service conditions would require great mechanical strength, freedom from disturbance under extreme vibration, and uniformity of product sufficient to make possible absolute interchangeability of the tubes in sets, without the necessity of readjusting when changing tubes, also that minimum of size consistent with dependable operation.

To turn out tubes by the thousand by factory methods involves great difficulties. Recently the total rate of production in the United States of high quality standardised tubes was considerably in excess of one million a year. This rate of production could be made many times greater on short notice.

The degree of vacuum required is such that unusual methods of exhausting are necessary. The heating of the tubes in electric ovens is supplemented by heating of the elements of the tube by excessive filament and plate electrical power input. Molecular pumps are employed, necessitating an extremely large number of pumps to handle quantity production. Special treatment of metal parts prior to assembly is employed to reduce the gas given off by them during the exhausting process.

Another problem is that of making the complicated metallic structure of all tubes exactly alike, in order to insure identical electrical properties. One company is prepared to manufacture, in quantity, a certain tube in which the clearance between filament and grid is only three-hundredths of an inch, the allowable variation being, of course, only a small percentage of this.

Tubes developed may be divided into two general classes: the tungsten filament types as developed and manufactured by the General Electric Co., and the De Forest Radio Telephone & Telegraph Co., and the coated filament or Wehnelt cathode types as developed and manufactured by the Western Electric Co. The coated filament tubes so far have proven superior to the tungsten filament tubes for Signal Corps use. Both classes have been standardised as regards base, exterior dimensions, filament current and voltage, and in addition, plate voltage and output for transmitting tubes; and amplifying power and detecting power for receiving tubes. Except in certain special cases, the Signal Corps uses two types of tubes, one for transmitting, and another for receiving. The French and the British have been using one type for both transmitting and receiving, but present tendencies of the British are toward different tubes for different duties.

Vacuum tubes are now employed for electric wave detection, frequency amplification, telephony, continuous wave telegraphy, voltage and current regulators on generators, and for other miscellaneous purposes.

Prior to April, 1917, a few experiments had been made, in which speech had been transmitted from airplane to ground by wireless methods; but the apparatus involved was hopelessly crude. The services of the Western Electric Co.'s engineers were enlisted, and under the direction of the Signal Corps, rapid development resulted in successful tests as early as August, 1917. Speech was exchanged between airplanes 25 miles apart in October, and sample sets were sent at once to the Army in France for trial. Several thousand sets were ordered and have been completed and distributed to flying fields in America and to the Air Service in France.

The satisfactory performance of this apparatus has resulted in a new type of military unit known as a voice-commanded squadron. The commander of an air fleet directs the movements of the individual units in any manner desired.

Other uses are in communicating information from airplanes to ground stations, and in directing one or more airplanes from a ground station.

An essential element of the airplane radiophone is the power equipment, which includes a double-voltage D.C. generator driven by an air fan, with a vacuum-tube voltage regulator. The equipment consists of the vacuum tube transmitting and receiving set, and the special telephone transmitters and receivers. The development of a transmitter which is affected by the human voice, and not by the enormously greater engine and wind noises, is one of the principal features of this set. Similarly, to shield the ears of the aviator from the same noises required a special combination of sound-insulating materials surrounding the telephone receivers and suitable for use within an aviator's helmet.

The antenna originally consisted of a flexible copper wire several hundred feet long, unreeled by the aviator and trailing almost horizontally behind the airplane. Modified antennæ using much shorted wires fixed to the framework are now used.

The operation of the sets is extremely simple, all adjustments being made before leaving the ground. The only manipulation required of the aviator is that of the change-over switch to change from talking to listening.

The Signal Corps developed a self-contained set, which consists of three units—the 200-watt, 900-cycle alternator, driven by a regulating air fan, and containing in a stream line case attached to the generator, all the elements of the set. This apparatus is of the synchronous spark type, with four spark tones and nine wave lengths. The weight of the complete unit is 23 lb., and size only 6 in. by 6 in. by 26 in. The regulating air fan maintains the speed of the generator within 4 per cent. of 4,500 R.P.M., with air velocities between 60 and 200 miles an hour.

**Proceedings* of the American Institute of Electrical Engineers, February, 1919. Abstract.

The remaining units in the complete set are a tuning coil, with antenna ammeter attached, and the antenna system, comprising a reel, insulated bushing, and trailing antenna. Voltages of 30,000 or more are produced, and ranges of communication of 100 miles have been accomplished with this set.

The use of directional effects of loops or coils for receiving wireless signals has resulted in the development of a wireless compass for airplanes which gives positive information to the aerial navigator, and enables him either to locate his position by triangulation with respect to two beacon land stations, or to fly at any given angle with respect to a certain beacon station.

The apparatus consists of two principal parts—the antenna coils and the tuning and amplifying apparatus. The antenna coils are mounted in the fuselage of the Handley-Page airplane, with suitable means for rotating in azimuth. The amplifier is extremely sensitive, consisting of a detector and six-stage amplifier. A novel feature of the amplifier is the use of iron-core transformers for frequencies of 100,000 cycles.

The direction of the beacon land station is determined by maximum strength of signals, in a highly ingenious manner developed originally by the British. The precision of the directional effect is remarkable.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Telephone and Telegraph Line Construction.

I think engineers generally will consider our practice of telephone and telegraph line construction a disgrace to the country. Every time we have any severe weather there is the same old trouble—lines down and exasperating delay. The usual excuse given is that it is due to the snowstorm or some other similar cause, which is no excuse. It was the same before the war.

Do the Post Office engineers realise that this country is not Florida or Bermuda, and that lines put up in this country should be installed for the climate and conditions in this country? The overhead lines of power companies seldom give way, and it is just as important that the telephone and telegraph lines should likewise be immune in this respect.

To make matters worse, when a section is down it is put up again in the same manner, and naturally with the same result next time the inclement weather repeats itself. Could anything be more futile?

I think we should be interested to hear from the Post Office engineers what steps they propose to take to remedy the present state of affairs. I hope it is not that because they are Government officials with assured jobs they are content to leave matters as at present.

In view of the vital importance of telephones and telegraphs for carrying on business, the yearly national loss if it could be computed would be an eye-opener. Spending money on repairing lines damaged by heavy weather is like throwing money away, as this can be avoided by putting up suitable lines in the first place.

G. F. S.

Manchester, *April 10th*, 1919.

Tax the Bachelor—of Science.

Of course the bachelor should be taxed. Look at the salary he is offered in the "Situations Vacant" Column of a recent issue of the Electrical Review.

A 'Varsity man with a degree and a certain amount of practical experience is eligible, at the age of about 25, to become a Chief Lecturer in Electrical Engineering in London at—£3 per week.

With such annual increments, too, that in 20 years, say when he is 45, he could be drawing £400 per annum. If he be not, therefore, severely taxed for being a bachelor, he might have the temerity to start saving at this age, and even to rush into marriage at 50.

And if he had insured his life heavily enough, and had the grace to die at the right time, his son, even, might think of going to a 'Varsity—one of the meanest and cheapest, of course, say the one in which his father had been Chief Lecturer in Electrical Engineering. Perhaps!

B.Sc.

April 12th, 1919.

The City and Guilds Technological Examinations.

As a student in the first year's course of electrical engineering preparing for the above examination, I would like to state that I think that the preliminary examinations are a great encouragement to beginners, especially as many students never reach the final stage. However, if a student fails in the final examination now, he has at least the credit of having passed the previous ones, a fact which may prove of great value to him.

F. E. Rowland.

London, N.W., *April 11th*, 1919.

BUSINESS NOTES.

Letters from the Forces.—"Major" writes:—"I still belong to H.M.S. ———, and am awaiting further instructions as to where I may be sent, and I take this opportunity of again thanking you for so regularly sending me the Electrical Review. It has always reached me safely, and it has been most useful in keeping me in touch with my profession. It has been the only really reliable 'connecting link' which I could always depend upon for any information of the electrical world during the war, and during my 3½ years in the Orkneys, and I join with the many electrical engineers who have also availed themselves of your kind offer, in expressing my most grateful thanks."

German Dependency on Foreign Minerals.—The *D.A.Z.* (February 25th) contains a summary of an address delivered by Prof. Beyschlag at a meeting of the Berlin District Association of German Engineers, on the extent of Germany's dependence on foreign countries for her minerals after the war. The Professor divided the minerals requisite for German industry into three groups, the first containing minerals not found in Germany, or only found in insufficient quantities, the second containing minerals which are found in abundance but not yet in sufficient quantity to meet the demands of industries, and which must in part be imported; and the third containing minerals found in such quantities that after these demands have been met export is possible. To the first group belong the precious metals, white tin, and metals needed for admixture with steel, *e.g.*, nickel, chrome, wolfram, molybdenum, and vanadium, have to be imported. Tin comes mainly from the Malay States and Bolivia; this latter country supplied Germany before the war, but now the United States have become its chief customer. Germany obtained nickel from Canada and New Caledonia. Besides the metals mentioned there is also a lack of the important quicksilver, which was imported from Spain and Tuscany. Graphite, sulphur, phosphorus, lead, zinc, manganese, iron, and copper are found in Germany, but in comparatively small quantities. Before the war Germany produced 10 per cent. of her copper requirements, and after the war one-third of these requirements may find a substitute in aluminium, which Germany has learnt to produce within the country, the rest being covered presumably by surplus production in the United States. German iron ore, which is frequently of a poor quality, may well be exhausted in between 45 and 60 years. On the other hand, France, by the acquisition of Lorraine, will become the richest in iron ore of the European countries, and in the end will be obliged to export to Germany. Germany has abundance of potash salts, even if she has lost her world monopoly by the French acquisition of Alsace. There are also large quantities of coal and lignite, which are, however, endangered by Polish annexation claims in Upper Silesia and by those of France in the Saar district. Germany is also rich in aluminium produced from clay by an electrical process, and in electrically-produced nitrogen, while she has learnt how to win oils from coal and lignite and bituminous schist. The Professor was of opinion that by untiring labours Germany might again be partially independent of foreign countries.

Trade Publications for Durban Library.—The Borough librarian of the Durban Municipal Library desires to receive trade publications from the United Kingdom for display in the reading rooms. Over 1,000 people visit the reading rooms daily, and a selection of British commercial publications should prove an excellent advertising medium. Several orders, he states, have been known to have gone to some of our competitors through the presence of the latter's publication in the reading rooms. Publishers of United Kingdom trade and technical papers wishing to avail themselves of this opportunity should write to the Borough Librarian, Municipal Library, Durban, Natal.—*Board of Trade Journal.*

Industrial Paralysis of Germany.—Mr. Wilfred Hill, on his return from a visit paid to German territory in Allied occupation at the request of the War Office, was interviewed by the *Birmingham Post*, and in the course of his remarks he said: "I interviewed many Germans, and they told me their chief desire was to obtain sufficient supplies of food and to get settled again into normal ways of life. I visited some of the big German factories, and was profoundly impressed by their wonderful equipment, organisation, and efficiency. The aniline dye works, at Leverkausen, which I saw, employ in normal times, 20,000 people, although at present the number is about 10,000. We have nothing approaching the area of these works in this country. Factories stretch in one direction for a mile and a quarter, and they are all under the same control. As regards the future of German industry, I formed the opinion that we have little to fear from it for the next twelve or eighteen months. There is in Germany on the one hand an almost complete absence of important raw materials, and on the other, there is considerably more uncertainty about the labour question than in this country, whilst the heavy taxation and general shortage will bring about a high cost of living for a considerable time to come. That fact will have a profound effect upon the cost of production generally. The moral I saw in the situation was that we should lose no time in taking advantage of the temporary paralysis of Germany; that we should bring our own methods of production thoroughly up-to-date and get ourselves well-established in the markets of the world whilst we have them at our disposal." Mr Hill did not think that Germany would ever give this country such a hard run in the commercial race as formerly even when her industries were revived England was now in a much better condition to cope with her competition than before the war He believed that Germany, by hard work could pay the cost of the war and indemnities—"and they will work hard." he added

A State of Paralysis in England.—In the course of a speech, delivered in the capacity of chairman of Cammell, Laird & Co., Ltd., Mr. W. L. Hichens said that in the business world one of the worst results of the present discontent was a paralysing uncertainty which hampered all activities. We were losing trade in foreign markets at a time when every effort ought to be made to increase it. We did not know what the cost of anything would be a few months ahead, and it was difficult, if not impossible, to make a firm quotation. Stability for a definite period was essential if we were to do business, and if we were to make the money out of which wages were paid. The agitators who made it their business to create an atmosphere of instability and flux were doing the greatest dis-service to those whose cause they claimed to champion, for they were attempting to destroy the conditions which made organised existence possible. There was no doubt we were being under-sold in many directions, and the course of events tended to weaken rather than strengthen our position in the markets of the world. In view of the widespread interest attaching to the problem of the relations between Capital and Labour, it might be useful to take the operations of the company in 1918 as a concrete instance and consider how far the results justified the oft-repeated complaint that capital got too much and labour too little of the profits of industry. The distributed profits amounted to £176,028, less than 5 per cent. of the total wages and salaries bill of the year. In other words, if capital had received no profit at all it would have been possible to pay another shilling in the pound to the wage-earners and the salaried staff. If a recognised system of profit-sharing had been adopted by the firm, and the balance, after providing 5 per cent. on the capital, had been divided equally between labour and capital, labour's share would have been £29,000, which was equivalent to about 16s. per cent., or barely 2d. in the pound on the wages and salaries bill. It must not be forgotten that it was the possession of capital which enabled the firm to find employment for so many workers, and if it were jeopardised, the employment of the workers would necessarily be jeopardised also. He did not think the game was worth the candle when the price was 2d. in the pound, or at most 1s. in the pound, if the stakes were wholesale unemployment.

Swiss Exhibition.—The Swiss Trade Exhibition will be held at Basle from April 24th until May 8th. This year the number of exhibitors has increased to 1,300 firms. In 1917 business to the amount of 20 to 25 million francs was done; last year that amount was doubled. Between two and three hundred thousand visitors attended the first and second exhibitions, and the number of buyers last year was 18,000. The exhibition aims not only at an increase of the Swiss home trade, but also at an extending of the Swiss exports. The goods offered are purely Swiss, and a strict control is stated to exclude all foreign products from participation. The general public are admitted two days in the week, according to the principle: "The exhibition is a means of communication to connect buyers and exhibitors." According to the *Board of Trade Journal*, the goods offered are divided into 19 groups, including the following: Heating, light, and sanitary fittings; technical articles in metal, wood, glass, cork, leather, india-rubber, &c.; machinery and tools; fine mechanical instruments, instruments and apparatus; electrical industry; sundries.

Iron and Steel Stocks.—Withdrawal of Control.—The Minister of Munitions desires to draw the attention of all concerned to the order made by him on January 7th, 1919, known as the Steel and Iron (Purchase and Returns) Order, 1919. It may be explained that during the war, part of the cost of production of iron and steel was met by direct subsidy from the Government. The subsidies in connection with the manufacture of pig iron have been continued to April 30th, 1919, and in consequence the prices of pig iron (as well as of manufactured iron and steel made therefrom) have been restricted to prices below the economic level. After the withdrawal of subsidies at April 30th, the entire cost of manufacture will have to be met by the iron and steel makers. It was explained in the Ministry notice published on December 2nd, 1918, that steps would be taken to prevent any hoarding of subsidised material during the period for which the subsidies were continued. For this purpose the above-mentioned order was passed. It provides in effect that no person is entitled to increase his stock of iron and/or steel by more than 100 tons except under a permit from the Ministry, and that such permits should only be granted on condition that the holders should repay to the Ministry a drawback (representing the subsidies paid on the material by the Ministry) in respect of all such stock which may be held by them on April 30th, 1919, exceeding by more than 100 tons the amount of stock held by them on October 31st, 1915, or October 31st, 1918, whichever is the greater. The drawback referred to, which has been fixed at 30s. per ton in respect of iron and/or steel, is a refund to the Government of the subsidies paid by it in respect of material which has not at that date been incorporated in any structure or plant or work in progress. The order further requires all persons who on April 30th, 1919, hold a stock of iron and steel, or either of them, of 100 tons or more to furnish to the Controller of Iron and Steel Production within fourteen days after April 30th, 1919, a true and complete return of the stock of iron and steel held by them (*a*) on October 31st, 1915, or October 31st, 1918, whichever shall be the greater; and (*b*) on April 30th, 1919. Forms of return for the purpose of the order may be obtained on application to the Controller, Iron and Steel Department, Ministry of Munitions, Whitehall Place, S.W. 1. The Minister of Munitions desires to point out that the order applies to all persons whether iron and steel makers, merchants, stockholders, engineers, shipbuilders or other users of iron and steel, who hold over 100 tons of iron and/or steel on April 30th next. Instructions as to the classes of iron and steel to be included will be found on the return form referred to. It should be added that this return is called for under the powers conferred on the Minister of Munitions by the Defence of the Realm Act and Regulations, and any person failing to comply with the order is liable to the penalties provided under the Act.

The Trade Outlook in Argentina.—In the course of an article on "British Trade Interests in Argentina" appearing in the Peace Issue of the *Review of the River Plate*, Mr. H. O. Chalkley, commercial secretary, H.B.M. Legation, Buenos Aires, says that British capital has been invested in Argentine industries as follows:—

Tramways, £27,418,938.
Telephones and telegraphs, £3,196,926.
Electric light and power, £2,720,520.

The writer says that the place of the United Kingdom as the source of the capital which was regularly invested in Argentina before the war has not been taken by any other country nor has there been any decided tendency to finance undertakings locally. In consequence, railway construction, public works, port works, dredging and other development schemes have been suspended. This cessation of foreign capital investment must be regarded as an important factor in the reduction of the Argentine import trade, indicating the prospect of a notable increase in that trade, if and when such capital advances to the republic are renewed. On the other hand, new factors have arisen in this country, which may well retard foreign investments. During the last two years there have been constant labour troubles, and it is certain there are more to come in the future. The situation has been made more difficult by outbreaks of sabotage and attacks on property for which no adequate remedy or form of reparation has been found. The rate of interest which will be required to attract foreign capital to investments in Argentina will undoubtedly be higher owing to uncertainty as to the effects of these conditions. Mr. Chalkley adds:—

"The outlook for the prosperity of Argentina cannot be otherwise than favourable. The immediate effects of the cessation of hostilities might be summed up as a suspension of business in the import trade and uncertainty with regard to exports, but these effects are temporary and cannot affect for long the basic conditions which point to an assured prosperity. The expansion of the Argentine import trade, which is one in which British manufacturers are specially interested, may be counted on so long as purchasing markets and means of transport are found for the export of Argentine products. British manufacturers may view their prospects of trade with Argentina with confidence, and it would be an opportune moment to abandon the British habit of unfounded self-depreciation which was indulged in before the war. The high reputation which they held has if anything been increased by experience during the war, and they have only to quote competitive prices for the right article to be assured of preferential treatment by the Argentine importer. In greater adaptability to local tastes and requirements and reliability and quality British manufacturers can hold their own in the Argentine market; what has to be studied is more systematic methods of distribution, including a closer personal knowledge of the country. In addition, it may be said that no subject is more important for the future of British trade with the River Plate than the provision of adequate transport arrangements unencumbered if possible by the handicap of deferred rebates, a system that before the war drove much trade to the continent which would otherwise have fallen to the share of British manufacturers."

Bankruptcy Proceedings.—Louis Alfred Thomsom, who had traded at 59, Victoria Street, Westminster, as an electrical engineer, under the style of Saville & Walton. An application for an order of discharge was made on April 8th to Mr. Registrar Mellor at the London Bankruptcy Court. Mr. J. B. Knight, Official Receiver, reported that the applicant failed in November, 1915, with provable claims £2,547 and assets valued at £135, but which had only realised £6, the chief items being book debts, which proved to be irrecoverable. Having served with the Imperial Yeomanry in South Africa, and been for nine years in the employ of Messrs. Siemens Bros., Ltd., electrical engineers, the bankrupt in 1910 commenced a similar business without capital, in partnership with Nield at Bream's Buildings, Chancery Lane, W.C., under the style of "Saville & Walton." For the purposes of the business the applicant borrowed £1,000 of his father-in-law, and Nield £200 of his mother. The business was considerable and necessitated them resigning their positions with Messrs. Siemens Bros., Ltd., which they had at first continued to hold. Branch businesses were opened at Cardiff and Cobham; thereafter there was a loss, and in October, 1913, the partnership was dissolved on accounts showing a deficiency of £550, Nield retiring on his mother being paid £100. In 1913 the bankrupt removed to 39, Victoria Street; the business was considerably restricted owing to trade disputes; in August, 1914, he again enlisted, and subsequently obtained a commission in the R.F.A., in which at the date of the receiving order, he held the rank of captain. His manager continued the business, which was ultimately closed in May, 1915, and these bankruptcy proceedings followed on the petition of a creditor. The bankrupt attributed his failure and insolvency to loss by carrying on the business between October, 1913, and May, 1915; and to loss on a speculation in linseed oil. As offences, the Official Receiver reported (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; (2) trading with knowledge of insolvency; and (3) contributing to the bankruptcy by rash and hazardous speculations. The applicant intimated that he wished to obtain an immediate discharge subject to a judgment, and his Honour adjourned the hearing until May 6th.

Edward Sidney Steel.—A further sitting of the London Bankruptcy Court was held for this public examination under the receiving order made in April, 1916, against Steel Bros., electrical engineers, 206, East India Dock Road, E. The debtor stated when he first attended under the proceedings that he never had a partner. He commenced the business in October, 1914, and carried it on successfully until the end of 1915, when as he had to join up he made arrangements to dispose of it. A statement of affairs was lodged showing liabilities £580 and assets £80, represented by shares in Steel's Electric & Engineering Co. The Official Receiver reported that the debtor was stated to have gone overseas, and it would be futile to further adjourn his public examination. The sitting was accordingly adjourned *sine die*, with liberty to the Official Receiver or the debtor to apply for it to be reinstated in the list when the debtor was able to attend the Court.

F. J. Earle, electrician, 3, St. Nicholas Road, Truro—Receiving order made April 9th on creditor's petition.

German Ebonite Substitute.—The Hornite Works Joint-Stock Co. has been recently founded at Düsseldorf, with a capital of M. 300 000. Hornite is an ebonite substitute prepared from industrial residues, which in appearance and wearing qualities not only replaces ebonite, but will, it is said, owing to its extraordinary cheapness and special qualities, drive it off the market. Hornite will be used for door handles, window pushes, walking-sticks, telephone installations, cycle handle-bar grips, and various technical or surgical purposes.—*Kölnische Zeitung*, March 7th.

German Wire Prices Advanced.—The Rolled Wire Association raised the price of rolled wire by M. 100 per ton in February. The Union of Wire Works recently called a meeting of members, at which the prices for wire products were to be raised in conformity with the increased rolled wire prices. In the meantime, the prices of all wire products were advanced by the same amount as the rolled wire price, viz., by M. 100 per ton.—*Kölnische Zeitung*.

Where the Huns Destroyed.—The works of the Thomson-Houston Co., at Lesquin-les-Lille, which gave employment to 1,000 people, were destroyed by the Huns. Of the two large buildings comprising the works, one was taken down and carried off to Germany early in 1918, while the other, after being used by the enemy as an establishment for repairing war material, was set on fire by the Germans as they retreated in October last.

Iron and Steel Output.—The following statement as to production of iron in the United Kingdom is issued by the Ministry of Munitions:—

Pig Iron.

	Output during week ending Mar. 22nd, 1919. Tons.	Number of furnaces in blast.
Hematite	64,000	103
Basic	51,000	83
Foundry, forge, and other qualities	38,000	97
Ferro-alloys	5,000	12
Total	158,000	295

The Brazilian Industrial Delegation.—Mr. W. S. Barclay, of the Federation of British Industries, sailed on Saturday for South America, to act as a special Commissioner to conduct back to this country the Brazilian delegates who have been appointed by the Brazilian Government to undertake a tour in this country as the guests of the Federation. At the end of the present tour of these Brazilian delegates the Federation intends to send a permanent Commissioner to Brazil as part of its Overseas Commissioner Service.

New Electrical Companies in India.—Among the new electrical concerns recently formed in India, are the English Electrical Co., 6, Hastings Street, Calcutta—capital, 100,000 rupees; and the Metallic Filaments Co., 55, Basettipet, Bangalore City—capital, 100,000 rupees.

Catalogues Wanted.—The Warrington Electrical Co., Ltd., who have commenced business at 82, Sankey Street, Warrington, require lists of electrical accessories, switchgear motors, and other electrical apparatus.

Government Stores.—It is announced that Mr. W. J. Larke, O.B.E., Controller of the Disposal of Miscellaneous Stores, has removed from the Hotel Métropole to Caxton House, Westminster, headquarters of the Miscellaneous Stores Department.

Liquidation. — Electricity Supply Co. for Spain, Ltd.—Meeting, May 14th, at 38, Commercial Street, London, E., to hear an account of the winding-up from the liquidator.

Book Notices.—"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII. No. 3. March, 1919. New York: The Institute Price $1.

"The Strowger Automatic Telephone Exchange." By R Mordin. Pp. xii. + 186 : 82 figs. Price 21s. net. "The Elements of Telephony." By A. Crotch. Second edition. Pp. 114 : 57 figs. Price 2s. net. London E. & F. N Spon, Ltd.

Trade Announcements.—The Stuart Electrical Co., of Union Chambers, Temple Row, Birmingham, have commenced business as electrical engineers and contractors, with Mr. F. W. Twentyman, late of Messrs. Ellis & Ward, Ltd., of London and Birmingham, as manager. Catalogues and lists, with trade terms, are desired.

Mr. Bernard Meggitt, who has been demobilised, has taken over the control of the electrical business of the Progressive Engineering Co., Ltd., at his old address, Station Street, Mansfield.

Mr. G. H. Morland, discharged from the Forces, has commenced business as an electrical engineer at 22, West Street, Maidenhead.

Mr. Thos. Hall has commenced business as an electrical engineer at 4, New Road, Kenilworth.

The Allied (Sheffield) Iron and Steel Co. Ltd., of 18, Cadman Lane, Norfolk Street, Sheffield, have opened a branch to deal in motor-cars, lorries, tires, and electrical equipment, including dynamos, motors, switchgear, cables, lamps, and electrical accessories.

Mr. Joseph Marson, for 20 years with Mr. G. R. Marson, of Hales Street, Coventry, has commenced business as an electrical engineer and contractor at 17, Styvedale Avenue, Coventry

The Lead Market.—In their report dated April 12th, Messrs. James Forster & Co. state:—"The 'Controllers' have again reduced the price of lead 20s. per ton, making it £25. We venture to say that the reductions made in the last fortnight have not been necessary, and have not resulted in the sale of more lead than would have taken place without the reductions. . . . Consumption at home, and export, is increasing, and is certain to increase, but, on the other hand, the stock—96,450 tons—restricts buying to prompt requirements, and consumers are very unlikely to depart from this course."

The report of Messrs. G. Cawson & Co., also dated April 12th, says:—"There has again been a good business done in all positions. The control price was reduced to £25, and this brought in quite a good trade—consumers buying freely to cover their requirements. . . . There is no doubt that prices have now come down to a reasonable level. Seeing the greatly increased cost of production, and the advance in coal and labour, it is quite certain that output will gradually show a considerable decline, and consumers are probably well advised in covering their forward requirements. The outlook continues favourable for a good trade, and as the Labour position is now more settled, and Peace apparently in sight, we look for a continued good demand."

Catalogues and Lists.—It may be understood, as a general rule, that copies of publications mentioned in this section may be obtained on application to the firm or company at the address given.

Messrs. Fullers, Chadwell Heath, Essex.—Illustrated price-list (4 pp.) of Fuller dry (square and round-type) batteries for P.O. telephone and railway work, and inert batteries for telegraph and telephone, gun-firing, and naval service.

Hart Accumulator Co., Ltd., Marshgate Lane, Stratford, London.—Eight-page illustrated price-list, describing their Hart "M S L" batteries (6 and 12 volts) for motor-car electric starting and electric lighting. Spare parts are also tabulated very clearly.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—Forty-page fully illustrated and descriptive catalogue, giving particulars of their "Safuse" and "Donlok" Home Office switch and fuse gear for factory installation service. Prices are tabulated.

Cheap Steam, for March, 1919 (issued by Messrs. E. Bennis and Co., Ltd., of Little Hulton), is a very fine number. Not many technical publications are yet able to avail themselves so generously of art paper. There is a technical feast of more than 50 pages of editoral matter, including a finely-illustrated reprint from *Engineering* of a description by G. F. Zimmer of the coal-handing appliances at the Coventry electricity works, with large infolded drawings; also a full reprint of a paper and discussion on "Steam Engines and their Relation to the Fuel Economy Problem" (A. E. A. Edwards, at the Birmingham Association of Mechanical Engineers): the "Education for Genius" address (E. C. Reed) is continued, as is also "The Control and Measurement of Temperatures"; and some of Mr. A. W. Bennis's notes on "Fuel Economy" are extracted.

Reconstruction.—Pamphlet No. 20, issued by the Ministry of Reconstruction, deals with the subject of "Land Settlement."

L.C.C. Capital Expenditure.—It is no longer necessary for the London County Council to obtain the special consent of the Treasury to the incurring of capital expenditure, as the war restrictions have been withdrawn.

Works Extension.—Messrs. Marshall, Sons & Co., Ltd., have purchased a site at Gainsborough, upon which to extend their works.

Export Restrictions.—The *London Gazette* for April 11th contains particulars of amendments in and additions to export restrictions.

LIGHTING AND POWER NOTES.

Accrington.—Proposed Loan.—The T.C. has agreed to apply for sanction to borrow £85,000 for additional plant and mains in connection with the electricity undertaking.

Belfast.—Proposed New Power Station.—At the last monthly meeting of the T.C. it was reported that the tenders for the foundations of the new harbour generating station ranged from £120,000 to £170,000; it was estimated that the buildings would cost at least 50 per cent. more than the foundations, and that the total cost would be from £250.000 to £300.000. The original estimate of Sir John Snell was £46,000 for the buildings and foundations. Alderman Tyrrell said that the interest on the revised estimates for the complete scheme would be £60,000, instead of £27,500, and this would fall on the consumers. Agreements had been entered into with the two shipbuilding firms, and the only change that could be made in the charges for energy was that which depended on the price of coal. A special meeting of the Council is to be called to consider the matter.

Blackburn.—Proposed Loan.—The T.C. has approved of application being made to the L.G.B. for sanction to a loan of £250,000 for the proposed new generating station at Whitebirk.

Canada.—Strike.—The strike of the Montreal Light, Heat and Power Co.'s employés on Wednesday last week, for the recognition of their union has not resulted in the closing of the services as many of the employés are remaining on duty.

Cheriton.—E.L. Scheme.—The U.D.C. is supporting a petition to the Folkestone Electricity Supply Co. for terms for a supply of electricity for lighting in the district.

Cheltenham.—E.L. Scheme.—The T.C. has decided to apply to the L.G.B. for a loan of £26,000 for completing the lighting of the town by electricity. The Gas Co. had informed the Council that in future its charges would be £10 per lamp, and it was stated that a saving of £4 per lamp would by effected by adopting electric lighting.

Continental.—Germany.—The Provincial Landtag of Pomerania has decided to grant a subsidy of Mk.13·5 mill. for the overland power transmission system, which it is desired to make independent of coal by taking advantage of water power.—*D.A.Z.*

The Deutsche Wasserkraft Verband is the name of a new association which has lately been formed at Berlin with the object of encouraging the utilisation of the water-power resources of the country for the generation of electrical energy for power and other purposes.

Derby.—Price Increase.—The extra charges for electricity have been advanced by the T.C. from 40 to 60 per cent.

Doncaster.—Price Increase.—The price of electricity has been increased by the T.C. from 25 per cent. to 40 per cent. above the pre-war charges.

Dublin.—Electricity Charges.—The T.C. has decided that the 50 per cent. advance put on the price of electricity last October shall only continue in force during the June quarter.

Dartford.—Proposed Price Increase.—The U.D.C. has applied to the B. of T. for an order to increase the statutory maximum price of electricity for lighting by 50 per cent. Energy is to be supplied to the engineering works of J. & E. Hall, Ltd.

East Cowes.—Proposed Price Increase.—The U.D.C. has decided to oppose the application of the Isle of Wight E.L. Co. for power to increase its charges for electricity from 8d. to 9d. per unit.

Ellesmere Port.—Proposed Bulk Supply.—In view of Government action regarding the supply of electricity. the U.D.C. has deferred sanction to a supply of electricity in bulk to the Ship Canal Portland Cement Co. by the Mersey Power Co.

Folkestone.—E.L. Charges.—The T.C. has rejected a recommendation by the Electricity Charges Sub-Committee authorising, under the deed of transfer, an increase from 7d. to 7½d. per unit for electricity, on the application of the Electricity Supply Co. The B. of T. has sanctioned an increase to 8d., subject to the T.C. agreeing to alter the deed of transfer, which provides for a maximum charge of 7d.

Godalming.—Electricity Charges.—The Urban E.L. Co. has decided to enforce a minimum quarterly charge of 13s. 4d. for electricity supplied up to 20 units.

Hastings.—Price Increase.—The T.C. has decided to apply to the B. of T. for consent to increase the advance of 20 per cent. on pre-war charges for electricity to 50 per cent.

High Wycombe.—E.L. Charges.—The E.L. and P. Co has decided to charge a minimum of 13s. 4d. per quarter for energy consumed up to 20 units.

King's Lynn.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £34,200 for extensions at the electricity works in connection with the supply of electricity to two shipyards at West Lynn.

Knottingley.—E.L. Order.—The U.D.C. has decided to proceed with negotiations for the transfer of its E.L. order to the Electrical Distribution of Yorkshire, Ltd.

Malvern.—Extensions.—The U.D.C. has decided to supply electricity for power and lighting to the works of the Morgan Motor Co., Ltd., which are outside its area.

Mitcham.—Mains Extensions.—The County of London E.S. Co. has informed the Council of its intention to lay cables in the town.

Portrush.—E.L. Scheme.—The U.D.C. has decided to proceed with an E.L. scheme, and to approach the Belfast Banking Corporation for a loan of £10,500 for the purpose.

Redcar.—E.L. Scheme.—The U.D.C. has appointed a deputation to interview the Cleveland and Durham E.P. Co. with regard to a supply of electricity in bulk for the lighting of the district.

Rochdale.—Proposed Loan.—The T.C. has decided to apply to the L.G.B. for sanction to a loan of £68,500 for extensions at the electricity works.

Stretford.—Price Increase.—The Electricity Committee has increased the charges for electricity from 65 per cent. to 80 per cent. over pre-war charges.

Torquay.—Year's Working.—The receipts of the T.C. electricity department for 1918 totalled £21,091, and the expenditure £23,234, leaving a net loss of £2,143.

Energy for Tramways.—It was stated at a meeting of the Council that the tramway company was being supplied with electricity at below cost price, and negotiations have been entered into for the charges to be increased.

Warwick.—Proposed New Station.—The Leicestershire and Warwickshire E.P. Co. has applied to the B. of T. for consent to erect a generating station at Emscote.

Watford.—Proposed Bulk Supply.—The North Metropolitan E.P.S. Co. has submitted revised terms to the U.D.C. for a supply of electricity in bulk.

Warrington.—Loan Sanction.—The T.C. has received consent to a loan of £11,011 for electricity purposes, and all applications for lighting installations are to be proceeded with. There are prospective demands for power to the extent of 10,760 h.p., and action with regard to these has been deferred pending an interview with the B. of T.

Worle.—E.L. Scheme.—The Weston-super-Mare E.L. Co. has been asked upon what terms it is willing to supply electricity to the parish for lighting and power.

TRAMWAY AND RAILWAY NOTES.

Barrow.—Municipal Purchase.—The T.C. has secured an extension of time to consider its option to purchase the British Electric Traction Co.'s system within its area.

Continental.—Italy.—A strike which took place at Rome, on Thursday, last week, included tramway men. The strike had no economical motive, being purely political, and ended the same evening. The leaders are under arrest.

Edinburgh.—Fare Revision.—The T.C. has decided to support the application of the Edinburgh and District Tramway Co. for B. of T. sanction to increase the tramway fares from 1d. to 1½d. per mile.

Halifax.—Price of Rails.—The Tramways Committee has decided to call the attention of the Municipal Tramways Association to the high price of tramway rails and materials, with a view to the Government being asked to fix a reasonable maximum price in connection therewith.

Heywood.—Year's Working.—The receipts of the Corporation tramway department for the past year totalled £6,795, an increase of £1,200; passengers carried numbered 17,525,190, an increase of 1,114,166, although the car-miles run were 98,306 less than in the previous year.

Huddersfield.—Sunday Service.—Differences between the Tramways Committee and its employés have been settled, and a complete day's rest per week is to be granted to every man as soon as sufficient staff can be obtained to make it possible; the Sunday service, which had been suspended. has been resumed.

London.—Accidents.—The breaking of an axle on a west-bound train between Blackfriars and Temple led to traffic dislocation, on Thursday morning last week, on the District Railway, as announced in our last issue. Trains going east at the time could not be run back and the line cleared for on-coming trains. Some passengers had to be conducted along the line to the nearest station.

Another mishap, which added to the disorganisation, was caused by a fire breaking out in the motor carriage of an Ealing-Southend train near Hammersmith Broadway Station about 9 a.m. The flames were quickly overcome, but trains running eastwards were for a time held up.

Owing to the burning out of a signal cable, there was some delay, on Friday, on the Metropolitan Railway.

The City and South London Railway Co. proposes to deposit a Bill which, although out of time, will be proceeded with this session. The Bill proposes to extend the time for the enlargement of the tunnels and other works authorised in 1913 and interrupted by the war, until August 15th, 1924. Powers are also sought to construct three new subways to relieve the traffic at Stockwell and Clspham Common Stations, and to borrow for the purposes of the undertaking by the creation of Redeemable Second Debenture Stock any sum not exceeding £1,500,000, carrying interest at the rate of 5 per cent. per annum.—*The Times.*

Owing to the breakdown of a tramcar on the South London L.C.C. tramway system on Thursday morning last week, all the tramcars were brought to a standstill for about 20 minutes.

L.C.C. Fares.—The L.C.C. Finance Committee has recommended that the L.C.C. tramway fares be increased from the present average of 1·8 miles per 1d. to 1·5 miles per 1d.

L.U.T. Fares.—The London United Tramways Co. states that from April 13th its ordinary fares will average 1d. for 1¼ miles. and about 1d. for three miles in the case of workmen's fares.

Newcastle-on-Tyne.—Sunday Service.—The Tees-side Committee of the Iron and Steel Trades' Confederation has asked its members to cease work on Sundays unless the tramway service is restored.

Northampton.—Power for Tramways.—The Tramways Committee is considering an offer of the Northampton E.L. and P. Co. to supply power for tramway purposes at 1⅛d. per unit for 1.500.000 units per annum, or 1⅖d. for 1.250.000. During the year ended March. 1918, energy generated by the Corporation and consumed on the tramways. cost a little over 1½d. per unit. It is estimated that the Corporation could save £4,000 per annum by closing down its generating station and taking all its supplies from the company.

Rochdale.—Year's Working.—During the past year the receipts of the Corporation tramway department amounted to £110,564. an average of 18·3d. per car-mile, against £102,205 in the preceding year.

Trade Union Amalgamation Ballot.—The ballot of the London and Provincial Union of Licensed Vehicle Workers, on the question of amalgamating with the Society of Tramway and Vehicle Workers, resulted as follows:—For, 17.498; against, 689. The figures of the Tramway and Vehicle Workers are not yet available.

United States.—Railway Electrification.—The U.S. Fuel Administration, which recommended the electrification of certain mountain sections of the Californian railways, as a war measure, has issued a report containing data regarding the conversion under peace-time conditions. The cost is estimated at $23,000,000. The power requirements would be about 267,000,000 units, and the maximum demand about 121,600 kw. The report states that over 20 per cent. of the production of coal and oil fuel in the U.S. is consumed by the railroads. and half of this is wasted by the inefficiencies of steam locomotion.

One-Man Tramcars.—The new type of one-man tramcars is now in use on 130 tramway undertakings throughout the U.S. The cars are extremely light, weighing from 12,000 to 15,000 lb. fully equipped, and seat 32 to 40 passengers. They are fitted with safety apparatus which shut off the power, bring the cars to an emergency stop, sand the track, and open doors at each end if the driver becomes incapacitated. It is claimed that, by the use of these cars, double the service can be maintained at the same expense.—*Journal of Electricity.*

Electric Railway Operation.—Preliminary figures of the quinquennial report on the electric railways of the States of Florida, Idaho, Wyoming, Connecticut, and Rhode Island have been issued by the Bureau of the Census, U.S. Department of Commerce. The statistics relate to the years ending December 31st. 1917, 1912, and 1907. The totals include electric-lighting plant operated in connection with electric railways, and not separable therefrom, but not mixed steam and electric railroads. or railways under construction.

The figures for Florida show that the number of companies was 8 in 1917, and 10 in 1912 and 1907; there were 183·03 miles of track in 1917. compared with 164·84 in 1912, and 118·26 in 1907. The income from all sources was $2,444,514 in 1917, compared with $1,969,315 in 1912, and $1,371,541 in 1817, and operating expenses increased from $956,860 in 1908 to $1,155,091 in 1912, and $1,387,107 in 1917. Taxes, interest, fixed charges, &c., increased from $186,222 in 1907, to $424,717 in 1912, and $516,556 in 1917. The net income was $540,851 in 1917, $389,507 in 1912, and $228,459 in 1917. The electrical power consumed in 1917 amounted to 32,073,156 units, and in 1912 to 25,529,043. Of this power. all but a small amount was generated by the companies.

The figures for Idaho and Wyoming show small gains in trackage, equipment, and income for the semi-decade 1912-1917, but they are far below the gains made during the period of 1907-1912. The operating companies in these two States numbered 6 in 1917, 5 in 1912, and 2 in 1907. There were 127·7 miles of single track in 1917 (Idaho 104·65. and Wyoming 23·05), compared with 111·84 miles in 1912 (Idaho 88·93, and Wyoming 22·91), and 44·24 miles in 1907, the latter being all in Idaho. Passengers carried in 1917 numbered 4,736,414, with a passenger revenue of $423,940, compared with 5,568,781 revenue passengers, and a revenue of $450,913 in 1912. The total income was $524,182 in 1917, compared with $519,153 in 1912, and operating expenses increased from $368,697 in 1912 to $375.858 in 1917. Taxes, interest, fixed charges, &c., amounted to $154,302 in 1912, and $132.786 in 1917.

The figures for Connecticut and Rhode Island show general gains for both the five-year periods, 1912-1917, and 1907-1912. The number of operating companies was 9 in 1917, 10 in 1912, and 15 in 1907. The mileage of single track in Connecticut in 1917 amounted to 1,080, an increase of 6·3 per cent., compared with 1912. and of 38·2 per cent., compared with 1907. The corresponding items for Rhode Island were 454 miles, 4·2 per cent. and 5·3 per cent. respectively. The number of passengers carried in 1917 was 319.931,011. compared with 266,385.229 in 1912, and 213.725,761 in 1907. The income from all sources was $18,614.261 in 1917, compared with $14,457,064 in 1912. and $11.838.033 in 1907, and operating expenses increased from $7.601.929 in 1907, to $9,090,782 in 1912, and 14,187.238 in 1917. Interest. taxes, fixed charges, &c., amounted to $3,693.440 in 1907, to $3,439,952 in 1912, and to £4,518,093 in 1917.—*B. of T. Journal.*

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—A wireless concession for 30 years has been granted to the German Telefunken Co.

British Cable Censorship.—Lord Reading declares that there is no foundation for the complaints, reported from Paris, that the British censorship has been used to promote the interests of British trade at the expense of that of America.—*The Times.*

Cable Delays.—The time taken in the transmission of telegrams from abroad continues to show improvement, but the delays are still causing great inconvenience and loss. From particulars given in the *Times*, it will be noted that a telegram from Brussels took three days in transmission, while another from Berlin was received on the day after dispatch. Other Allied capitals, such as Bukarest and Belgrade, suffer even more than Brussels in this comparison with facilities granted to the enemy.

Telephone Installations.—The Post Office states that it is unable to effect fresh telephone installations at present, owing to the shortage of wire and skilled linemen.

Wireless Call Signals.—The Air Ministry states that as some confusion appears to exist with regard to the wireless call-signs allotted to aircraft for the trans-Atlantic flight, each machine has been given a group of three letters lying within the limits D K A to D M Z. which serves as a call-sign and as a rapid method of establishing the machine's identity. Thus D K A is the wireless call-sign of the Sopwith machine competing in the trans-Atlantic flight.

Wireless Operators.—A dispute has arisen between the Association of Wireless Telegraphists and the Shipping Federation regarding the payment of £3 per month war-risks bonus granted by the Shipping Controller in October last. The Association states that no payment has yet been made. and has decided that, unless the money is paid by noon on April 16th, no wireless operators will sail from British ports. Over 4,000 wireless operators of the mercantile marine are affected.

Wireless Telephony.—Mr. Ernest F. W. Alexanderson, consulting engineer of the American General Electric Co., announces, according to the evening Press, that his company is considering plans for a trans-Atlantic wireless system, to enable New York to converse with Paris and London. He says two devices, which make the plans practicable, are a bridge receiver and a barrage receiver, both being his own inventions. The bridge receiver permits continuous conversation as in ordinary telephony. Conversation on wireless telephones previously has been carried on in relays—that is, one man could not speak and listen at the same time. The barrage receiver permits the operator to centre his attention on the message in which he is interested.

The Royal Air Force is busy pursuing research work in wireless telephony in France: new apparatus is being put to practical use under test conditions in connection with the Folkestone-Cologne aerial mail service. Along this route a chain of call stations is being installed, and the machines are being fitted with both sending and receiving sets. As yet the idea has not passed the experimental stage.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Brisbane.—May 15th. Department of the Treasury. h.t. switchboard, storage battery and motor-generator set for the electric power house, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.) from the offices of the company in Brisbane.—*Tenders.*

Melbourne.—May 14th. Victorian Railway Commissioners. Cells, renewals, caustic soda and mineral oil for caustic soda batteries. (Contract No. 32,194.)

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

Bedford.—May 3rd. Electricity Department. Meters for 12 months. (See this issue.)

Birr (King's County).—May 1st. Birr Electric Light and Power Co., Ltd. Hydraulic turbine and accessories, electric generator, reducer set and motor booster, switchboards, alterations to P. & G. storage battery, overhead distributing lines, wood poles and fittings. (April 11th.)

Dublin.—April 24th. Electricity Supply Committee. High-tension switchgear and alterations to existing switchgear. (April 11th.)

Dundalk.—April 29th. U.D.C. Electricity Department. Replating of storage battery. (April 11th.)

Edinburgh.—April 21st. School Board. Installation of electric light at London Street School. Mr. J. Stewart, S.S.C., Clerk to the Board, Castle Terrace.

Lancaster.—April 25th. Corporation tramway uniforms. (April 11th.)

London.—Battersea.—May 1st. Electricity Department. One water-tube boiler, superheater, economiser and mechanical stoker, induced-draught plant for main flues. (April 11th.)

L.C.C.—The Highways Committee recommends that tenders be invited for the supply of axle boxes, porcelains, track insulators, insulator clips, track insulator stems and refined tin ingot, required for use in the tramway department.

Tynemouth.—April 24th. Corporation. One 500-kw. rotary converter, with accessories. (April 11th.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Australia.—Commonwealth Department of Works and Railways. Electromedical apparatus for military hospitals.

Motor generator sets, £798.—G. Weymouth, prop.
Control panels, £155; wallboards, £604.—J. L. Newbiggin.
Faradic coils, £178.—E. A. Machin.
Milronom interrupters, £252.—V. Nightingall.
Radiant shoulder baths, £39; violet ray high frequency sets, £95.—W. Watson & Sons.—*Tenders.*

Bradford.—Corporation. Electricity Committee :—

Two "Venturi" meters for turbo-generators.—George Kent, Ltd.

Tramways—

Eight tons steel tie-bars, at £39 10s. per ton.—Bayliss, Jones and Bayliss, Limited.
1,000 copper rail bonds, £81.—B.I. and Helsby Cables, Ltd.
Materials for 600 Thermit welded joints, at 19s. 6d. per joint plus 25 per cent.—Thermit Welding Co., Ltd.
Three tons w.i. welded rings, one ton clips, and one ton bolts and nuts, £204.—E. Longbottom.
29 tons round mild steel rods, £659.—Crossley & Davenport.
800 tons high-silicon steel rails, at £18 12s. 6d. per ton (150 tons to be treated by the Sandberg sorbitic steel process, at 31s. per ton extra, including royalty and supervision during manufacture).—Walter Scott, Limited.

Dover.—T.C. :—

Tramway points and crossings.—Hadfields, Ltd., £90 per set.

Dartford.—U.D.C. :—

Switchboard extensions.—Johnson & Phillips, Ltd., £362.

Huddersfield.—The English Electric Co., Ltd., has received a contract from the Huddersfield Corporation for a 5,000-kw. turbo-alternator set, speed 3,000 r.p.m.

London.—L.C.C. Main Drainage Committee. Water softening plant at the Southern Outfall boiler house :—

Paterson Engineering Co., Ltd., Holborn, W.C.		£525
" " " " "	(alternative tender)	570
J. Wilson	(recommended)	**537**
United Water Softeners, Ltd.		576
" " " "	((alternative tender)	475
Bowes, Scott & Western		659
Bell Brothers		9[illegible]8

L.C.C.—The Highways Committee recommends that the Committee be authorised during the Easter recess to open any tenders, involving a capital expenditure of over £500, which may be received for the supply of materials, &c., for tramway purposes.

Reading.—T.C. :—

Motor chassis for the railway welding machine and for the tramway tower wagon.—British Automobile Traction Co., Ltd., £1,000.

Sunderland.—T.C. :—

C. C. Wakefield & Co., Ltd. and Ressoils, Ltd.—Turbine and cylinder oils to the Electricity and Lighting Department.

Wolverhampton.—T.C. :—

Motor shed for the electricity works, £541.—T. & S. Ilam.
72 consumers' meters, various sizes, £409. Chamberlain & Hookham, Ltd.

FORTHCOMING EVENTS.

Institution of Electrical Engineers.—Thursday, April 24th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Fullerphone, and its Application to Military and Civil Telegraphy," by Major A. C. Fuller, R.E.

Society of Technical Engineers (North-Western District).—Friday, April 25th. At 7.15 p.m. At Milton Hall, 244, Deansgate, Manchester. District mass meeting.

Junior Institution of Engineers.—Friday, April 25th. At 7.30 p.m. At 39, Victoria Street, London, S.W. "Commercial Flying," by Mr. J. D. North (of Boulton & Paul, Ltd.).

NOTES.

Industrial Reconstruction Council.—At the Saddlers' Hall, on Wednesday, April 30th, a lecture on "The Aeroplane in Industrial Development," will be delivered by Mr. Holt Thomas.

Appointment Vacant.—Station superintendent (£250 to £300), for the Grays Thurrock U.D.C. Electricity Works. See our advertisement pages to-day.

Electrical Trades' Crisis in London.—The dispute between the National Federated Electrical Association and the Electrical Trades Union, London Branch, has assumed a serious aspect. The Union refuses to agree to an amicable settlement, and if the lockout takes place it is probable that a national strike will result.

An Electrically Welded Gondola Car.—Reference to what is believed to be the pioneer attempt at fabricating a steel freight car structure by the electric welding process is made in the *Railway Review*. As long ago as 1911, the American Car & Foundry Co. fabricated a steel, drop-bottom gondola car, as an experiment, by electric spot welding. At the time electric spot welding was by no means in common use, and the practical limit of commercial equipment then available was two 3/16 in. plates. It was therefore necessary to design a complete new apparatus. The company succeeded in building a machine capable of welding a ¾-in. core through plates assembled in thicknesses up to 2¼ in. The machine consisted of a structural steel frame with a 66-in. throat, having a recess for the accommodation of an 85-kw. transformer and arranged for 440-volt primary circuit and a 25-volt secondary circuit. The electrodes were of copper 3 in. in diameter with the welding points reduced to ⅞ in. Regulation of the primary circuit was effected by means of taps in the primary winding to supplement which, a choke coil also was employed. Pressure was applied to the work through the medium of an air cylinder device. Owing to the inaccessibility of some of the connections and to the use of a considerable number of castings, as in the case of the door hinges, &c., only about 85 per cent. of the fabrication was effected by means of welding, rivets being resorted to for the remainder. In the underframe, welding was used on the centre sill and cross bracer cover plates and in the end sill and the body bolster assemblies. With the exception of the ladder irons, it not being desired to risk human life by attaching them by a process admittedly experimental, the entire superstructure was assembled by the spot welding process. It was estimated that at least one-third of the time otherwise required to put the car together had been saved, added to which was the saving in wear and tear on the tools and machinery ordinarily used in punching and reaming rivet holes, to say nothing of the wasted power entailed in the operation of these tools through the medium of compressed air and the expense involved in replacing broken drills and reamers and the maintenance of the compressed air machinery. A study of the work led to the conclusion that the actual power requirement by the new method of car fabrication had been reduced to about one-third of its former value. By way of testing the completed car, it was given a 150 per cent. load, under which it was shown to be a very rigid structure and developed no permanent set. In seven years' service the car had made a very creditable record—it being an experiment without precedent—and it still continues in everyday service.

Polyphase Commutator Machines.—When a polyphase commutator machine is connected in the rotor circuit of an induction motor—*e.g.*, as a Leblanc exciter or Kapp vibrator—it is found that the voltage at the terminals of the commutator machine does not agree with the calculated value, and, furthermore, if this voltage is measured with a voltmeter of the electro-dynamometer type with several ranges, the readings obtained on the different ranges of the voltmeter are not in concordance. These effects, according to an article in the *Bulletin* of the Société Française des Electriciens, are due to the presence of harmonics. The machine has the property of acting as a condenser as regards low-frequency currents, but as a reactance as regards higher harmonics. The high-frequency currents produced by the teeth cannot, therefore, penetrate the rotor windings, and the rotating flux is, in consequence, distorted so as to induce high-frequency electromotive forces in the stator windings. These may reach 2 to 3 per cent. of the stator voltage. This accounts for the departure of the stator voltage from the calculated value, and also for the inconsistency of the readings of the voltmeter, as the reactance of this voltmeter is appreciable in respect of the high-frequency currents that are produced. The article concludes with an interesting discussion of the phenomenon of self-excitation of polyphase commutator machines. The action is compared with the oscillation of a mechanical system consisting of a linkage made up of four gyroscopes suspended from one corner and weighted at the opposite corner. The self-excitation is said to be a resonance phenomenon determined by the apparent capacitance of the armature and the reactance of the external circuit.

The Schoop Process.—The Schoop process of squirting metal may be used, according to *E.T.Z.*, for forming the plates of condensers by depositing metal on glass. Also good electrical contacts may be produced by squirting metal on to the metal surfaces to be electrically connected. Carbon electrodes may be joined to metal terminals by the use of the squirting pistol. This has important application in the construction of electric furnaces for carbide and other substances, and in the manufacture of carbon brushes for dynamos. Brushes may also be made of metal deposited on paper, or another such support. The process is suitable for replacing soldering or brazing, for instance, in the construction of squirrel-cage armatures with aluminium bars, which are first coppered and then soldered. The joints of steel rails of electric railways may be connected by a deposit of zinc, thus eliminating copper bonds. Insulators may be coated with metal so as to improve in certain places the distribution of the electric field, and thus avoid local high intensities. It has even been proposed to make light accumulator plates by coating asbestos, fibre, or other light materials, with a layer of lead. Electric heaters are produced by squirting metal on to fireproof slabs.

Electrical Developments at Palmers' Works.—In referring to the reconstruction and modernisation of the iron and steel works at Palmers' Shipbuilding and Iron Works on Tyneside, Mr. Mure Ritchie, the chairman, stated, at a meeting of the company held at Newcastle-on-Tyne, that they were utilising waste gases from the blast furnaces for driving blowing engines and to drive the engines of the electric power plant which supplied the energy for the steel works, shipyard, and engine works. No more economical means of providing power to works had been discovered. Their 36-in. cogging mill had been electrified, and the electrical appliances in the roughing and finishing mills in the same train were now being installed. New electrical saws had been installed, and the cooling banks had been enlarged and modernised. Large new batteries of gas producers had been installed, with overhead railway tracks to supply the melting shops.

Institution and Lecture Notes.—Sheffield Society of Engineers and Metallurgists.—On April 7th, Mr. J. S. Atkinson read a paper before this Society on "The Application of Powdered Fuel."

Society of Technical Engineers.—The North-Western District Council of the above Society will hold a district mass meeting, at 7.15 p.m. on Friday, April 25th, 1919, at the Milton Hall, 244, Deansgate, Manchester, to which chemical, civil, colliery, electrical, mechanical, and mining engineers are invited.

South African Association of Municipal Electrical Engineers.—The third annual Convention of this Association was commenced at Port Elizabeth, on February 10th. Mr. B. Sankey, city electrical engineer of Port Elizabeth, was elected president for the ensuing year. The valedictory address of the retiring president (Mr. John Roberts, of Durban) was read, and an address was given by the new president.

Royal Institution.—The following are amongst the lecture arrangements at the Royal Institution, after Easter :—Prof. W. H. Bragg, two lectures on "Listening Under Water ; Dr. H. S. Hele-Shaw, two lectures on "Clutches" ; Prof. Frederick Keeble, two lectures on "Intensive Cultivation" ; Prof. H. S. Foxwell, two lectures on "Chapters in the Psychology of Industry : (1) Fourier and other Pioneers in the Movement for the Humanising of Industry ; (2) Modern Industrial Organisation : Where it Fails to Observe the Humanities of Industry, and the Results." The Friday evening meetings, at 5.30 o'clock, will commence on May 2nd, when Prof. John W. Nicholson will deliver a discourse on "Energy Distribution in Spectra." Succeeding discourses will be given by Sir George Macartney, Dr. S. F. Harmer, Sir Alexander C. Mackenzie, Sir John Rose Bradford, and Prof. Sir Ernest Rutherford.

Sir J. J. Thomson, lecturing on Friday last, on the electrical properties of crystals, said that quartz crystals ran in twins, and whatever one twin did, the other twin was sure to do exactly the opposite. Tourmaline crystals were not entirely above suspicion, but they were more reliable. By a series of experiments it was shown how, by the application of pressure to the two ends of a tourmaline crystal, it was electrified positively at one end and negatively at the other end, the amount of electricity developed bearing direct relation to the pressure applied. By means of electricity generated in this way it was possible to draw curves enabling the exact time at which an explosion would take place to be calculated. One demonstration consisted in the application of red lead to one end of a tourmaline crystal and sulphur to the other end, with the result that the lead was electrified positively and gave forth a red light, and the sulphur was electrified negatively and gave forth a yellow light.

Hydro-Electric Power in India.—In the course of a paper on "The Industrial Development of India," read before the Manchester Section of the Society of Chemical Industry on April 4th, Mr. H. N. Morris said that the production of hydro-electric power would in the future have a very important bearing upon the development of India's industries. So far as he was able to judge, said the author, neither Switzerland, Norway, nor even Niagara, could compare with such schemes as the Koyna River and other water-power projects in India. Mr. G. Gunn, in the course of the discussion, said that in this country we were very much handicapped, simply because the Board of Trade would not allow power to be carried at a very high voltage.

Fatality.—An inquest was held at Chelmsford recently concerning the death of J. McAngus, 26, who, after demobilisation a few weeks ago, entered the employ of Messrs. Crompton & Co., Ltd., at the Arc Works, as a labourer. He was killed while at work through placing his foot on a bare connection of an electric cable. According to the evidence he was wiping down a machine with cotton waste, and put his foot on a 350-volt live cable, which had been placed under a table out of the way. Witnesses stated that the connection should have been covered with insulation, and it was an error of judgment on the part of a tester that it was not so covered. A file was found standing on end and making a connection between a cast-iron stool and one pole of the switch. But for the file anyone could have stood for any length of time where the deceased was, with impunity. Deceased was wearing boots with nails and iron plates on his heels. Artificial respiration was continued for some time. The Coroner said it was impossible to say how the file got there. The jury returned a verdict of "Accidental Death," and expressed the opinion that there was an error of judgment on the part of the tester in not having the cable properly insulated.

Wireless Interceptor.—With regard to German substitute materials, in a wireless interceptor manufactured by the Telefunken Co., the insulating materials used are remarkably inferior to any others that have yet been examined. There is an almost complete absence of ebonite, rubber, and brass, and the materials used in substitution would only have been employed under the pressure of great scarcity. The various switches, &c., are mounted in the usual manner on a slab screwed down to the box. This slab would normally be of ebonite ; in the present instrument it is, however, made of three-ply white wood blacked over. The coupling coils are mounted, instead of on ebonite, on tubes of papier-mâché with white wood ends, and the windings are insulated with silk without any rubber. The terminal clips by which the dry cell is connected into circuit are mounted on what appears to be a poor quality of ebonite fixed to a wooden cylinder. The buzzer is mounted on a small disk of stoneware, and the connecting leads are insulated with paper. The variable condensers are not cut out of the solid aluminium, as in the best practice, but are composed of thin sheets of aluminium cast into corner blocks of babbit metal. All nuts and terminals are of gunmetal. The only ebonite that is used is in the knobs of the switches, and the thin graduated sheets mounted on the surface of the board indicating the positions of the various switches. The dry cell, instead of being sealed up with pitch, is closed at the top with four layers of cardboard.

Compensation Claim.—At Bolton County Court last week, compensation was sought from the Bolton Corporation for the death of John Clough, an assistant turbine engine driver at the electricity works, who died by drowning on January 25th. It was contended that he met his death in the course of his employment, but Mr. G. Jordan, for the respondents, cross-examined to suggest that it might be a case of suicide. Judge Spencer Hogg reserved judgment.

German Accumulators.—An accumulator, salved in May, 1918, seems to be of normal construction, and affords no evidence of shortage of materials. Its construction, however, is interesting as regards the method of allowing gases to escape, and returning spilt liquid into the cells. The battery consists of two cells in closed boxes of celluloid within an outer case of ebonite. The cells are separated by a small compartment with which communication is effected through both cells by glass tubes at the opposite ends of the cells, passing into the middle compartment, and dropping down to about three-quarters of the depth at the ends of the compartment, remote from the ends of the cells at which the glass tubes start. The middle compartment is provided with a vent so that gases can escape from both the cells through the central vent. Any liquid that accumulates in the middle compartment is returned to the cells by the siphon action of the glass tubes. The plates are held apart only by the action of combs of celluloid across the tops of the plates.

Big Conference of German Technicians at Eisenach.—For the first time delegates from all the engineering institutes, trades and schools in all parts of the Empire except the occupied districts met in conference in Eisenach on February 5th. Among those who attended were the Postmaster-General, the president of the Württemberg Technical Association, the presidents and delegates of the great mining technical organisations, and representatives of the German Engineers' Association, the Electrical Engineers' Society, various chemical associations, the Society of Architects, the Railway and Postal technical officials, &c. The conference is a result of the Revolution, which strengthened into action the long-entertained idea of a meeting of the entire German technical interests. The conference proceeded to settle its organisation, especially the statutes and lines of action of the association. It proposed that technical knowledge should have some part in all school programmes of study, and that in the high schools of other professions some instruction in technical affairs should be given; further, that the people should be made familiar with the working and importance of technical ideas for economy and culture, and technical experts of the necessary personal capability and knowledge should have more share than before in the work of public bodies with the powers of full members. The Association will also undertake to further the civil and citizen rights of its members and adherents. It has already achieved success in that among the members of Parliament elected since the Revolution, the number of technical engineers has increased tenfold. These have been in many cases consulted by the Foreign Office in the consideration of the peace conditions and their influence is on the increase. The limits of their competence were, however, clearly recognised by the conference, and the statement was applauded that great questions must not be regarded only from the technical standpoint. Great anxiety was evinced over the terms imposed by the Entente for the prolongation of the armistice, and the conference passed a resolution for transmission to the Government and National Assembly in Weimar, pointing out the great dangers of such concessions as the handing over of locomotives and agricultural machines, and asking that such pledges should not be made without previous consultation with the technical experts.—*Frankfurter Zeitung*, February 18th.

Accidents to Steam Turbo-Alternators.—A Sub-Committee of the "Union of Electrical Syndicates" has reported on the means for restricting accidents to turbo-alternators, says the *Revue Générale de l'Electricité*.

According to the evidence collected it appears that the machines that heat most are subject to the most frequent breakdowns, even if they are for moderate voltages and are protected from short circuits by external choking coils. It is, therefore, important that more attention should be paid to the question of overheating than hitherto. Machines for more than 10,000 volts seem to be too sensitive, and if higher transmission voltages are necessary, it is desirable to consider the use of autotransformers to double the generator voltage. An advantage of using transformers lies in the absence of the need for external choking coils. For very large alternators the voltage should be limited by the employment of a reasonable number of slots and two conductors per slot.

The usual statement that short-circuit currents are limited by added reactance is a fallacy. The added reactance must be in the leakage circuits of the stator and rotor, and external reactance does not reduce the instantaneous short-circuit current. Designers should therefore take steps to increase the leakage reactance of the machine and dispense with external current-limiting reactance.

The insulation of turbo-alternators should be of a higher grade than that of the general run of machines, and the interstices should be filled with impregnating material that remains solid at 100 deg. C. The insulation tests should be taken at 2.5 times the normal voltage for generators destined for use in generating stations where the liability to accidents is normal, and at three times the normal voltage, if there is reason to suppose that the machine will be subject to abnormal stresses owing to the nature of the line to be served. The insulation between various sections of the winding should be tested during construction at the normal voltage of the machine.

Temperature indicators (thermo-electric or resistance) should be built into the windings at positions that are enumerated.

The committee is of opinion that the suggestion to subject finished sets to sudden short-circuits offers more disadvantages than advantages. The limitation of the consequences of a breakdown should be effected by devices for shutting off air circulation and injecting steam or some non-combustible gas. It is useful to provide excess voltage relays for automatically opening the field circuit, rather than the armature circuit, when a short circuit occurs.

New Zealand Water-Power.—The hydro-electric scheme for the North Island was submitted to the New Zealand Parliament on November 29th. The scheme was prepared by the late chief electrical engineer, Mr. Evan Parry, and provides for three large generating stations to distribute energy to the whole of the North Island. The sources of power to be used are the rivers Mangahao, Waikaremoana, and Arapuni. It is proposed to supply energy to every householder on the island, every industry requiring power, and also for main-line railway electrification. For this purpose a supply of 160,000 H.P. would be required, to be generated as follows: Arapuni, 96,000 H.P.; Waikaremoana, 40,000 H.P.; and Mangahao, 24,000 H.P. This would be equivalent to one-fifth horse-power per head of population. The length of transmission lines would be 1,421 miles, with 29 sub-stations, and the scheme would be capable of further development later. The total capital expenditure is estimated at £7,599,441, including interest during construction and financial assistance to local authorities. Capital charges are put at £547,728 per annum, and working expenses at £200,000.

A similar scheme for the South Island has not been worked out, but would consist of a system of power stations linked together, and would cost less than the North Island scheme.

The question of railway electrification, says Mr. Parry, is already urgent, and in course of time an electric service on both road and railway will be a necessity; there is no question as to the advantages of electricity where frequent service is required. Another branch of electric haulage which may have an important effect on the future of New Zealand is the provision of light railways for agricultural purposes.

Referring to the distribution of power, the report says that it would be possible to supply the whole of the North Island from one central generating station, but this would not be the best method. Energy can be transmitted at 100,000 volts up to 150 miles without serious difficulties, but greater distances give rise to trouble. It is laid down that, as a general rule, it would pay to develop any sources of power yielding 20,000 H.P. or over on a 50 per cent. load factor, at a cost of £20 per H.P. or under, as an alternative to transmitting energy 130 miles from another source.

The scheme does not provide for large special metallurgical processes, but is confined to the ordinary lighting, heating, and industrial load, with limited amounts for railway electrification, electrochemical and electrometallurgical industries.

The development of the Waikato district would entail heavy expenditure in the initial stages, and would take some time to carry out; this could be obviated by the acquisition of the plant of the Waihi Co., at Hora Hora, which is at present only working at half its capacity.

The power from the Mangahao River would be obtained by diverting the water by means of tunnels and pipes of a total length of about three miles, and there would be a fall of about 900 ft. at the power station. The complete installation is estimated to cost £438,654, or £18.3 per H.P. delivered on the main transmission lines.

In connection with the development of Lake Waikaremoana, it is proposed, as a first stage, to divert the River Waikaretaheke into Lake Kaitawa, and thereby obtain 29,000 H.P. This scheme could be extended to produce 156,000 H.P., but is a long distance from any load, and it is only proposed to develop 40,000 H.P. The cost is put at £544,369, or £13.16 per H.P.

For the Auckland and main trunk supply, and the bulk of the Taranaki supply, alternative schemes have been selected at the Arapuni Gorge and the Waikato River, of which the Arapuni is the better, provided the construction of the big dam is practicable. This scheme would produce 162,000 H.P., but only 96,000 would be required for the present purpose. The cost of the power station is put at £1,078,700, or £10.78 per H.P., and if the scheme were extended to produce 162,000 H.P. the cost would be £1,426,707, or £8.78 per H.P.

Another scheme is for the development of the Ariatia Rapids, but this does not fit in with the general scheme; by the construction of a dam a fall of 175 ft. could be obtained, which would produce 135,000 H.P.

The transmission lines provided for are of the suspension type, on ironbark poles, with steel towers in special places. A considerable part of the total length of 1,421 miles would go across country, and would be of a substantial type; the cost is estimated at £1,795,240. The main sub-stations would transform energy down to 11,000 volts for transmission to smaller sub-stations, which would supply the local authorities and power users. The cost of the main sub-stations would be £838,808, and of the secondary sub-stations and distribution lines, £2,056,000. All the estimates are prepared on the basis of a 12 per cent. increase on pre-war prices.

It is proposed to provide a fund to assist local authorities in increasing the load by advancing money on loan, and to assist manufacturers in the installation of electrical plant.

The estimated total capital expenditure per H.P. is £45.63, which compares with £50 per H.P. for the Lake Coleridge scheme, the success of which is already assured.

The Minister of Finance said that a Bill would be presented providing for the whole scheme, but at present no labour was available.

Exhibition of Electromedical Apparatus.—The exhibition organised by the British Medical Association, and held at the Imperial College of Science and Technology, South Kensington. was closed on Friday after a successful run of three days. There was much of interest both to be seen and heard, though chiefly from the medical rather than the electrical point of view. A number of interesting papers were read and demonstrations given at the various London hospitals in connection with the exhibition in the sections of surgery, medicine, preventive medicine, and pathology. A demonstration of X-ray apparatus was given on Friday afternoon at the War Office X-ray Laboratory, Fulham, and amongst the exhibitors of electromedical apparatus, embodying the latest advances in X-ray technique, were Messrs. Harry Cox and Co., Ltd., and the Medical Supply Association.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials. — The Sunderland T.C. has advanced the salary of the electrical engineer (Mr. A. S. Blackman), from £1,000 to £1,200.

Mr. A. W. Annets, borough electrical engineer at Morecambe, has resigned.

The Carlisle T.C. has increased the salary of Mr. H. P. Baynham, chief assistant engineer at the electricity works, to £225 a year. plus 35 per cent. war bonus, as from February 11th last.

The Malvern U.D.C. has increased the salary of the gas and electrical engineer (Mr. Trow Smith) to £475 per year.

The Reading T.C. has increased the salary of Mr. F. H. Glover, works assistant engineer of the tramway department, from £180 to £192 a year ; and that of Mr. R. J. Fardell, chief clerk, from £180 to £200.

The Gillingham (Kent) T.C. has increased the salary of the chief assistant engineer at the electricity works (Mr. D. W. Ritson), to £200 a year, exclusive of war bonus.

The Bradford City Council has approved the increase of the salary of the City electrical engineer (Mr. Thos. Roles), by £250 per year to £1,250, and also the advance to the deputy electrical engineer.

The Accrington Corporation Electricity Committee has recommended that the salary of the borough electrical engineer (Mr. A. W. Clegg) be increased by £100. His present salary is £500, and the increase is conditional that he remains with the Corporation for at least two years.

General. — Major Gerald Hooghwinkel, R.F.A., M.I.E.E., M.I M.M., of Messrs. Hooghwinkel, Anthony Brown and Partners, consulting engineers, has recently arrived home from France on demobilisation. Major Hooghwinkel joined the R.F.A. in 1914, and, after training, went to Gallipoli in 1915. He subsequently saw active service in Egypt, Salonika and France, remaining there until recently. He is taking up his consulting practice again after 4½ years' absence. Capt. Anthony Brown is still on General Allenby's staff in Egypt, but hopes to return soon. He went with his regiment to India in 1914, and acted as A.D.C. to the Viceroy for three years. The firm has recently opened a branch office in Paris, and is interested in reconstruction schemes in France and Belgium.

Sir Adam Nimmo, K.B.E., has resigned his position in the Coal Controller's Department.

Mr. J. L. H. Cooper, B.A., has resigned his position as assistant resident electrical engineer of the Great Central Railway Co., at Immingham and Grimsby Docks, and has commenced practice as a consulting electrical engineer at Grimsby and district. His business address will be Royal Dock Chambers, Grimsby.

Mr. A. Black, power superintendent, Messrs. J. & P. Coats, Ltd., Paisley, has been appointed chief engineer at Manor Mills, of the Dunlop Rubber Co., Ltd., Birmingham. He takes up his new duties early in May, and will be glad to receive latest catalogues and lists from manufacturers of steam, hydraulic and electrical plant and equipment, and all accessories connected therewith.

A complimentary dinner and presentation to Mr. D. G. Sumner, of Messrs. L. E. Wilson, electrical engineers, Manchester, took place on Thursday, April 10th, at the Midland Hotel, Manchester, to celebrate his safe return from Persia, for the second time, and also to mark the successful completion of the important electrical work undertaken in that country. A number of guests from the East were present.

Roll of Honour.—The Military Medal for conspicuous bravery in Mesopotamia, has been awarded to Lance-Corporal W. Siddle, who was, prior to the war, on the Corporation electricity staff at Warrington.

Obituary.—Mr. A. J. Walter, K.C.—We regret to learn that Mr. Arthur James Walter, K.C., was killed on the London Underground Railway on Wednesday last week. The *Times* very correctly observes that both the Bar and Science have suffered a great bereavement by his death, for he was pre-eminent among barristers learned in patent law and scientific matters, and for many years was in demand for cases in which these two specialised and highly technical subjects were involved. He had a private laboratory in which he indulged his scientific tastes in connection with electricity and chemistry. He will be remembered by our readers from his appearances in well-known electrical patent litigation, including the Marconi patent cases. Mr. Walter was an associate of the Institution of Electrical Engineers, since 1899, and had served as a member of the Council. When his death became known in the High Court, both Bench and fellow counsel alluded in terms of high praise to his exceptional qualifications and attainments and spoke of the great loss sustained by the death of so brilliant a man.

The death is announced from Bodenbach, Austria, of Herr Carl Borchardt, director of the Oesterreichische Bergmann Electricitätswerke.

Sir William Crookes.—The Institution of Electrical Engineers was represented at the funeral service for the late Sir William Crookes, O.M., F.R.S., past president, by Mr. C. H. Wordingham, C.B.E., president ; Colonel R. E. Crompton, C.B., Mr. W. M. Mordey, and Prof, J. Perry, F.R S., past presidents ; Mr. J. Devonshire, Sir R. Hadfield, Bart., F.R.S., Mr. W. Judd, and Mr. A. P. Trotter, members of Council ; Mr. R. D. Grieves (representing Sir John Snell), past president ; and Mr. R. Tree representing Mr. Rowell, the secretary.

Wills.—Sir Guy Calthrop, the late coal controller, left £15,300.

The late Mr. Wm. Cordrey, governing director of W. H. Willcox and Co., Ltd., left £137,354.

CITY NOTES.

New York Traction Difficulties. The following interesting comments are reproduced from the *Times* financial column: "There have occurred two new receiverships among the traction companies of New York City—both foreseen, and to some extent discounted. The New York Railways Co., which is the subsidiary of the Interborough Consolidated Corporation, controlling most of the surface roads on Manhattan Island, gave up the fight against an increasing deficit on March 19th; the parent company followed it into a receiver's hands two days later. So far the money-maker of the combination, the Interborough Rapid Transit Co., has kept out of the courts; but it, too, is having a struggle to keep its head above water. When it passed its March dividend it brought into question the payment of interest on the Interborough-Metropolitan 4½ per cent. bonds, falling due on April 1st. These bonds were exchanged, originally, for Interborough Rapid Transit stock, on the basis of $200 in bonds for $100 in stock, and as the Rapid Transit Co.'s annual dividend was 9 per cent., the receipts from this source exactly met the bond interest. Officers of the Interborough Consolidated Corporation were frank to say, even before that company went into a receiver's hands, that the Interborough-Metropolitan April interest could probably not be paid, and a protective committee for the bondholders has been formed with the Guaranty Trust Co. as depositary. The Interborough Rapid Transit Co., it should be said, controls the ordinarily very profitable subway and elevated road systems of Manhattan, and a part of the systems in Brooklyn. Its only rival in Brooklyn is the Brooklyn Rapid Transit Co., which went into receiver's hands some time ago. The troubles of all New York City's traction companies are the same. In the numerous consolidations to which they have been subject their capitalisations have been swollen out of proportion to their real worth, and the inherent weakness of their financial structure has been brought out by the present era of high costs of labour and materials. Through war-time delay in completing new subways, in which large amounts of money have been sunk, the contracts with the city government have been thus far profitless. There is owing to the Interborough organisation alone, on account of its preferential right to earnings from subways, more than $6,000,000. The city government has consistently blocked every effort on the part of the traction companies to increase their rates of fare, for reasons that are almost entirely political, having mostly to do with municipal ownership programmes."

Companies to be Struck Off the Register.—The following are to be struck off the Register within three months unless cause is shown to the contrary :—

Acousticons, Ltd.
Defries, Ltd.
Derby Boiler Co., Ltd.
Electrical Industries Development Co., Ltd.
Electric Hiring Syndicate, Ltd.
Electro-Chlorination Syndicate, Ltd.
Tube Cleaners, Ltd.

London Electric Railway Co.—The "Financier" states that the directors have decided to petition Parliament for leave to introduce a late Bill, mainly for the purpose of raising money to construct the works authorised in 1913 and 1914, in addition to the capital then authorised for those works. The money required will be raised by the issue of £1,000,000 new debenture stock.

Prospectuses.—*Major & Co., Ltd.*, who have been carrying on business as chemical manufacturers at Hull, and have produced various products including fuel oil, wood preservatives and electrode carbon, have been offering for subscription at par 100,000 7 per cent. cumulative participating preferred ordinary shares of £1 each. The money is required to provide additional working capital for the extending business, and redeeming the 5½ per cent. debentures.

Fuller's United Electric Works, Ltd.—The list is to close on April 23rd in an offer for sale of 200,000 8 per cent. cum. participating preference shares of £1 each at 21s. per share. Reference is made to the matter in our "Stocks and Shares" Letter to-day.

Western Power Co. of Canada.—Report for 1918 states that operating revenues amounted to $448,709, against $450,160, and operating expenses to $163,418, against $130,559, net operating revenues being $285,291, against $319,601, and gross income $294,078, against $331,793.—*Financial Times.*

Rhondda Tramways Co., Ltd.—Preference dividend 6 per cent. (being 4 per cent. for 1913 and 2 per cent. on account of 1914); £10,000 to renewals and reserve; £1,044 carried forward. The gross revenue for 1918 was £98,862, against £82,255 for 1917. The passengers carried were 13,926,707, against 12,865,806 for 1917. The average receipts per c.m. were 16.73d., against 13.87d.; receipts per passenger 1.67d., against 1.50d.

Lancashire Dynamo & Motor Co., Ltd.—A further dividend of 5 per cent. has been declared, making 10 per cent., free of tax, for 1918. The *Financial Times* states that for each of the three preceding years 12½ per cent. was paid on the capital as it then stood, 47,551 ordinary shares having been issued in April, 1918.

Stock Exchange Notice.—Application has been made to the Committee to allow the following to be quoted in the Official List:—

British Westinghouse Electric & Manufacturing Co., Ltd.—185,000 additional 8 per cent. cumulative preference shares of £2 each, fully paid (Nos. 500,001 to 685,000).

Consolidated Electrical Co., Ltd.—Income for year ended March 31st £5,846; net, £3,750, plus £2,947 brought forward. Dividend on ordinary shares, 2½ per cent.

Vickers, Ltd.—The 1918 accounts are not yet completed, but a final dividend is recommended on the old ordinary shares of 1s. 6d. per share, equal to 7½ per cent., free of tax, making a total of 2s. 6d. or 12½ per cent. The holders of the new ordinary shares are entitled to a final dividend at one-half the above rate, namely, 9d. per share, or 3¾ per cent., free of tax.

London United Tramways, Ltd.—Last week the Chancery Court sanctioned the scheme of arrangement and reduction of capital which had been adopted by the different classes of holders. There was no opposition.

Anglo-American Telegraph Co., Ltd.—Interim dividend for quarter 15s. per cent. on ordinary and £1 10s. per cent. on preferred, less tax.

Electrical Utilities Corporation, Ltd.—Quarterly dividend of 1¾ per cent. on preference shares.

STOCKS AND SHARES.

Saturday Morning

Near advent of the Easter holidays has made little difference to Stock Exchange markets. The booming conditions in oil shares have stimulated animation elsewhere. Industrials enjoy high popularity. Labour bogeys have been pushed unceremoniously into the background. Investors are taking new issues with marked freedom. Quick premiums are established upon sound shares. Midland Power Distribution preference are 5/32 premium in Liverpool and, if anything, rather better in London. Intangible rumours hint at a few of the electricity supply companies coming into the market for fresh funds. We, of this column, cannot trace any foundation for such reports, but they are not inherently improbable, and when capital is manifestly complacent to lend, there is seldom a dearth of borrowers.

East London Railway ordinary stock has suddenly come to life, and a fair amount of business developed in the stock about 4⅜ to 4½. The debenture stocks have not moved, the third and fourth being quoted 18½ and 12 respectively. City and South-London ordinary was last dealt in at 12, on February 2nd, 1918! For that year the company paid 1⅜ per cent. on its ordinary stock, comparing with 1¼ per cent. on Metropolitan Railway Consolidated, which stands at 26½, while Districts, now 23½, have received nothing for 37 years. When the new capital is provided for reorganising the rolling stock, &c., of the City & South-London, the company should have at least a chance of greater success. There is no lack of traffic, as passengers know to their sorrow.

Underground Electric income bonds have risen to 96. With the Budget coming on April 30th, the demand for tax-free dividend stocks is quickened, and this explains further small improvements in the Eastern Telegraph group. Attention may be drawn to Telegraph Constructions, which at 24 yield 5 per cent. net on the money, equal to 7⅛ per cent., allowing for tax at 6s. in the £. Recently divided by two, on the doubling of the share capital, the possibilities are in favour of an increase in the dividend, and the security offered by the shares as a sound investment is undoubted.

After rising to a shade above £5, Marconis gave way as earlier buyers elected to take their profits. The price slipped back to 4 13/16, but fresh support came in, and the market regained buoyancy. Marconi Marines have also rallied, and a further improvement is anticipated by the speculative brigade upon the shares being quoted ex the rights offered by the new issue. Canadian and American Marconis are both rather heavy: the former suffer from having been overbought on a Stock Exchange tip circulated when the price stood about 16s. It is now 15s. 9d.

Indian Tramway shares are in request, and Calcuttas have hardened to 7¾. The 5 per cent. preference are 4, and the 4½ per cent. debenture stock is 71, as against 99½ upon the outbreak of war. Madras Electric Tramways 6 per cent. preference have firmed up to 4¼, and the company's 5 per cent. debenture stock is 86. Rangoon 6 per cent. preference are also about 4⅛. The Brazilian Tramway bonds show a dullish tendency. Rio firsts and seconds are both ½ lower at 91½ and 81 respectively. Mexican Utilities have hardly moved. British Columbia Electric issues remain flat. Canadian Tramway descriptions were unaffected by threats of strikes.

The manufacturing group keeps very steady, but there is no outstanding feature of interest. Underwriters say they are being offered plenty of stock for after-Easter. A rally amongst rubber shares deserves notice, but the price of the produce is still just under a florin per lb. Golfers wonder why the price of golf balls is maintained at the level to which it was advanced when rubber rose to 10s., and over, per lb. Rubber has dropped to 1s. 11¾d., but golf balls are dear as ever. The iron, steel, and armament lists are better, for choice, on the settling-down of Labour conditions in the industrial areas.

The prospectus is now published of Fuller's United Electric Works, Ltd., and 200,000 8 per cent. cumulative participating preference shares of £1 each are offered for sale at a guinea apiece by Messrs. George Clare & Co., Ltd., of 9, Old Broad Street, E.C. The company has acquired four companies in the electrical business, making, amongst other things, accumulators, primary batteries, electric wire and cable, and miners' electric lamps. Details of the company's assets, together with a profit statement for each of the past three years, are furnished in the prospectus.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price April 8,		Yield
	1917.	1918.	1919.	Rise or fall.	p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	7½	—	£6 8 0
Charing Cross Ordinary	4	4	3½	—	5 14 4
do. do. do. 4½ Pref...	4½	4½	3⅜	—	6 13 4
Chelsea	5	8	3¾	—	4 1 1
City of London	8	8	11⅞	—	6 14 8
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅝	—	6 11 0
do. do. 6 per cent. Pref.	6	6	9⅜	—	6 8 1
Kensington Ordinary	7	6	5⅞	—	5 2 2
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref...	5	6	3⅞	—	7 14 10
Metropolitan	4	5	3¼	·	7 13 10
do. 4½ per cent. Pref. ..	4½	4½	3¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅛		7 0 4
South London	5	5	2⅞	—	6 19 4
South Metropolitan Pref.	7	7	20/6	—	8 18 7
Westminster Ordinary	9	8	6⅝	—	6 0
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	99½	—	6 0 7
do. Def.	1½	83/5	21⅞	—	7 18 0
Chile Telephone	8	8	7⅜	—	5 8 6
Cuba Sub. Ord.	7	7	11	—	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	161½	—	*4 19 0
Globe Tel. and T. Ord.	7	7	14½	—	*4 18 7
do. do. Pref.	6	6	10½	—	5 14 6
Great Northern Tel.	22	22	81	—	7 2 0
Indo-European	13	13	67½	—	5 18 0
Marconi	20	20	5	—	4 0 0
Oriental Telephone Ord.	10	15	2 7/16	—	6 3 0
United R. Plate Tel.	8	8	7⅛	—	*5 1 7
West India and Panama	1/3	1/3	1⅝	—	*3 17 0
Western Telegraph	8	8	16¾	—	*4 16 10
Home Rails.					
Central London Ord. Assented ..	4	4	62½	—	6 8 0
Metropolitan	1	1¼	26½	—	4 14 7
do. District	Nil	Nil	23½	—	Nil
Underground Electric Ordinary..	Nil	Nil	8¼	—	Nil
do. do. "A" ..	Nil	Nil	9/3	—	Nil
do. do. Income ..	4	5	94½	—	*5 5 10
Foreign Trams, &c.					
Adelaide Sup. 8 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	3¼	—	—
do. do. 2nd Pref. ..	—	—	3¼	—	—
do. do. 5 Deb... ..	5	5	67½	—	7 8 6
Brazil Tractions	—	—	56	—	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62	—	8 0 0
do. do. Preferred	Nil	Nil	40	—	Nil
do. do. Deferred	Nil	Nil	41	—	Nil
do. do. Deb. ..	4½	4½	61	—	6 19 1
Mexican Trams 5 per cent. Bonds..	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	63	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	68	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3¾	—	4 0 0
British Aluminium Ord.	10	10	1	—	5 16 8
British Insulated Ord.	25	12½	2	-	6 5 0
British Westinghouse Pref. ..	7½	7½	2¼		6 3 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5½	—	6 8 10
Castner-Kellner	25	20	3¼	—	6 8 1
Edison-Swan, "A"	—	—	1 1/16	—	7 5 6
do. do. 5 per cent. Deb. ..	4	5	75½	—	6 12 8
Electric Construction	10	10	1½	—	8 0 0
Gen. Elec. Pref.	6	6½	10⅜	—	6 5 4
do. Ord.	10	10	17⅞	—	*5 12 0
Henley	25	25	2 5/16	—	6 8 2
do. 4½ Pref..	4½	4½	4	—	5 12 6
India-Rubber	10	10	16¾	—	*5 19 3
Siemens Ord...	—	10	6⅝	—	*7 11 0
Telegraph Con.	20	20	24	—	5 0 0

Dividends paid free of Income Tax

"RULES" IMPOSED BY ELECTRIC SUPPLY AUTHORITIES.

By CHARLES A. BAKER, M.I.E.E.

The "rules" to which attention is directed in this article are those imposed by the electric supply authorities upon the consumers, under the various titles of regulations, terms, conditions, &c., and any criticism, comment, or suggestion is directed to such "rules." The supply of electricity is largely governed by regulations and conditions made by the Board of Trade, under section 6 of the Electric Lighting Act, 1882, for securing the safety of the public, and for ensuring a proper and sufficient supply of electrical energy; it is not the intention of the author to discuss these regulations, but they are referred to from time to time, and in such cases are read as parts of the Act to which they refer.

The subject is the common ground where the vendor of electrical energy meets the purchaser or consumer, whilst wiring contractors and manufacturers of all descriptions of electrical appliances are interested because every new consumer attached to the mains means new business. Many of the electric supply managers and engineers get a perspective view of the subject which is taken at too close a range, they generally demand that "rules" laid down by themselves be accepted; it must not be forgotten, however, that the Acts authorising the supply of electricity establish in a measure the grant of a monopoly or an "area" for the conduct of business wherein opposition is strictly limited, and clearly defined obligations are imposed in order that the public may benefit by the undertaking. The consumers have very substantial rights, which they are under no compulsion to sign away in order to obtain a supply of electrical energy.

It can, I believe, be shown that the deletion of some "rules" will benefit the industry and remove difficulties, encouraging rather than discouraging consumers to be connected up to the supply mains; if existing "rules" assisted in economy, low price, or security of supply, no word should be raised against them, nor should any substitute for them be permitted which might derogate from economical working.

It should not be assumed as a result of perusing this article that the electric supply authorities are all generally taking advantage of their consumers; the "rules" which are quoted are from different sources, and it is not suggested that any supply authority's form of agreement embodies all the bad points herein noticed, whilst some of the agreements may not embody any of them; uniformity and simplicity are, however, as desirable in this as in many other matters.

Whilst taking part in the discussion of Mr. Seabrook's Institution paper on "Residence Tariffs" in 1912, the author referred to the subject of "rules" in very plain though condensed language (*vide* I.E.E. *Journal*, Vol. 48, p. 419); several members of the Institution also mentioned the subject during Mr. Ferranti's presidency, whilst taking part in the discussion on "The Causes Preventing the more General Use of Electricity for Domestic Purposes." There can be no doubt that a cumbersome application form involving a lengthy agreement is a stumbling block; the incautious consumers are prone to take for granted that what they are asked to sign is exactly what everybody else has signed, which, as a matter of course, has been carefully examined by the police or some other central control body which watches over their general security, so it is sure to be all right, and therefore they need not trouble to read it; whilst the cautious consumer is annoyed and frightened, annoyed at being obliged to waste the time necessary to read through and grasp the relative bearing of a lot of clauses, and frightened at the way he finds that he is asked to put himself into the hands of the other part to the agreement. There remains the class of consumer who is big enough, and bold enough, to look after himself; he strikes out all or most of the clauses, or employs his solicitor to draft a simple notice requiring the supply authority to give a supply by a definite date in accordance with the terms of its Provisional Order, and he gets the supply which he is entitled to.

The Incorporated Municipal Electrical Association drafted and revised in 1914 "Model General Conditions for Supply of Electrical Energy," consisting of 16 clauses with blank spaces for filling in "local regulations" and "local clauses." Up to the point when a Provisional Order is granted to some person or company it is safe to assume that the interests of the public, whom the Provisional Order is intended to benefit, have been carefully watched and guarded by a competent tribunal and its officials; to *vary* the terms of such Provisional Order by a subsidiary agreement is a proceeding that should generally be avoided by the public because it is dangerous.

It may be stated generally that although some electric lighting Provisional Orders contain special clauses, yet all granted in and since 1889 are in the same model form; this model in 1899 assumed concrete form as the Electric Lighting (Clauses) Act.

The Provisional Orders clearly set out that the supply authority is bound to lay mains on being required to do so and to supply energy; any person requiring a supply must serve a notice upon the undertakers, specifying the premises in respect of which the supply is required, and the maximum power required . . . and if required by the undertakers, enter into a written contract to continue to receive and pay for a supply for a period of at least two years . . . and give security for the payment; if the occupier uses any form of lamp, &c., in a manner so as to interfere with the efficient supply to any other person, the undertakers may discontinue to supply energy to those premises; the undertakers shall not be compelled to give a supply unless they are reasonably satisfied that the electric lines, &c., are in proper order. On the other hand, the supply authority must not prescribe any special form of lamp or burner, and every person is entitled to a supply on the same terms on which any other person is entitled under similar circumstances to a corresponding supply, and the supply authority must not show any undue preference.

Here, then, is the basis for a written contract—and, as far as I can find, the only basis—which is intended to give the supply authorities reasonable financial security for the cost of the work done in connecting the consumer, and for the value of the energy supplied, and the right to verify that a consumer's installation is in reasonably good order to prevent any abuse of the service which might be detrimental to other users, whilst the supply authority must not exercise any voice in the form of consuming device employed, and must treat all consumers alike.

In practice what happens, as is well known, is that, when an individual or firm desires to become a consumer, an "application form" is sent to him by the supply authority; such application forms generally vary for each particular supply authority—there is a noticeable absence of uniformity amongst them—but they are usually drafted on such lines that by signing the application form an agreement is entered into containing clauses which do not come within the basis of the written contract already adumbrated.

My experience of these documents is principally in connection with those of the supply authorities of London and the neighbourhood, but I have had the opportunity of perusing a considerable number of similar documents issued from provincial centres, and from the consumer's point of view there are usually clauses squeezed in which in justice ought not to be there, or, if there at all, should be modified in tone. I do not find that any of these "rules" purport to be imposed under any specific clause of the respective Supply Authority's Acts, nor is there any indication that they have been approved by the Board of Trade. In other matters the author has found that the Board of Trade, before approving rules, requests that due notice of the intention to make rules shall be advertised, and any parties desiring to raise objection are given a hearing, but no such reasonable and fair opportunity has ever been given to the consumer of electrical energy in regard to the "rules" imposed by the majority of the supply authorities. If some of the "rules" were put forward as suggestions, a principle which has been adopted in a few cases, they might be found deserving of considerable merit whereby the consumer would benefit if he so desired, but a suggestion and a rule are very different things. The authority which imposes a rule without the right to enforce it places itself in a most unenviable position; this position has perhaps been created in some instances by the interference of the secretary or town clerk or other official concerned in the undertaking with the duties of the manager or engineer of the electric supply authority, or one or more of the directors or town councillors may have suggested that a water or gas or other commercial undertaking with which he was associated found a certain rule useful, and therefore applied it to the electrical undertaking without regard to the fact that the latter is a statutory undertaking, with important duties to the public, and with strictly limited powers in the direction of imposing rules.

Whilst dismissing any claim to legal knowledge, one must unfortunately approach this subject from the dry and uninteresting standpoint of the law, and on referring to the very excellent and comprehensive work by the late John Shiress Will "The Law Relating to Electric Lighting, Power, and Traction," I fail to find that the supply authorities have any power under the Electric Lighting Acts to impose rules upon the consumers who take a supply of electrical energy for domestic, manufacturing, or other purposes. (In the case of a supply at *medium pressure* the supply authority should see that Board of Trade requirements on the consumer's premises are carried out, but such a case is special, and need not be considered here.)

In the majority of the "rules," one or more clauses are to be found expressing conditions as to how the wiring of the premises is to be effected; it has been already pointed out that the supply authority cannot be compelled to give a supply unless satisfied that the electric lines, &c., are in proper order. This is amplified in regulation No. 29 of the Board of Trade, "for securing the safety of the public," which is as follows: "The undertakers shall not connect a consumer's wires with their mains unless they are reasonably satisfied that the connection would not cause leakage . . . exceeding one ten-thousandth part of the maximum supply current to the premises; and where the undertakers decline to make such connection they shall serve upon the consumer a notice stating their reasons for so declining." As an example of how this is interpreted by one of the supply authorities, I quote the following rule: "No installation will be connected to the distributing mains until it has been (1) tested and inspected, and (2) the supply authority's conditions of supply and the wiring regulations they enforce have been complied with. (3) At the time arranged for the test and inspection there must be in attendance to meet the supply authority's representative a representative of the wiring contractor capable of giving any information required respecting the installation. . . . (4) The wiring contractor must also provide any ladders or steps which may be necessary to make an examination of the work; (5) and if required, must remove all lamps from their holders for the purpose of a further test for insulation resistance between poles. The supply authority will test and inspect each new installation once, free of charge, but (6) if the wiring . . . be found to be defective or unfinished, or not to conform to the requirements, the defects, &c., must be remedied, and another inspection must be made. (7) All test orders after the first must be accompanied by a fee of 5s., in default of which they will not be acted upon. Electricity will not be supplied if (8) the installation does not comply with these conditions and the wiring rules of the Institution of Electrical Engineers, both as regards the manner in which the work has been carried out and the insulation resistance obtained on test." Such a "rule" forms an excellent example of an apparent underlying desire on the part of the supply authority to withhold giving a supply, to discourage any consumer wanting a supply; although the supply authority is established with a view to providing for a public necessity, it fences itself round with obstacles that may keep consumers off its mains.

The "rule" indicates (1) that the supply authority claims a right to go all over the premises of the consumer to inspect the installation, whatever the nature of the premises may be—a castle or a workshop; this is emphasised in a "rule" quoted later, and is a condition certainly never intended to be created by the Electric Lighting Acts, nor is it possible to justify any such procedure upon any ground of usefulness on the part of the supply authority. The right to test is admitted, but not the right of inspection as suggested in the "rule." The next point (2) raised by the "rule" concerns the supply authorities' conditions of supply and wiring regulations; under *neither* heading has the supply authority any right to make conditions or regulations. The "rule" proceeds (3) to compel the wiring contractor—a gentleman not referred to in the controlling Acts or Board of Trade Regulations—to attend and afford any information, and (4) to provide ladders, &c., and unless all this is done the installation will not be connected. (5) "If required all the lamps must be removed for a test between poles." The Board of Trade regulation, quoted above, refers only to leakage to earth which might interfere with the supply to other premises; no test between poles is, in the author's opinion, contemplated by the regulation. It is interesting to note that the new edition (1916) of the Institution of Electrical Engineers' Wiring Rules differs from the original rule on this point. Rule 129 (1916) introduces a test between poles which was not provided for in Rule 121 of the 1911 edition. Then (7) as to levying a fee—which is usually stated to be 5s.—for making a second test, I cannot find that any supply authority has the right to charge such a fee, and believe that such an imposition—if it ever is imposed—is illegal. The position is this: A consumer decides upon his installation, and in due course notifies the supply authority that he requires it to give him a supply at certain premises by a certain date of a certain maximum demand: on testing the installation the supply authority finds, let us suppose, a weak spot, and declines to connect: the weak spot must evidently be put right, and a new notice served upon the supply authority in exactly similar terms to the last one, with the exception of an altered date. The supply authority can come again and test if it pleases; but, unless there is good reason for continuing to decline to connect the consumer, it renders itself liable to a penalty under its Provisional Order if it fails to make the connection; and the non-payment of a fee —unauthorised by the Provisional Order—could never be accepted as a good reason for declining to connect an installation; the supply authorities are entitled to charge for energy supplied and for the supply or hire of meters, and in some cases for laying services, and for nothing else. One other point in the "rule" which invites attention is that requiring the wiring to be done according to the Institution of Electrical Engineers' Rules and insulation resistance figures. The Institution's Wiring Rules have everywhere received unstinted praise, and so far as the author is aware, no adverse criticism of them has been attempted—presumably, therefore, it is not possible—and if these excellent rules were *suggested*, by the supply authorities, a good service would be done to their consumers; but the supply authorities must not enforce these rules, they have absolutely no power to do so. It will at once be seen that the insulation resistance figures under the Institution of Electrical Engineers' Rules are not the same as those necessary under the Board of Trade regulation. Take, for example, an installation of 50 20-watt lamps; by the Institution of Electrical Engineers' Rule 129 (1916 edition) the insulation resistance should be 30 megohms divided by 50 points, or 600,000 ohms; by the Board of Trade regulation the maximum current taken by the 50 20-watt lamps would, if supplied at 200 volts, be 5 amperes, or at 100 volts 10 amperes. One ten-thousandth part in each case, converted into figures of resistance, becomes for 200 volts 400,000 ohms, and if the supply is at 100 volts, 100,000 ohms; and these figures alone must guide the supply authority in connecting up or declining to connect up a new installation. Some systems of wiring necessitate one pole being permanently earthed; provided that a double wound transformer is used there can be no objection on the part of the supply authorities to such systems of wiring, all that they need test is the primary winding of the transformer, the wires and fittings do not concern them.

(*To be concluded.*)

SEIZURES OF DIESEL ENGINE PISTONS.

By EDWARD INGHAM, A.M.I.Mech.E.

One of the principal troubles in the working of Diesel engines is seizure of the piston. When it is remembered how small is the clearance between the piston and the cylinder liner in such engines, it is rather surprising that cases of seizure are not far more frequent than they appear to be.

It is common knowledge that in a Diesel engine, small piston clearances are absolutely essential if a high efficiency and smooth running are to be obtained. The designer of the engine is confronted with the problem of reducing the clearance between the piston and the cylinder liner to within the smallest practical limits, without, at the same time, involving undue risk of seizure of the piston.

When seizure takes place, it is not difficult to realise that the results may easily prove disastrous; thus, if the motion of the piston be suddenly arrested, the energy stored in the fly-wheel tends to keep the crankshaft rotating, so that the crank exerts a severe pull on the connecting rod, with the result that the connecting rod or cross-head bolts are severely strained. Should the bolts fail, the consequences may be easily imagined. In one instance with which the writer is acquainted, where seizure of the piston caused failure of the cross-head bolts after elongating them and reducing their diameter from 1 in. to ⅝ in., the connecting rod was badly bent, and fracture of the piston and the cylinder liner resulted. One of the nuts from the broken bolts dropped and fouled the crankshaft and the engine frame, and as a consequence, a piece of metal was broken out of the frame, whilst the crankshaft, which had four double-sweep cranks, was twisted evenly throughout its entire length, the angle between the first and the last crank being about 15 degrees.

This example will serve to show how disastrous may be the effects of a piston seizure.

In a general way, it may be said that seizures of Diesel engine pistons are mostly caused by over-heating of the piston, and the expansion of the metal which results. As already pointed out, the clearance between the piston and the cylinder liner must be extremely small. If then a piston expands much more than the liner, the small clearance is reduced to such an extent that the piston cannot move freely, and seizure is the consequence.

The tendency to seizure is, of course, aggravated by the fact that in the ordinary trunk-piston engine, where the piston is attached directly to the connecting rod, the forces imposed on the piston do not, as in the case of the steam engine, act in the direction of the axis of the cylinder. Owing to the obliquity of the connecting rod, a more or less severe side pressure is exerted on the cylinder walls, so that the motion of the piston is not as uniform and free as it otherwise would be.

Clearly, if the trouble under consideration is to be obviated, it is of fundamental importance that the temperature of the piston be prevented from rising too high. Hence the question of lubrication must receive the most careful attention. Not only the piston and the liner surfaces, but the piston pin and the top bearing of the connecting rod must be efficiently and continuously lubricated. With the horizontal type of engine, lubrication of the piston and the liner surfaces can be effected satisfactorily by a single feed on the upper side, since gravitation assists in distributing the lubricant, but with engines of the vertical type, which is the type mostly used, the lubricant must be supplied through a number of feeds, as many as four in the smallest engines if a thorough distribution of the lubricant is to be effected.

Lubrication of the piston pin and the top end bearing is effected in different ways, which we need not consider here. Special care should be taken to ensure that the pin will be thoroughly lubricated at starting times.

When an engine is shut down, the heat radiated by the piston, pin, &c., has a tendency to burn up the lubricant in the top end bearing, so that when the engine is again started, the lubrication of the bearing may be deficient. Over-heating of the pin and the piston may then result, involving considerable risk of seizure. The great majority of piston seizures appear to have been brought about in this way.

With the object of preventing over-heating, some pistons are cooled by means of water or oil, and this is an effective method of reducing the risk of seizure, provided the circulation of the liquid is maintained.

The design of the piston is a factor of considerable importance in regard to this question of piston seizures. It must be such that the liability to distortion will be reduced to the minimum, since a very slight amount of distortion may lead to seizure. The design must also be such that expansion will take place uniformly all round the piston. There should be a good body of metal, as this will assist in the escape of the heat transmitted to the piston. Special attention should be given to the question of avoiding initial strain during casting, which might lead eventually to fracture. A fracture in a diametral direction would be especially liable to cause a seizure. It is common knowledge that most

Diesel engines are of the trunk-piston type, but Messrs. Mirrlees, Bickerton & Day, of Stockport, have introduced a cross-head type of engine. This type of engine is far less liable to piston seizures than the ordinary type. The provision of a cross-head, slides and piston rod, results in the piston's moving truly and freely in the direction of the axis of the cylinder, so that side thrusts are obviated. For this reason alone, the cross-head type of engine is an improvement over the trunk type, but there are other reasons. The connecting rod top end bearing, instead of being in the cylinder, where the heat is intense, is well away from the cylinder; hence there is less liability for the bearing and the piston to become over-heated. Further, the engine is provided with forced lubrication, so that every bearing is continuously flooded with oil. A small hand pump, which is fitted in connection with the lubricating system, enables all the pipes and bearings to be primed with oil just before starting up, and in this way, all bearings are copiously supplied with the lubricant from the commencement of the running.

Many piston seizures are to be attributed to the use of cooling water containing lime and magnesium salts. When there is a large quantity of these in solution in the water, the salts are liable to become deposited in the narrow water spaces, involving risk of overheating and fracture. The practice of allowing water to circulate for some time after the engine has been shut down will tend to prevent the deposition of the solid matter, which is mainly due to the increase in the temperature of the stationary water which takes place when the engine is stopped and the heat in the metal walls in transmitted to the water.

It will, of course, be understood that the tendency to piston seizures will be aggravated by overloading the engine, or by running it for prolonged periods, whilst lack of attention on the part of the attendant will also increase the tendency.

A PROGRESS MANAGER'S FIRST TALK WITH FOREMEN.

By W. J. HISCOX.

Gentlemen,—I have come into this factory, a stranger to you all, with one object in view—to facilitate progress so that, as nearly as possible, the maximum output is obtained. It has been recognised by your management that something is lacking; that, no matter how hard you work, the result does not come up to expectations. It has, therefore, been decided to introduce into the business a progress manager, a man who is prepared to overhaul and amend the existing organisation, with a view to giving you every facility for extending the production of your several departments, and ensuring that all the enterprise and all the effort you put into your work are taken advantage of, and not allowed to deteriorate through inefficient organisation.

It casts no reflection upon your ability or upon your enterprise that the management has decided upon this course. On the contrary, it has been recognised that too much has been expected of you in the past; that you have extended yourselves more than should have been necessary, in the endeavour to minimise, as much as possible, the ill-effects of faulty and defective organisation. The appointment of a progress manager, therefore, is as much in your interest as in the interests of the firm, for he will relieve you of all administrative and other duties not strictly within your purview, and that will enable you to devote your whole time to the supervision of your department, and to the problem of economical production, commensurate with the capabilities of your department.

That is your legitimate duty, and it will not be interfered with. Each one of you is, or should be, an expert in the particular line of business under your control. My business is to tell you what is required, and not how to meet those requirements. That is your affair. I can tell you what is expected of your department. You have to realise those expectations, or demonstrate, to the satisfaction of the management, that those expectations are impracticable.

In this connection I shall be the critic of the factory. I shall criticise (on behalf of the management) any department which, in my opinion, is not laying itself out to meet its commitments, and it will be up to you to disprove my statements. Such criticism will be quite impersonal, and utterly devoid of animosity. It will be actuated solely by the exigencies of production, which claims from you, as from me, every consideration. Calculations will not be based entirely upon theory, for it is recognised that shop conditions constitute a most formidable factor. Every consideration will be extended, and with the elimination of many of the vexatious details which in the past have had an adverse effect upon departmental efficiency, it is reasonable to hope that the working conditions will materially benefit.

Although, as may be expected, I shall be more directly interested in certain departments, my views will be directed to the broad aspect of progress. Being concerned with output from the factory, I look upon the factory as one huge department, and the departments as units, each of which excites my interest in proportion to the bearing it has upon the output of the factory. I am not prepared to extend preferential treatment to those departments which, in the eyes of the foremen, are my direct concern. On the contrary, I shall welcome your criticism, and I should certainly not take a lenient view of the act of any person within those departments which was calculated to affect adversely the efficiency of any other department.

During the short time I have been here, one fact at any rate has forced itself upon my notice, viz: That in this, as in every other factory where similar conditions prevail, the foremen and the administrative staff are at loggerheads, each side blaming the other for the unsatisfactory state of affairs existing. Taking it for granted that the organisation sadly needs improving, I am going to exercise my prerogative and criticise the foremen for what, in my opinion, is their contribution toward the present state of affairs. You will think this is decidedly premature, and I know that your method of answering will be by retaliation. I will, however, anticipate your answers, which will be somewhat on these lines:—

At the outset you will retaliate by telling me to put my own house in order. You will point to the imperfect organisation which exists; the blunders and the delays consequent upon the inefficiency of the stores and progress. You will tell me that, had you been content to remain strictly within the confines of your legitimate duties output would have suffered, machines could not have been kept running, and costs would have considerably increased, on account of the maintenance of partly employed mechanics. You will tell how you grubbed about for work, how you explored the stores, and discovered undreamed-of possibilities; how you invaded other departments and other sections, and actually carried work across to your own department rather than incur a delay by waiting for the parts in question to pass through the usual routine. You will tell me that, so far from you contributing to, or being responsible for, the present undesirable state of affairs, you actually went out of your way to combat it, and that the responsibility must, to a very large extent, be shouldered by the departments I most directly represent. To this I am bound to say that I agree with you.

It is, however, to raise these departments to a high degree of efficiency that I want your help. I want to study your existing system, and to consider its weak points. I want to find out where the system fails, and why it fails, and if possible to remedy the defect. To do this, however, I must have the co-operation and goodwill of the foremen. They must accept the fact that I am here to be of assistance to them, and I want them to realise that I *can* be of assistance to them. That is why I criticise. Criticism is the finest thing in the world to make a man tell what he knows. Take a police court case. The prosecutor (or the defendant) goes into the box and tells his story. He is then cross-examined by the opposing counsel, and it is really surprising what different points are brought to light—points which were wholly neglected (or only lightly dwelt upon) in the straightforward evidence. The evidence is the bald outline of the facts as they appear to the interested party. The cross-examination elicits the details, which may put a different complexion on the whole matter. So it is with criticism. The story of the administrative staff and the story of the foremen are diametrically opposed, but criticism reveals virtues and faults on both sides, so that the adjustment of the differences becomes a much simpler proposition.

Having gained (as I hope) the goodwill of the foremen, I will deal with the question of putting my own house in order, and at the same time endeavour to show to what extent the foremen are retarding that very desirable consummation. Taking, for the purposes of illustration, the stores department as the house to be put in order, I will first of all ask you to imagine yourselves in the position of a stores official.

You would find yourselves in a department catering for the needs of the entire factory. You would speedily discover that facilities for ensuring rapid progress were entirely lacking; that there was not sufficient accommodation for the volume of work pouring into the department, and that the class of labour you had to depend on was not by any means Grade 1. On account of the inadequate accommodation you would be obliged to house a portion of the work in temporary structures, and, although a correct record of the parts in question may be available, the chances are that many of them would be missing when required. Foremen and charge-hands, intent only upon the needs and interests of their own departments, would bombard you from morning till night; before you could get away on one job someone else would be cursing because you were not in a position to satisfy his needs at the moment. Work must be had for the shops, and the operators will not wait, for that would mean losing money. At the same time, work must be received into the stores, checked, and signed for, and there must be no delay here, otherwise the operator may have to wait another week for his bonus.

You cannot find this, and you cannot find that, so the foreman comes in to help you. He discovers something which will suit him just as well, so he takes a few of the articles away with him to make a start upon. As soon as possible you send the material out, without remembering, or perhaps without knowledge of, the few parts the foreman walked away with, and at a later date the cry is raised that the records do not tally with the actual stocks.

You get work into the shops, and some days afterwards you are informed that this part and that part is missing. You protest that the correct quantities were issued, but your protests are cut short by the foreman, who politely tells you that progress is being retarded, so you hand him a few extra articles, and again wonder in a few weeks' time why records and stocks do not agree.

Having experienced this (in imagination), does it not occur to you, as foremen, that you could do much to alleviate the troubles of the stores official? I do not want you to help him inside his department, but outside; and if I am to put my house in order I must have your co-operation and sympathy outside. A man digging a trench does not make much progress if someone on top will persist in shovelling the earth back again. And now to put the house in order—with your help.

In the first place, you will remain outside the stores. It may inconvenience you for a little while, but you will feel the benefit later on. The stores official must work out his own salvation inside. It is his responsibility to meet your requirements within a reasonable time; but he must be given reasonable time. Everything cannot be supplied on demand; there must be time for preparation. Parts must be located, taken down, counted, and the necessary documents made out—and all this takes time. Every foreman knows (or should know) when he is likely to require work, and there should be no difficulty in every foreman giving the stores from, say, one-half to two days' notice (according to the magnitude of the order) that material is required.

When once the whole of the items comprising any specific order have been delivered to the shop, and accepted as correct by the foreman, it must be understood that the liability of the stores, with regard to quantities, &c., ceases. It has often happened that an operator is unable to find a certain article required in connection with the order, so, obtaining a requisition from his foreman, he presents this to the stores, and obtains a replacement. This procedure is adopted upon the slightest pretext, and it does not tend to improve the working of the stores. The complaint of the operator is that short quantities are issued from the stores, and further supplies are demanded. It may be that an article is scrapped, or mislaid, and if extra parts are issued from the stores at any time at the behest of the foreman, it is obvious that surplus parts will accumulate in the shop. Periodically, these are collected and returned to the stores, thereby throwing all records out of gear, besides incurring the risk of scrap parts being treated as good stock.

It is desirable to make it as hard as possible to get extra parts from the stores, without actually retarding progress, and it is proposed, therefore, that all cases of this description shall be dealt with by the inspection department. If a part is scrapped in the shop, and needs replacing, or if it is unsuitable, and needs rectifying, the article, together with the foreman's report, will be sent to the inspection department. The inspector will examine the part in question, and make out his report, which will be sent to the stores. It can then be dealt with in an intelligent manner. If an article is missing, the foreman of the department handling the order must be held responsible, and an inspector's report to this effect must be sent to the stores before a replacement can be issued.

All material sent into the stores, from whatever source, must pass through the inspection department before being accepted into stock. Several instances have occurred where scrap material is kept in stores as good stock, and this must be eliminated. It must be remembered that the storekeeper is not an inspector, and he has the right to assume that every article passing into the stores is good stock.

These proposals will not doubt throw extra work upon the inspection department, and also (for the time being) upon the foremen of other departments. It is in this direction, however, that I want your help, in order to facilitate my task of reconstructing the stores. This is my first duty, and when once accomplished the ground will be ready for the application of a general progress system.

I have outlined the first phase of my reconstruction scheme, and the help I require from you. The first duty of a progress manager is to ensure that production shall not suffer during the reconstruction period, and if I can rely upon your support I am confident that in a very short time the whole factory will derive an advantage.

SURFACE CONDENSING PLANT FOR LARGE POWER STATIONS.

By R. J. KAULA, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

In most condenser calculations it is assumed that the heat quantity to be absorbed by the cooling medium is the latent heat of the steam corresponding to the pressure of condensation.

Table I gives the heat units rejected to the condenser per lb. of steam for a few typical initial steam conditions and turbine efficiencies, on the basis of an exhaust pressure of 1 lb. absolute. It will be seen that under the more usual conditions the latent heat slightly exceeds the actual value to be dealt with, so that there is a corresponding margin in hand. Since, however, most constants derived from test results make no allowance for this difference, it is the more important that a correction should be introduced where the heat units exceed the latent heat figure. The specific heat of the water is taken as unity, regardless of its consistency and temperature. On these assumptions, the quantity of cooling water required per lb. of steam to be condensed is, in lb.—

TABLE I.

Steam inlet.		Tubine efficiency, per cent.	Heat units rejected, therms.	Latent heat. therms.
Pressure, lb. per sq. in. abs.	Superheat, deg. F.			
300	250	80	1.006	1,043
200	200	75	1,028	1,043
150	100	70	1,017	1,043
150	100	65	1,035	1,043
14·7	0	60	1,051	1,043

$$W = H/(T_2 - T_1) \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

where H = latent heat in therms, T_1 = cooling water inlet temperature in deg. F., and T_2 = cooling water outlet temperature in deg. F.

The difference t_2 between T_2 and the temperature of the steam at the pressure of condensation T_0 is, to a large extent, a measure of the efficiency of a condenser. Whilst test results frequently show t_2 as low as 5° F., it is well to estimate on 8° or 9° F., so as to ensure an ample margin of cooling water under all conditions of working.

The amount of surface area to be allowed for a given duty of condensation is given by the formula—

$$S = Q\,H/T_m\,K \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

where S = cooling surface in sq. ft., Q = quantity of steam to be condensed per hour in lb., H = latent heat at pressure of condensation in therms, T_m = mean temperature rise in deg. F. $= (T_2 - T_1)/\log_e[(T_0 - T_1)/t_2]$, and K = heat-transmission coefficient in therms per sq. ft. per hour per deg. F.

Since t_2 is usually predetermined and the remaining factors in the formula are fixed, as conditions to be attained, S may be said to vary inversely as K. Until comparatively recently K was taken at a figure varying from 300 to 500. But it has been proved that K for a given condenser design varies distinctly with the cooling-water velocity V. For values of V ranging from 3 ft. to 6 ft. per second, K may be taken as a function of the square root of V. For lower velocities the rate of variation is, no doubt, greater owing to the almost entire absence of turbulence, and for higher velocities the curve flattens out somewhat. If therefore the surface is increased to obtain a margin, this will only be fully effective provided that the water velocity is maintained. K is also dependent on efficient air extraction and on features of general design, so that the bare measure of the tube area presents no gauge of the margin available.

The degree of dryness of a tube is known to have a material effect on its heat-transmission coefficient, and it follows that in this respect the tubes nearest to the steam-inlet opening are more effective than those placed lower down, which may be assumed to be coated with a water film.

The more recent development of condenser design tends to reduce the drop in pressure across the tube nests to a minimum, notably by means of ample steam lanes, and this helps to provide a maximum number of tubes within what may be termed the dry zone. The provision of steam baffles in the tube space has now been entirely abandoned as being harmful rather than otherwise On the other hand, guide vanes in the steam inlet opening are frequently introduced to assist the initial distribution of the steam.

The ratio of length to diameter needs to be kept reasonably low to avoid the formation of dead pockets at either end of the condenser, and a practical working limit for L/D may be taken at 2, whilst a value of 1·5 should be aimed at.

In surface condenser design for land work, the direction of the flow of the water is opposite to that of the steam. With wet-type air-pumps using the condensate as sealing water, this system is practically a necessity, but since the majority of modern plants use dry pumps, this point does not require the same consideration, and the higher condensate temperature obtainable with a parallel-flow condenser would be a decided advantage.

The advantage to be derived on a siphonic circulating-water system by adopting the parallel-flow principle reaches a substantial amount where the distance from water level to the highest point of the system is considerable. On the other hand, the reduction in siphonic vacuum to be maintained on a low-head system is in itself a considerable advantage.

It is not suggested that the parallel-flow principle possesses such advantages as to warrant its general adoption, but there would appear to be good grounds for its use on siphonic circulating-water systems.

As far as the user is concerned, there is little to choose between cast-iron and wrought-steel shells. Cast-iron shells are considered liable to crack when the turbine is changing from atmospheric exhaust to vacuum, and *vice versâ.* On the other hand, wrought steel is liable to corrosion. As a matter of experience, the author has not heard of a single instance where a cast-iron shell has actually cracked, except in the course of manufacture. It seems unlikely that cast iron will prove economical in peace time for sizes of, say, 20,000 sq. ft. and upwards.

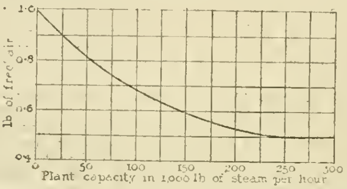


Fig. 1.—Curve Showing lb. of Free Air at Atmospheric Pressure and at 60° F. per 1,000 lb. of Steam.

In land practice the water velocity in the tubes varies usually between limits of 4 ft. and 7 ft. per second, depending on the permissible friction loss and the attaining of a suitable shape for the condenser. The friction loss varies with the square of the water velocity, and may be divided into the following items:—

Loss in the tubes themselves	I
„ at tube inlet and outlet	II
„ in the water-boxes and inlet and outlet branches ...	III

Whereas I is simply determined by the diameter and length of tube selected, II and III will vary according to the care exercised by designers and draughtsmen. By providing suitable bellmouths on the ferrules a saving can be obtained on II without materially adding to the cost of production. Sharp right-angle bends at the inlet and outlet branches should be avoided wherever possible, especially at the inlet, as the waste in friction head may reach quite a substantial figure.

The quantity of air to be dealt with depends on the number and condition of joints under vacuum, on the air-tightness of the turbine glands, and on the quantity of air carried over with the steam. Since the peripheries of the joints and glands vary approximately as the square root of the output of the plant, the quantity of air to be allowed per lb. of steam condensed should be materially less on a large unit than on a small one. The variations in air-pump capacity called for in purchasers' specifications indicate a considerable divergence of opinion as to what constitutes a reasonable allowance in this respect. It would seem very desirable that some form of standard should be established, to which all condenser makers could work, and the curve shown in fig. 1 is put forward as a suggested basis for high-pressure turbine plant where the condenser is mounted immediately below the turbine. It is naturally important that the air-pump capacity should be ample; at the same time, an excessive margin means a continuous waste of auxiliary power.

Modern types of air pumps can be divided under three headings:—

1. Reciprocating pumps.
2. Rotary air pumps.
3. Steam ejector pumps.

The Edwards pump is the only example of the first group which can still claim to hold its own even in the largest installations, but where vacua of over 27½ in. to 28 in. are concerned it may be ruled out, except in conjunction with a vacuum augmentor. Its comparatively low power consumption, reliability, and low maintenance cost are its chief advantages. Where a vacuum augmentor is in use the steam consumed by the jet requires to be added to the pump power consumption, and in practice this amounts to anything from 0·5 to 1 per cent. of the main turbine consumption, whereas the pump itself should not consume more than about 0·2 per cent. of the turbine power. The disadvantages of the Edwards pump are its bulk and its low running speed, and where the pump uses the condensate as sealing water the temperature of the latter needs to be kept low, and the condensate becomes strongly aerated—a frequent source of boiler troubles.

All rotary types of air pump consist of one or more water jets, which entrain and compress the air. In the case of the kinetic system, the water jet works in series with a steam jet. The efficiency of such pumps is still very low.

The steam-ejector type of air pump represents a development of the Parsons vacuum augmentor. In simplicity it equals the water-jet type, with the advantage of using pipes of small dimensions instead of comparatively heavy water pipes. There can be little doubt that the claims of the steam ejector are strong enough to ensure its success and widespread application.

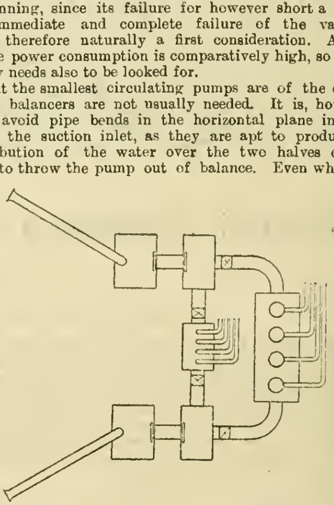
The failure of an air pump does not in itself involve an immediate change to atmosphere, as the consequent accumulation of air in the condenser is very gradual where the system is reasonably air-tight. Provision should therefore be made, where necessary, by means of suitable non-return valves, to ensure that such a failure is not accompanied by an inrush of air through the air pump.

The introduction of rotary air pumps brought in its train the general use of separate condensate pumps. The conditions to be met are such as to impose the utmost difficulty on the design of a pump of the centrifugal type, and much practical experience had to be gained before satisfactory designs were evolved. Low water velocities on the suction side are essential, as well as in the impeller, to guard against cavitation troubles. To ensure these conditions, and stability over the large range of fluctuating loads which such pumps are called upon to handle, it is well to work on the lower part of the pump characteristic, well below the point of maximum efficiency. Since the total power involved is small, the question of efficiency is not of material consequence.

An ample static head on the suction side is required to overcome pipe friction and to ensure that the water enters the pump with a sufficient initial velocity. The connecting pipes between the condenser and the pump should be as short as the lay-out will permit, with a minimum number of joints. Unfortunately, the same reasons for inserting non-return valves on the suction side apply to condensate as to air pumps.

The circulating pump forms a vital link in the chain of apparatus that constitutes a condensing plant, as regards continuity of running, since its failure for however short a period means an immediate and complete failure of the vacuum. Reliability is therefore naturally a first consideration. At the same time the power consumption is comparatively high, so that a high efficiency needs also to be looked for.

Since all but the smallest circulating pumps are of the double impeller type, balancers are not usually needed. It is, however, advisable to avoid pipe bends in the horizontal plane in close proximity to the suction inlet, as they are apt to produce an uneven distribution of the water over the two halves of the impeller and to throw the pump out of balance. Even when the water levels are constant, provision should be made for reasonable variations in head. Regulating the water supply, according to the head, by varying the pump speed is much to be preferred to throttling.



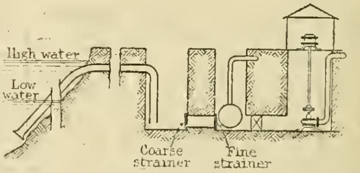


Fig. 2.—Arrangement of Strainers and Pumps on Tidal River.

In large power stations it is customary to provide separate turbo-generating units for supplying the power to all auxiliary machinery, and for lighting purposes, so as to ensure complete independence of the main plant. There is nothing to choose between three-phase and direct-current supply for this purpose, but the possibility of obtaining speed variation is a marked advantage in favour of the latter system, and this applies particularly to the circulating pumps.

In smaller stations not provided with such auxiliary units, the necessity of starting up on atmosphere after a complete shut down, where electric motors are used for driving the condenser pumps, has led to the extensive adoption of steam turbine-driven pumps. Coupling the three pumps to a single turbine has considerable drawbacks. It seems preferable to drive the condensate pump electrically, particularly since the plant can be started on vacuum with this pump standing.

If the steam consumed by the combined air and circulating pumps is excessive for feed-heating purposes, as, in fact, is usually the case, it becomes necessary to provide separate drives for the two pumps, or to build the auxiliary turbine of the pass-out type. Such steam as cannot be utilised in the feed heater can either exhaust into the condenser or into the low-pressure stages of the main turbine.

The former system is rather extravagant in steam consumption, although where gear driving is adopted it is quite possible to obtain a very fair efficiency in turbines of 200 to 300 H.P. and upwards. If the auxiliary turbine exhausts into the low-pressure stage of the main turbine, the economy will be found to be about equal to that obtained with electric driving, but the complications which this introduces into the construction of the main turbine are undesirable, and additional steam space is required in the low-pressure blading just where it is hardest to obtain.

Since, apart from a limited amount of saving that can be obtained at lighter loads by speed regulation or throttling, the power consumed by the condenser auxiliaries represents a constant loss, their most economical arrangement deserves the closest attention.

In a modern power station, where the water quantity to be dealt with amounts to hundreds of thousands of gallons per minute, the means of handling the water is a primary consideration in the design and lay-out of the engine house. In the case of a non-tidal riverside station, where the river level coincides with the condenser basement level, the most satisfactory plan is to allow the water to flow by gravity in an open concrete duct into the engine room, with branches leading from the main duct to each pump, the latter being placed close to the condensers. The discharge pipes from the condensers should be led into a corresponding outlet duct, in which the water is maintained at a sufficient level to enable it to return to the river by gravity. A similar arrangement can be adopted in a cooling-tower station, if separate pumping plant is provided alongside the towers to deliver the water to the top of the towers. This arrangement of separate pumps makes it possible to adjust the number of towers in use according to the atmospheric conditions and independently of the number of condensers on load. Where the water-level conditions prohibit the use of open ducts, it is preferable in large stations to run separate pipe lines for each unit.

Perhaps the most difficult condition to be dealt with is that of a tidal river containing large quantities of solid matter which require to be strained before the water enters the condenser. Fig. 2 shows a diagrammatic arrangement of strainers and pumps to deal with such conditions. The water is siphoned from the river into a strainer chamber, and passes from there through two sets of grid strainers into a clean-water chamber, and then to the pump house. The strainer chamber and clean-water chamber are duplicated, so that the flow of water may be reversed for the purpose of clearing the strainers, and at the same time to prevent silting of the main pipe inlets. The discharge pipes from the condensers are led into a discharge chamber, their outlets being below water level. Valves are shown between the clean-water chambers and the pump house and discharge chamber to give the required reversal of flow. In smaller plant, and where no great difference in water levels has to be dealt with, strainers of the endless-chain type, with water-jet cleaning gear, as first introduced by Messrs. Dickinson and Porter at Leeds, are generally effective. So-called revolving strainers, such as the Bailey and Jackson type, are too cumbersome for large plants, and the inevitable leakage loss is a considerable drawback to their use.

Under modern conditions a condenser designed for a vacuum of 28½ in. (Bar. 30 in.) with cooling water at 70° F. will still be capable of maintaining a vacuum of 27 in. if the cooling-water quantity and surface are halved, and when dealing with the same quantity of steam. If therefore a condensing plant is arranged to consist of two condenser bodies with separate water connections and valves, it is possible to open up the water side of one condenser at a time for cleaning purposes, and to continue running at approximately full load without a heavy loss of vacuum. It is, of course, not possible to remove tubes under such conditions, as the inactive condenser remains under vacuum. Naturally, such an arrangement means a substantial increase in first cost, greatly complicates the general lay-out of the whole plant, and can only be justified where the water conditions are exceedingly poor.

Discussion in London.

Mr. E. **Bailey**, opening the discussion, said that unfortunately the time had not yet come when standardisation could be accomplished. What they really were in need of was some plant at the minimum cost and operating with the minimum amount of water, but at the same time highly reliable. A striking point was the large variation in power that was required for the different systems. He was in agreement as to the difficulty of removing debris from the water; with regard to the author's arrangement of strainers and pumps to deal with a tidal river containing large quantities of solid matter, he did not think it was a practicable arrangement if the water was dirty, although it might work well with clean water. With dirty water, he thought in such an arrangement the flow would have to be reversed as often as once in five minutes if it was to work properly, and that was out of the question. The suggestions made by the author concerning the so-called rotary strainer associated with his name were hardly warrantable he thought. Strainers 6 ft. in diameter could now do the same work as those formerly 8 ft. in diameter, and the leakage loss had been reduced from 15 per cent. to 2 per cent. The device was being constantly improved, and he had hopes of it being standardised in the near future. The author had made some good suggestions regarding the aeration of the condensate; that subject had not been considered sufficiently in the past, and he looked forward to much improvement in this respect.

Mr. W. B. **Woodhouse** thought the paper full of sound practical advice, and he was in full agreement with it. On account of corrosion difficulties he was personally in favour of cast-iron being used for large shells, even if such shell had to be made in sections. With regard to screening the water, he thought that operation was best done in stages through finer and finer screens. In his opinion stoppage for the purpose of cleaning condensers should not be necessary; surely some means could be evolved by which cleaning could be carried out while the condenser was at work. He was in agreement with the author's remarks as to what constituted a reasonable allowance in air-pump capacity. The variations called for in purchaser's specifications were very large, and capacities much lower than those called for were found to be ample. Standardisation in this respect would be very useful. With regard to air-extraction devices, steam-jet extractors were the right things to use; it was logical to suppose that the best means of entrapping a gas was by means of another gas. Such extractors worked extremely well, they were simple, and they eliminated a piece of rotating machinery. Corrosion was a very complicated problem, it occurred in all sorts of places. He suggested that variable speed pumps might have certain advantages, but perhaps they would not be considered worth the extra complication.

Mr. G. W. **Partridge** congratulated the author on his paper, and said he was in agreement with the sentiments expressed therein. In his opinion, it was very important to sub-divide the plant, and he agreed with the previous speaker about having to shut down for cleaning purposes. Personally he would like to see two condensers for each turbine, but that might not be always possible on account of the space taken up, &c. The question of water velocities was one of importance; he had found that velocities varied very much. In America it was the practice to keep the velocity at about 9 ft. per second, which was said to help clean the condensers. From the point of view of reliability, the driving of auxiliary plant was most important. Assuming electrical driving, whether it was A.C. or D.C., there should be, in his opinion, three separate sources of supply to the auxiliary plant. One of these sources should be a separate generator entirely independent of the main-station generators or bus-bars. The three sources of supply would be normally connected in parallel with automatic change-over switches to operate in case of failure of one source of supply. He could not say that he was in love with the author's arrangement of pumps and strainers to deal with water from a tidal river which contained solid matter. By means of diagrams he illustrated the layout of the pumps at Deptford, and also a strainer designed by one of his assistants. The pumps were kept running at full speed and capacity pumping into a bus pipe, from which the water was delivered in turn to the condensers, thus forming a very flexible supply. The strainer was a rotary one, comprising a perforated gun-metal cylinder rotating against a scraper. The water was led in from the outside and discharged from the inside of the cylinder. Such strainers had given satisfaction for a number of years.

Mr. E. R. **Briggs** said that much work had been done during the last six years in the subject of heat transmission, especially in the U.S.A. The difficulties of carrying out proper tests were very great, such tests could not be obtained under running conditions. The water velocity had a large effect on heat transmission; in the U.S. they had now abandoned velocities of 9 ft. per sec., and considered 5 ft. sufficient. The question of water flow in large condensers was of importance. The firm with which he was connected was now building a large condenser which had in place of one water box, two boxes of stream-line construction so that the water on entering and leaving encountered the least possible friction. He thought the author's arrangement of strainers and pumps was wrong, because it would be found very difficult to keep the pipe lines clean and airtight. Further, the screens and pumps were drowned, and were not accessible.

Mr. I. V. **Robinson** thought the author would have done better had he used the more usual symbols in his formulæ; he had used too many T's, which might lead to confusion. With regard to large condensers, he thought that manufacturers would prefer shells to be smaller in diameter as compared with length. The cost increased more with the diameter than with length. Personally, he preferred steel shells, and he thought the reason why these had not been more generally adopted was that all manufacturers had not got the shop facilities for their manufacture. He thought it was probable that makers would prefer the sub-divided condenser as it was easier to make two shells in place of one large one. With regard to extraction pumps, he said the Edwards pump was a back number, although it had the advantage of simplicity, and was easily understood; it was not everyone who understood steam jets and how to use them. In his opinion, air capacity would be considerably reduced in the near future; at present they were over-estimating the amount that was necessary. The closed condensate system was the correct one to use; the less amount of air that came in contact with the water the better.

Mr. C. C. Paterson, O.B.E., agreed with Mr. Partridge's statement that for every lb. of coal burned 500 lb. of water were required. In the course of experiments on the cooling of a cylinder with water, he had found that only the outside of the column of water became heated, and the centre was often cold. When turbulence was introduced, however, the amount of water required for cooling was materially reduced, and he wondered whether the condensing water could be reduced in a similar way.

Mr. R. J. Kaula, in reply, said that corrosion was difficult to deal with, and sub-dividing the condenser would introduce complications which might off-set the advantage gained thereby. In his opinion, all large condensers would be built *in situ*. It was a pity to sacrifice speed regulation if it could be helped in driving auxiliaries. With regard to water velocities, he thought that about 6 ft. per sec. would be found economically sufficient.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Septon-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

7,981. "Machine for winding magneto armatures, coils, &c." R. W. Humphrey. March 31st.

8,060. "Electric fires." H. H. Barry & J. W. Reid. March 31st.

8,063. "Dynamo-electric machines." W. A. Price. March 31st.

8,083. "Dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) and A. A. Pollock. March 31st.)

8,084 "Electric transformers." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 31st.

8,085. "Machines for manufacture of electric incandescent lamps, &c." British Thomson-Houston Co. (General Electric Co., U.S.A.) March 31st.

8,106. "Locking-off switch for magnetos and accumulators on motor cars, &c." R. Cornwall. March 31st.

8,127. "Electric contact-makers." E. Marples. April 1st.

8,128. "Electric lighting systems for motor vehicles." E. Morris. April 1st.

8,133. "Electrical fuses." A. C. Wynne. April 1st.

8,146. "Head attachments for telephones." R. Rostron. April 1st.

8,151. "Electric bells." R. E. Ducie. April 1st.

8,154. "Electric immersion heater." P. H. Lamplough. April 1st.

8,156/7/8. "Telemotors." A. E. Alexander (Benson Electric Co., U.S.A.). April 1st.

8,163. "Telephonic repeaters." R. M. Chamney & C. Robinson. April 1st.

8,164. "Miners' electric lamps." E. H. Naylor & S. F. Tyler. April 1st.

8,172. "Electric light switches, bell pushes, &c." W. Hinos. April 1st.

8,175. "Electric coin-operating bioscope." J. M. Davey & S. M. Green. April 1st.

8,177. "Systems of electric power transmission." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 1st.

8,179. "Utilisation of high-frequency alternators in radio-telephony." Soc. Francaise Radio-Electrique. April 1st. (France, October 28th, 1917.)

8,198. "Electrode of perforating metal plates, &c." C. J. Holsgag. April 1st.

8,200. "Multiple-control apparatus for electric railways with motor-driven main switch drums." Akt. Ges. Brown, Boveri et Cie. April 1st. (Switzerland, May 3rd, 1918.)

8,208. "Magnetos." Soc. H. Abcuembourg Joret et Cie. April 18th. (France, April 3rd, 1918.)

8,213. "Electrical time switches." E. Schattner. April 1st.

8,222. "Means for fastening ends of wires, rods, &c., to terminals." T. F. Stent. April 1st.

8,246. "Electrical resistance for electric lighting, &c." A. W. Rayworth. April 2nd.

8,257. "Electric welding." F. J. Heyes. April 2nd.

8,278. "Dynamo-electric machines." R. W. Myers. April 2nd.

8,286. "Holders for wireless detecting crystals, &c." W. P. Thompson (V. J. Brochard). April 2nd.

8,292. "Spark plugs." S. Fisher & W. Priddey. April 2nd.

8,312. "Systems of electric power transmission." British Thomson-Houston Co. (General Electric Co, U.S.A.) April 2nd.

8,324. "Electromagnets." S. F. Barclay & Vickers, Ltd. April 2nd.

8,337. "Sparking plugs for internal-combustion motors." F. Beck. April 2nd.

8,352. "Electrical resistance elements." H. Wade (J. Thomson). April 2nd.

8,376. "Electrical fuses." H. F. McLoughlin, Simplex Conduits, Ltd., and L. M. Waterhouse. April 3rd.

8,388. "Electro-magnetic devices for alternating currents." G. H. Nepp, D. H. Ogley and Switchgear & Cowans. April 3rd.

8,432. "Electrically-driven compressing apparatus." C. Melano (Borgarello). April 3rd.

8,441. "Magnetos." A. E. White (Webster Electric Co., U.S.A.). April 3rd.

8,448. "Receiving methods of radio-telegraphic and radio-telephonic signals." C. Bardeloni. April 3rd. (Italy, October 3rd, 1916.)

8,449. "Machines for manufacture of bobbins for electric batteries." National Carbon Co. April 3rd. (U.S.A., October 1st, 1917.)

8,469. "Lighting electric lamps of bicycles." C. J. Hamilton. April 4th.

6,478. "Sparking plugs." G. H. Barraclough. April 4th.

8,529. "Manufacture of electrothermic devices." P. F. Zimmerman. April 4th.

8,550. "Storage batteries." P. D. Ivey & A. J. Salisbury. April 4th.

8,551. "Drain devices for storage batteries." P. D. Ivey & A. J. Salisbury. April 4th.

8,560. "Rotors for electric motors, &c." P. F. Brittain. April 4th.

8,563. "Switchgear for electro-magnetic wave transmission and reception systems." P. P. Eckersley. April 4th.

8,573. "Insulated electrical conductors." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 4th.

8,575/81. "Radio-telegraphy transmission systems." W. J. Mellersh-Jackson (A. Taylor). April 4th.

8,578. "Electrical systems." Domestic Engineering Co. April 4th. (U.S.A., April 6th, 1918.)

8,580. "Oscillographs, &c., and their application to radio or submarine telegraphy." A. Blondel. April 4th. (France, April 4th, 1918.)

8,601. "Electric relays or contact-makers for mine signalling apparatus, &c." J. R. L. Allott & E. Dean. April 5th.

8,608. "Electrical resistance devices." C. L. Browne & S. H. Heywood and Co. April 5th.

8,609 "Cable conduits for electric travelling cranes." C. L. Browne and S. H. Heywood & Co. April 5th.

8,642. "Carbon conductors for electricity." H. Wade (J. Thompson). April 5th.

8,649. "Dynamo-electric machines." British Thomson-Houston Co. (General Electric Co., U.S.A.) & F. H. Clough. April 5th.

8,650/1. "Station sets for intercommunicating telephones." R. L. Murray. April 5th.

8,652. "Driving mechanism for selector arm of automatic selector switches." R. L. Murray. April 5th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

13,899. Apparatus for use in wireless telegraphy and the like. Sueter, Groves & Binyon. September 30th, 1915.

14,071. Apparatus for the detection of sounds generated at a distance by means of ground vibrations. Gardner. October 5th, 1915. (Cognate application, 17,010/15.)

14,473. Submarine signal sound-receiving apparatus. Davison. October 13th, 1915.

14,474. Submarine signal sound-receiving apparatus. Davison. October 13th, 1915.

15,245. Apparatus for locating submarine and other boats by auditory vibrations. Padstore, Beaver & Claremont. October 28th, 1915.

15,320. Means for detecting and locating subaqueous sounds. Sykes and Morris. October 30th, 1915. (Cognate applications, 5,084/15 and 6,709/16.)

15,635. Instrument for ascertaining the tensional stress in flexible members, such as aeroplane stays, electric current-carrying wires, or other like stressed members. Avery, Ltd., & Gibbs. November 5th, 1915.

1917.

19,170. Electrolytic preparation of metals or alloys in the form of paste or sludge. B. Leech and H. & L. Slater. December 28th, 1917. (124,006.)

1918.

2,602. Automatic starting and stopping devices for electrically-driven air compressors. British Thomson-Houston Co. & J. Sugden. February 13th, 1918. (124,017.)

2,615. Alternating current dynamo-electric machines adapted for synchronous working. L. J. Hunt & Sandycroft, Ltd. February 13th, 1918. (Cognate application, 3,379/18.) (124,018.)

3,643. Construction of gas and electric fittings, candlesticks, and ornaments generally. J. Harrington. March 1st, 1918. (124,022.)

4,337. Electrical contact-making and breaking apparatus. British Thomson-Houston Co. & A. Young. March 12th, 1918. (124,041.)

4,530. Manufacture of electric accumulators. H. Leitner & W. H. Exley. March 14th, 1918. (124,050.)

4,548. Luminous signal or call device. J. L. Morisons. October 20th, 1917. (120,193.)

4,556. Signalling and navigation lamps, and switching devices more particularly applicable thereto. A. H. Morse. March 14th, 1918. (124,053.)

4,868. Method and apparatus for electric heating by high-frequency currents. Ajax Metal Co. September 19th, 1917. (119,220.)

4,869. Magneto-electric machines. R. B. North & A. M. Allen. March 19th, 1918. (124,064.)

4,965. Electric switches. Drake, Ltd., & J. W. Drake. March 21st, 1918. (124,066.)

5,166. Devices of the vibrated-diaphragm type for giving audible signals. J. F. Monnot. March 23rd, 1918. (124,071.)

5,323. Lampholders for incandescent electric lamps. L. C. D. Delanne. March 19th, 1917. (114,432.)

5,479. Apparatus for electrolysing salt solution. T. Matsushima. March 28th, 1918. (Convention date not granted.) (114,623.)

5,953. Elbows and like fittings for electric conduits. J. Wilkie. April 8th, 1918. (124,082.)

7,355. Means for regulating and measuring alternating magnetic fluxes and forces, particularly in testing machines. B. P. Haigh. May 2nd, 1918. (124,100.)

7,849. Tubular earths for electrical conductors. K. W. Hedges. May 10th, 1918. (Patent of addition not granted.) (124,102.)

7,866. Minimum current cut-out and apparatus for regulating the tension and the voltage and current from a dynamo. R. B. Ransford (Fabbrica Italiana Automobili Torino). March 10th, 1918. (124,104.)

8,870. Electric transformers, inductances and the like. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 29th, 1918. (124,113.)

10,049. Reverse-current electric devices of the Wheatstone relay type. British Thomson-Houston Co. & E. B. Wedmore. June 18th, 1918. (124,126.)

11,340. Electric motor starters. A. H. Railing & W. Wilson. July 11th, 1918. (124,136.)

11,464. Process of resuscitating spent electric dry cells. K. Horii. July 12th, 1918. (124,137.)

11,804. Directional aerials for use in wireless telegraphy. G. M. Wright. July 18th, 1918. (124,138.)

12,414. Devices of the vibrated-diaphragm type for giving audible signals. J. F. Monnot. July 30th, 1918. (124,141.)

1919.

1,633. Sparking plug for internal-combustion engines and method of manufacturing the same. C. E. Gerbaud. May 29th, 1918. (124,177.)

East Prussian Peat Industry.—A peat industry for East Prussia has been founded at Königsberg. It is hoped that this may relieve the fuel difficulty. Hitherto the peat available for household use has been expensive and of poor quality. The new industrial association will encourage the output and utilisation of peat, as well as systematic prospecting for peat layers. It will introduce better methods of working the peat and secure cheaper means of transport. (*D.A.Z.*, March 21st.)

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. APRIL 25, 1919. No. 2,161.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

ARBITRARY RULES.

We have often had occasion to point out that, with possibly a few exceptions (such as Glasgow and Manchester, which have obtained statutory powers), electricity supply authorities have no right to impose upon consumers "rules" relating to the technical details of their installations, and that, in fact, most of the conditions to which the intending consumer is required to subscribe, on pain of refusal to connect his installation, are entirely *ultra vires.* As long ago as 1899, when the subject of wiring rules was under discussion at the Institution of Electrical Engineers, Mr. C. H. Wordingham remarked that the power to enforce such rules was deficient; and in 1901, in a paper read before the Newcastle Local Section of the Institution, Mr. F. Broadbent exhaustively discussed the infinite variety of rules with which contractors were required to comply, pointing out that station engineers were addicted to issuing rules which might deter consumers, and which could not be enforced. In the article on this subject which is concluded elsewhere in this issue, Mr. C. A. Baker discusses the matter very fully, and shows how very liberally undertakers have construed their rights and privileges. We welcomed this article for two special reasons, which are set forth below.

We freely admit that in the early days of electricity supply, these local rules served a good purpose. Wiring practice was then slowly developing; authoritative standards were non-existent, and the jerry wireman had free play for his nefarious practices. In those days, say in the late '80's, we ourselves at times came across examples of cotton-covered solid wires of No. 8 or 10 B.W.G. laid in wood casing, with dry twisted joints, in installations carrying up to 100 volts; we have seen a gas-pipe melted and a fire started by contact with cotton-covered wires used to support a pendant lamp; wooden switch-bases, fuse-blocks, and lampholders, were in common use, and wonderful feats were accomplished with cotton tape, shellac varnish, and the indispensable Chatterton's compound. The famous Phœnix Fire Office Rules, first drawn up in 1882 by Mr. Heaphy, prolix, contradictory, and open to evasion though they were, nevertheless purported to establish a reasonable standard of quality for wiring and equipment, and held sway long after they had ceased to be the only, or even the best, code of rules; no doubt many of the local rules adopted by supply authorities in those days were based upon this code. But the conditions to which we have referred exist no longer. Wiring practice is now fairly well standardised, and in the Wiring Rules of the Institution of Electrical Engineers we have a code which represents the consensus of opinion of the best authorities on the subject, and which has been adopted by the Phœnix Assurance Co. itself, as well as by practically all the other fire offices in the country. As Mr. Baker shows, in many cases the local rules embody ideas which have long been obsolete, and probably are not enforced even by their authors; if they must have a code of rules, they should adopt that of the Institution. But there is no longer the same necessity for supply authorities to play the part of consulting engineers and inspectors; the general standard of wiring is nowadays far above that of the last century, and if a reputable contractor is entrusted with the work, there is a reasonable presumption that it will be satisfactorily carried out, while if the guarantee scheme of the Contractors' Association is availed of, the presumption becomes certainty. We hold, then, that these local "rules" are not only illegal, but also superfluous, and therefore ought to be abolished.

But our second reason is, perhaps, the more important. We have seen how, in the early days, the manager of an electricity undertaking not only had to act as engineer to his own concern, but also felt it his duty to act as technical adviser and protector to his prospective consumers—and discharged that duty with the aid of a formidable code of rules which he imposed upon them by *force majeure*. Last week we pointed out that the halcyon days of the engineer, as such, had passed away, and that the business manager was now the man of the hour. We do not suggest that the engineer cannot adapt himself to the latter *rôle*: in many cases he has done so with conspicuous success. But the point is this: while the instinct of the engineer is, above all, to ensure a sound job, that of the commercial manager is to increase his output, and, therefore, to attract new customers to the mains. Hence it is incumbent upon him to remove all obstacles to the accession of new customers.

We put it to the business man that this array of rules and regulations acts "in restraint of trade," and is therefore doubly illegal, besides foolish. Take the case of the gas supply authorities—the contrast is amazing. Do *they* interpose a set of conditions and obstructions between the customer and his supply? On the contrary—the connection of a gas installation to the mains is so simple a process, so quickly and politely accomplished, and with such an obvious desire to give satisfaction to the consumer, that it is actually a pleasure to go through it. If any slight defect is noticed, do the gas-men "require" the consumer to have it put right, and inform him that a second test will cost him 5s. (an illegal charge)? No—they put it right themselves, on the spot; there is no circumlocution or delay—the gas suppliers are out to sell gas, and lots of it, not to play the part of jack-in-office.

On the other hand, if one applies for particulars as to the supply of electricity, one is informed that one may have it on the basis of xd. per unit "flat rate," or yd. and zd. on the "maximum demand" system, or £a per kilowatt and bd. per unit, or m per cent. of the rateable value + nd. per unit, or otherwise; and a different charge will be made for cooking and heating, and another for power if used; and the would-be consumer must observe a book of rules, and is liable to have his supply cut off (illegally), even without notice. Surely this is not "business," but its very antithesis.

A new phase in the history of electricity supply is opening before us. Let us cast away all hampering, unnecessary restrictions, and *welcome* the new consumer; make his path easy, and abandon the tradition which requires that he shall fight his way through the wire entanglements and pitfalls which have embarrassed him up to now. The supply undertakers are the servants of the public, not their masters.

Rural Industries.

The main object of the proposed National Electricity Scheme is, of course, the supply of cheap power to existing industrial centres. The first District Boards to be set up will be naturally those for areas where industrial towns are clustered together in a more or less homogeneous group, and the enlarging and cheapening of the power supply would chiefly be to enable existing manufacturers to meet foreign competition and to keep our place in the markets of the world. But, subordinate to this admittedly prior claim, there is a secondary demand for the attention of the new Electricity Commissioners in the need for the decentralisation of the industries. The tendency up to the present has been for industries to crowd together; they have, in fact, been obliged to do so. But such indiscriminate crowding of certain centres brings with it a number of social evils—slums, small and inadequate houses, no gardens, high rents, no open spaces for children, smoke, dirt, and so on. Now, when a cheap supply of power is made available in the country districts, a good number of industries could leave these crowded centres altogether and work equally well in surroundings which offer every advantage of health and well-being to their employés. This point was dwelt upon in a paper written by an engineer some time ago on the water power of the country, and used legitimately as an argument for the utilisation of such source of power. But it applies much more strongly in the case of electric power, which can choose its locality, as favourable to rail, canal, or other facilities. The only disadvantage of thus decentralising would be, from the electric supply point of view, the cost of trunk mains and the losses of energy in transmission. But these, after all, are merely matters of £ s. d., and negligible in face of the pressing industrial and social problems which decentralisation would help, at least, partially to solve. Even if public money were spent, the State at large would benefit.

France's Electrical Bill Against Germany.

M. Louis Dubois recently submitted to the French Chamber of Deputies a report on behalf of the Budget Commission, in connection with the Bill dealing with the reparation of damages caused by the enemy during the war. The report discusses in detail the extent of the damage to various industries. In the case of electrical and mechanical engineering works, which represented a total working capital of £80,000,000 in 1914, the works have been destroyed in the proportion of 90 per cent. The machinery and plant were worth £18,800,000, and as prices have almost trebled in the meantime, the loss under this heading amounts to £50,760,000. The raw materials and manufactured products which were removed or destroyed, are stated to represent a present value of £54,000,000. It is estimated that the losses on working, due to six years of enforced stoppage, amount to £34,200,000, whilst the damages to buildings are computed at a further sum of £16,800,000. Dealing with the electricity supply works, the report states that 80 per cent. of the machinery and plant, which was valued at £6,000,000, has been destroyed, and as cost prices have risen about three-fold, the loss works out at £14,400,000. It is calculated that the losses on the working capital of £7,920,000, due to the stoppage of French working, amount to £5,720,000, whilst the damage to buildings is placed at £2,520,000.

Decline in German Export Orders.

The first issue of the monthly circular published by the Siemens group, recently pointed out that one-third of the production of manufactures by the German electrical industry was exported in normal times, and that one-third of the staff and workmen would have to find other employment if foreign orders were not received. In the third issue of the circular, it is now stated that orders from transmarine countries probably cannot be reckoned on in the near future. Not only so, but the arrival of orders from the European countries still open has dangerously declined. The orders received in

September and October, 1918, were far above the average of the preceding year. The circle of foreign customers, presumably, had been induced to place large orders at that time in consequence of the obviously approaching end of the war. With the starting of the revolution, however, the receipt of orders rapidly decreased, and the economic and political conditions in Germany have made it appear to other countries advisable to place their orders elsewhere.

U.S.A. and S. American Trade.

Leaders of manufacturing and export activity in the United States are displaying a certain anxiety regarding the future of their trade in South America. They recognise that, although handicapped during the latter part of the war by lack of freight and by a certain degree of difficulty in manufacturing, the conditions under which they have been operating in the Latin-American markets have, on the whole, been favourable to them. They recognise, moreover, that every possible outlet for their production and manufacture of goods must be assiduously exploited if their labour and their plant are to be kept occupied to the extent desirable.

The United States Commercial Attaché in Buenos Aires has been discussing the question whether his country will hold its present trade in the Argentine Republic. He does not expect that the United States will continue to supply Argentina with the greater part of its imports of textiles, glass-ware, china-ware, drugs, &c., but that it will do so to an increasing extent as regards iron and steel, machinery, automobiles, furniture, &c. British exporters might well note that his confidence is based largely upon the fact that an intelligent effort is being made by American manufacturers to supply the goods which meet the tastes and desires of the Argentine consumer. The United States firms will now reap the advantage of branches in the Argentine of their banking institutions, and, further, as regards representation, of having taken the right and sensible course of establishing their own branch houses or private agencies there to conduct their sales. Among those of particular interest to electrical and allied trades may be mentioned industrial machinery generally, including printing machinery and shoe manufacturing machinery, iron and steel goods, rubber goods, hardware, and lubricating oils. Furthermore, large Argentine concerns, many of them controlled by European capital, are locating permanent buyers in the United States. On the other side of the picture, however, the Commercial Attaché recognises that shipping facilities are turning again more in favour of European countries, that greater effort must be made in the United States to train men for taking up appointments abroad, and that better plans must be adopted by which the foreign buyer may be protected against the unreliable commission agent or manufacturer, because it is admitted that American trade has been harmed in South America during the past few years by the questionable actions of certain firms. Another direction in which the Commercial Attaché considers action is needed is the matter of investment of American capital in South American enterprises.

Siemens and Halske Works in Russia.

A report on the economic effects of Bolshevism in regard to the Russian Siemens & Halske Co. has just been issued by the Siemens group in Berlin from information furnished by a member of the staff of the former company. The report states that the company's works at Petrograd employed about 2,000 workmen in 1916, as compared with 700 in the last year of peace. In the autumn of 1915 it was decided, at the request of the Government, to build new works at Nishni-Novgorod for the employment of 2,000 men, and the expenses were defrayed substantially out of instalment payments made on account of large State orders. Owing, however, to the difficult transport conditions, delay took place in the delivery of the machine tools ordered in the United States, and it was, therefore, only possible to supply the first manufactures to the Government in the spring of 1917, or six months later than had been foreseen. In January, 1917, the Government of the Czar made a decisive change in the organisation of the company and that of the Siemens-Schuckert Co. A new company, for instance, was to be formed, with a capital of 25,000,000 roubles; the Government was to take over 35 per cent. of the shares, and 65 per cent. was to have been placed at the disposal of financial circles in Russia and in those of Russia's allies. The attempt to allocate the 65 per cent. in this manner was not successful, and, as a consequence, the only decision reached was to appoint a Joint Administration, composed of representatives of the Government and of the old management. The revolution occurred in March, 1917, and simultaneously with it arose demands of the staff and workmen for increases in wages and reduction in hours. The production declined rapidly, and fell in a few months to scarcely half the output prior to the revolution. After the revolution in October, when the Bolshevists gained control, the working capacity almost entirely ceased, and the production fell in 1918 to about one-tenth of that in 1916. New orders stopped with the end of the war; the old contracts were carried out in part, and partly cancelled or postponed; whilst private orders are entirely absent. The prices have risen enormously for whatever work has to be regarded as essential. For instance, a Morse apparatus which was sold for 157 roubles in 1914 was priced at 1,500 roubles in 1918; and a Baudot apparatus advanced in the same years from 4,000 roubles to 36,000 roubles. It was impossible from the middle of 1917 to pay the wages and salaries out of the proceeds of sales, and the Government had to make advances to the company to defray the further growing wages and salaries. In the autumn of 1918 the company was indebted to the Government for many millions of roubles without any prospect existing of these sums ever being repaid. The nationalisation of the undertaking was resolved upon in September, 1918, and the remaining 25 officials and 80 workmen became State officials, who are not able to do much more than maintain an inventory.

National Electric System for Spain.

A Royal Order published on Dec. 31st, 1918, provides that, as soon as possible, a permanent Spanish Electric Commission shall be formed under the direction of the Ministry of Public Works. This Commission shall report on the following points:—

1. The possibility and practicability of the construction by the State, directly or indirectly, of a national system for the distribution of electrical energy.
2. The maximum extension possible of such a system.
3. The approximate cost of such a system calculated on a basis of relatively normal prices, or with copper at between £70 and £80 sterling per ton.
4. The possibility of the State supplying the capital to be thus employed, or guaranteeing its interest, taking tolls on the energy transmitted, and how much this toll should be, or any other means of financing the system deemed preferable.
5. The possibility of a uniform pressure and the means to secure it.
6. The basis on which a law should be drawn up in connection with the foregoing.

The Director-General of Spanish Commerce, Industry, and Labour states that it is of transcendental importance to Spanish industry that it avail itself of the electrical energy that the country is capable of producing. A great deal has been done to this end, but there are still many problems to be solved in connection therewith. Water power is distributed throughout Spain, but only companies with large capital can confront the expense of producing sufficient power to electrify railways. While there is water power in some parts of Spain supplying energy a hundred miles away or more, there are also tracts where no such power exists. Climatic conditions vary largely, as does the flow of water in the rivers. For example, the proportion of water in the Guadalquivir in summer as compared with winter is 1 to 1,000; and, on the other hand, there are rivers on the slopes of the Pyrenees which are dry in the winter and fullest in August, when the snows are melting. Coal production has been brought to a prosperous condition during the war, but the problem of its transportation remains unsettled. Although general electrification is difficult, the undertaking in Spain is regarded as well within the realm of possibility.

AN ELECTRICALLY-DRIVEN WINDING EQUIPMENT.

Recently there has been put to work at Kilton Collieries an interesting example of an electric winder representing the latest practice in geared A.C. winding plant. The winder has been designed to suit the following conditions :—

Depth of shaft	720 ft.
Net load of stone	3·5 tons
Weight of cage and chains	3 tons
Decks per cage	1
Tubs per cage	2
Weight of one tub ...	0·65 tons
Output per hour	180 tons (iron stone)
Time of winding	45 sec.
Decking interval	15 sec.
Total time each wind ...	60 sec.
Drum, cylindro-conical ...	11-ft. to 15-ft. dia.
Turns on small diameter...	6 (three dead)
Turns on scroll	4
Turns on large diameter...	9·7
Drum speed	27·6 R.P.M.
Rope diameter	$4\frac{1}{2}$ in. circum.
Maximum rope speed ...	1,300 ft. per minute
Motor rating	370 B.H.P., 3-ph., 40 per., 2,750 v.
Motor peak	440 H.P.
Motor speed	255 R.P.M.
Ratio of gearing	9·25 to 1
Supply	3-ph., 40-per., 2,750 volts
Auxiliaries...	3-ph., 40-per., 440 volts

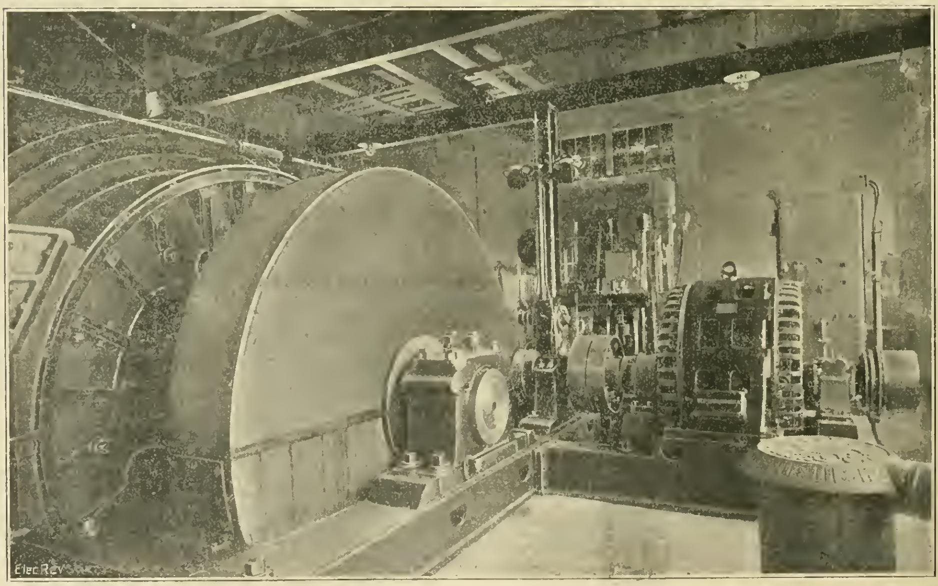

Fig. 1.—General View of Winding Plant.

The winder was built to replace a beam-type engine with overhead drum, which, although somewhat expensive to run as regards steam consumption, was, on the whole, free from costly repairs. Latterly, however, this engine developed defects, and its replacement became increasingly urgent. It was imperative that the steam winder should remain on duty until the last possible moment, and that the change-over should take place during a week-end. This was successfully accomplished, and the electric winder started work promptly on the Monday morning without any hitch. The new winder house is built immediately behind (relatively to the head gear) the old engine house; this incidentally resulted in the distance between the head sheaves and drum being increased in the rope plane, thus favourably affecting the angling of the ropes.

By this arrangement of buildings, the rapid transference of the ropes to the new drum, and the clearing of a way for them through the upper part of the old engine house was greatly facilitated, whilst, at the same time, no alterations whatever to the head sheaves were necessary.

The induction motor (figs. 1 and 2) is geared to a spur wheel on the drum shaft, the driving pinion being mounted on an extension shaft supported by two bearings, the connection to the latter shaft being made through a flexible coupling of the "pin" type. The gearing is of the double-helical variety, and is mounted in a dust-type gear box where the spur wheel dips into an oil bath. This wheel, which is about 10 ft. diameter, is split in halves for the purpose of facilitating its erection, and also removal of the drum shaft should this ever be necessary.

In order that high peaks may be eradicated and the winding cycle equalised to a great extent, a cylindro-conical drum has been designed and fitted. It is, perhaps, unnecessary to point out that the shorter the decking period can be made, the more efficient becomes the winding cycle. The decking period in this case is 15 seconds. Further equalisation is not called for in this case, especially as the supply company has installed within a short distance of this particular colliery, a synchronous motor for correction of the power factor in the district.

The drum brakes are operated by means of a compressed air engine which raises or lowers the main brake lever which is of the usual weighted type.

In the event of operation of any of the emergency trips —for instance, when an overwind occurs—a solenoid-released trigger causes the main brakes to go into the "on" position immediately. The interlocks are such that the brakes remain in the "on" position until the emergency condition is restored to normal and the power put on again.

The air compressor for the brake engine is of the two-stage type, driven by a 10-H.P. motor, and is supplied from a three-phase, 440-volt, auxiliary transformer, which also supplies the solenoid and controller pump motor.

The driver's platform (fig. 1) is of such a height as to give the operator a clear view of the whole plant under his care, a condition which is, perhaps, too often overlooked. The motor is controlled by a liquid controller of the weir type, fitted with oil-immersed reversing switches.

During the time the controller is in circuit a continuous flow of electrolyte is pumped into the upper tank, returning over the sluice gate into the lower tank. The movement of the operating lever throws the reversing switch in one direction or the other, according to the direction of rotation, and at the same time raises the sluice gate. This causes the level of the liquid in the upper tank to be raised, and, consequently, the resistance between the electrodes is decreased. When the operating lever is returned to the "off" position, the sluice gate is lowered again, and the level of the resistance liquid is lowered, thus increasing the resistance in the rotor circuit. Just before reaching the "off" position, the primary circuit is opened on the reversing switch. When it is desired to run at a slow speed, the sluice gate is lowered to an intermediate position, thus increasing the resistance as found necessary. Owing to the fact that the resistance liquid cannot follow the raised sluice gate faster than the pump can deliver the liquid into the upper tank, a certain minimum accelerating period of the motor must be adhered to, although it is possible to obtain a longer acceleration period. The acceleration period is adjustable within limits by means of a stop-valve in the delivery pipe of the pump. The system avoids unnecessary peaks. When winding men, it is often necessary to adopt a different rate of acceleration than when winding stone, and the necessary adjustment may be very quickly effected.

The reversing oil switches are fitted with safety interlocks, which are so arranged that the oil containers may not be removed without tripping the main oil switch.

An electric overspeed preventer device has been fitted, which in this case consists of a D.C. series-wound generator, chain driven from the motor extension shaft, and arranged to deliver its output through a bank of resistances, a relay, and an ammeter. These resistances are inserted into the generator circuit in a number of equal steps, each of which corresponds definitely to a certain number of completed turns, or fractions of turns, of the main drum during acceleration. The resistance inserted will only maintain the current in the small series-generator circuit constant up to full speed, provided the generator speed or drum speed rises at a definite set rate. Put in another way, the drum speeds as taken at short intervals must only reach certain values relative to the position of the rheostat. Should it exceed these, the resistance previously inserted would be insufficient to keep the current through the relay within a safe limit. In such a case, the result would be that, owing to too high a rate of acceleration having been permitted, the relay would trip the main oil breaker, and the equipment would be temporarily shut down. Similarly, when approaching the end of the wind, the operator must not neglect to slow down at a point in the wind for which the device is set, otherwise the resistances will be cut out more rapidly than the generator speed and volts drop, which would cause the excess current to open the breaker. It is, therefore, obvious that a winder fitted with this device must always be driven to diagram, and in such a manner as will ensure the maximum of safety, the driver being compelled to follow a definite accelerating and decelerating curve within safe limits.

The device acts as an efficient overspeed preventer during the constant full-speed running time of the winder, and also in the case of a loaded cage being lowered on the brakes only, and beyond "safe" speed.

The overwind switch is of the friction-driven type, being fitted with a flexible steel-rope drive working in a grooved pulley, mounted on the switch spindle. The rope is attached to a lever, which is struck when an overwind occurs by tappets provided on the depth indicator. The flexible cord pulls the switch open and shuts down the winder, but as the drive on the grooved pulley is by friction only, the switch may be reset by hand speedily, the rope slipping in the groove to permit this. It will, therefore, be perceived that should the winder be started in the wrong direction following on an overwind, no risk is incurred as the switch will always shut down the winder when the cage has moved less than 1 in. upwards.

The British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, supplied the complete winder, being principal contractors to Messrs. Bell Bros., Ltd., the proprietors. Messrs. Robey & Co., Lincoln, were subcontractors for the mechanical parts.

ERITH'S MUNICIPAL KITCHEN.

Thursday, April 10th, witnessed the opening of Erith's Municipal Kitchen and Restaurant, the ceremony being performed by Mr. T. G. Jones, Director of National Kitchens, of the Ministry of Food, in the presence of a large and representative gathering.

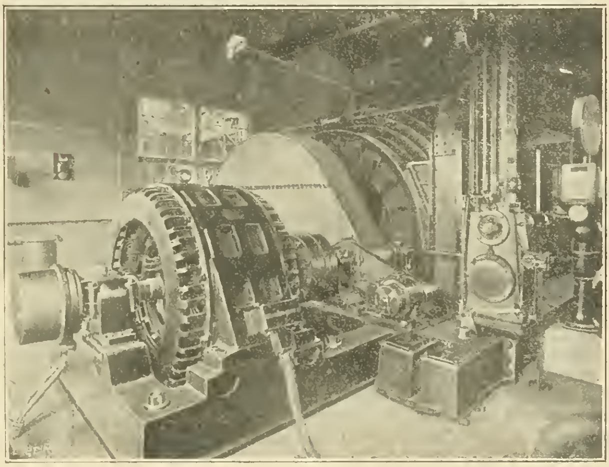

Fig. 2.—370/740 h.p. Westinghouse Induction Motor Driving Winder.

Occupying, as it does, a most central position, the new building bids fair to prove a boon to the public in many respects. The restaurant, which is under the capable management of Mr. and Mrs. J. Harle, of Newcastle-upon-Tyne, who have a wide experience in catering for large institutions and munition canteens, will supply meals cooked under the most hygienic conditions by electricity, at prices which come within the range of the most limited pocket.

The arrangements made for supplying meals for home consumption will enable a large number of persons to be served in the shortest time, separate entrances and exits being provided. Meals for consumption off the premises can be obtained from 11.30 a.m. daily, and dinners for consumption on the premises will be served daily from 12 noon till 2 p.m. Teas will also be provided each afternoon.

The room provided for the consumption of meals on the premises has been made as attractive as possible, the decorations are effective, whilst the general surroundings should help to contribute to the comfort of patrons.

The building was erected by the Erith District Council, the Government lending the money—£4,000—free of interest, to be paid in a certain time. The Kitchen is constructed of glazed bricks with vitrous tiled floor, and the restaurant of asbestos sheeting, while the roof is covered with asbestos slates supplied by the British Fibro-Cement Works, of Erith. The sinks and other kitchen equipment were supplied by the Stains Kitchen Equipment Co. Mr. Harold Hind, surveyor to the Erith Council, was the architect responsible for the plans, the building work being admirably carried out by Messrs. H. Friday & Sons, contractors, of Erith.

The whole of the electrical cooking apparatus was supplied and erected by Carron Company, of Carron, Stirlingshire, the work of erection being carried out under the supervision of its London representative, Mr. C. McKinlay, A.M.I.E.E.

Details of the equipment are as follows :—One treble-oven range comprising one single, and one double oven, the dimensions of the single oven being 22 in. by 20 in. by 22 in., and that of the double oven approximately twice the size, the heating elements being separately controlled and arranged for a wide range of heat regulation.

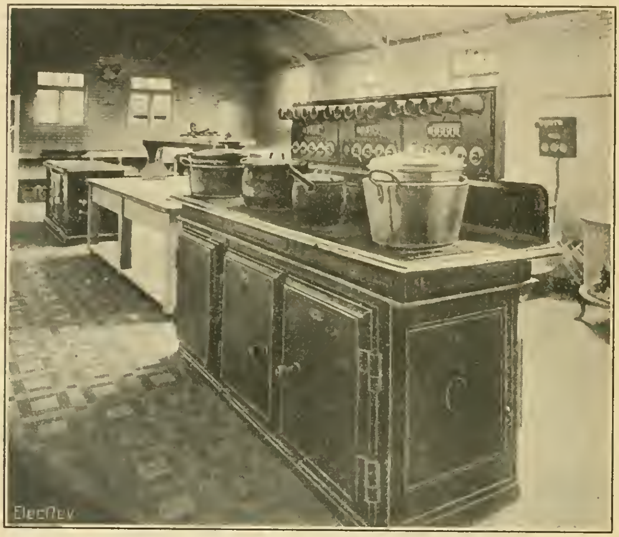

Fig. 1.—Treble-oven Range and Hot Closet.

The range is fitted with a continuous crown-plate with skirting at the back, and is complete with a separate switchboard on which are mounted the necessary rotary indicating switches, fuses, and pilot lamps for each circuit. The hob contains three large and six small rectangular boiling sections, the total maximum loading of the range comprising the ovens and boiling sections being 33 KW. A view of the range is seen in fig. 1.

The second item is an electrically-heated hot closet 6 ft. long by 2 ft. 10 in. high by 2 ft. wide, constructed of cast-iron, with a plain polished top, and with mouldings all round, and panelled back and ends, fitted with sliding doors to the front, and a perforated shelf in the centre, as seen in fig. 1. The heating elements are arranged at the back and ends of the apparatus, the controlling switches and fuses being mounted on a switchboard fixed at the end of the hot closet. The total maximum loading of the appliance is arranged for 4 KW.

The third item comprises three 30-gallon boiling pans, consisting of tinned-copper inner pans, with galvanised outer cases, cast-iron tops, bases, and legs, double-cased, and packed with heat-retaining material, complete with hinged lids and large-bore draw-off taps. These pans are shown in fig. 2. The total maximum loading of each pan is 12 KW.

Two electric steaming ovens make up the fourth item, each oven measuring $17\frac{1}{2}$ in. wide × 28 in. high × 23 in. deep inside. The construction consists of a sheet-steel outer case and galvanised iron interior, with accommodation for five galvanised wire baskets, and cast-iron top, base, legs, and door, with a drip gutter in front.

The water pan in the bottom of the oven is heated by means of elements arranged for various heat regulations, the whole being controlled by rotary indicating switches mounted on a separate board complete with fuses and pilot lamps. The bodies of the ovens are lagged with heat-retaining material, and a cast-iron supply cistern with ball valve is arranged at the side, as seen in fig. 2. The maximum consumption of each oven is 5 KW.

One double electric grill, as seen in fig. 3, forms the fifth item, consisting of two compartments, the internal dimensions of each being 16 in. by 17 in., complete with brander, porcelain enamelled soleplate, and drip tin, each compartment being independently controlled by a separate switchboard. The total maximum loading of the grill is 8 KW.

Two cast-iron electric fish fryers are provided, each measuring 20 in. by 18 in., by $4\frac{1}{2}$ in. deep, mounted on four substantial feet, complete with separate controlling switchboard, also shown in fig. 3, comprising rotary indicating switch, fuses, and pilot lamps, the maximum loading of the apparatus being 4·8 KW. each.

The last item but one comprises four electrically-heated hotplates, the dimensions of each being 17 in. by 9 in., mounted on four legs, and being complete with a rotary controlling switch fitted to the front of the apparatus. The maximum loading of each hotplate is 1·2 KW.

The eighth and last item is a six-gallon polished copper water boiler fitted with a lift-off cover, large bore draw-off tap, and controlled by a three-heat switch mounted on a separate switchboard ; the unit is complete with fuse and pilot lamp, the total maximum loading being arranged for 3 KW. The whole of the apparatus is balanced on the three phases of the supply main, and the pilot lamps of each separate piece of apparatus are painted a distinct colour, according to which phase they are connected. Three ammeters, also painted with the corresponding phase colours, are provided and placed in a prominent position, as shown in figs. 2 and 3, so that the total loading on each of the three phases may be kept under observation, and the balance adjusted

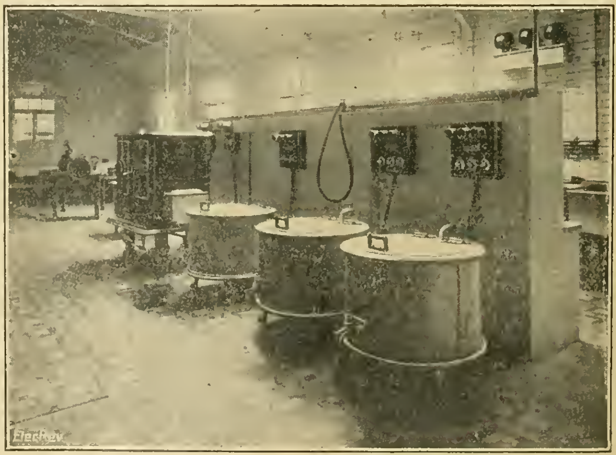

Fig. 2.—Boiling Pans and Steaming Ovens.

accordingly. The electricity supply is taken from the mains of the U.D.C., being three-phase, 50 cycles, at 350 volts. The cables are lead in through ducts under the kitchen floor, and terminate in cast-iron pipes running up the back of each piece of apparatus.

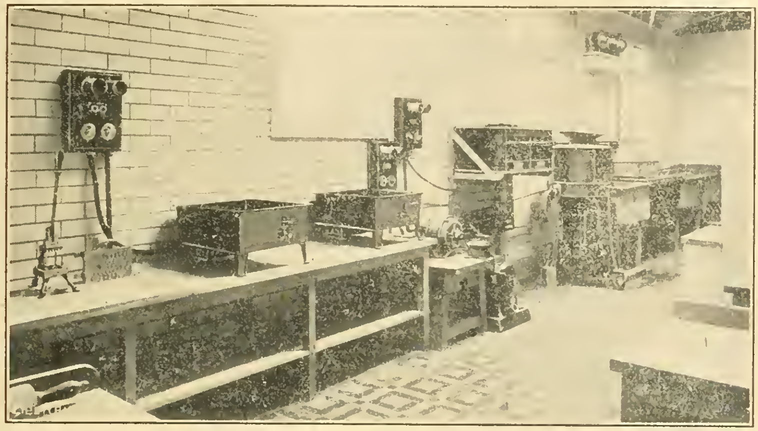

Fig. 3.—Auxiliary Electrical Apparatus.

In addition to the apparatus already mentioned, an electrically-driven mincer and potato peeler are provided, both being arranged to be driven by the one motor as seen in fig. 3.

In conclusion, our thanks are due to Mr. C. McKinlay for supplying the data set out above, and the U.D.C. for an opportunity to be present at the opening ceremony.

SEARCHLIGHT EQUIPMENT AND OPERATION.

By HUGH M. GOODY.

Having considered in a previous article* the principal apparatus and methods employed in searchlight work, it may be of interest to deal slightly more fully with one or two points regarding the electrical equipment in use in an overseas searchlight section, and the staff organisation.

Equipment.—The generating equipment consists, on stationary lights, of small petrol-electric sets of the "Aster," "Simplex," and similar makes for the 60-cm. diameter projectors, and of somewhat heavier sets—"Keighley," "Dorman," and others—for the 90 and 120-cm. diameter lights. Up to the early part of last year these stationary sets—sometimes of quite unwieldy design—were extensively employed for mobile work also, but when, in March, we were compelled to retreat in various sectors, the disadvantages of such heavy plant within comparatively short distances of the line became overwhelmingly evident. Subsequent to that date, therefore, nearly all mobile sections were fitted out with proper mobile equipments. These consisted of either "Tilling-Stevens" or "Dennis-Stevens" petrol-electric lorries. These lorries not only provide the power for the light, but when on the move carry the projector and crew, together with their kit and gear. The interior of the lorry is fitted up with a switchboard carrying a main switch, ammeter, voltmeter, and suitable fuses. Alongside the switchboard is mounted a substitutional resistance which provides a load when the arc is not in use. An automatic cut-out is fitted on the switchboard, so that as soon as the arc is struck the resistance is cut out of circuit. The voltage at the switchboard terminals is kept as near 80 volts as possible.

The lorry and the projector emplacement are usually some 200 yards apart, to prevent the noise of the engine interfering with the work of the lamp crew, and to transmit the current to the projector about 250 yards of C.T.S. cable is provided. This is so arranged that there is a voltage drop of 20 volts between the two points, giving a pressure at the lamp terminals of 60 volts. The resistance of the cable provides the necessary steadying resistance for the arc circuit.

In the projector emplacement is a switchboard fitted with voltmeter, ammeter, and switch. The arc of a 90-cm. diameter projector is usually run at 60 volts and 120 amperes are maintained. Careful adjustment of the carbons before dark is essential, so that there shall be no unsteadiness or flickering of the arc while in action. The lamp must also be focused, at any rate after each alteration of the carbons, to ensure that the positive crater is exactly at the focal point of the mirror; otherwise, of course, the beam will not be parallel.

A very important consideration involved in the arc-length is the shadow cone cast by the negative carbon, and it is necessary, if the best results are to be obtained, that this shadow cone shall be kept at its minimum value.

Theoretically, of course, to give a parallel beam, the light must be a "point source." This is, naturally, not a practicable possibility, even if the source be considered as the positive crater, and much less so when it is remembered that the whole of the arc is to some extent an illuminant. The result is that quite a large proportion of the rays reflected by the mirror are divergent instead of parallel. These rays are thrown on to the inside of the projector barrel, and reflected thence out through the front screen. They evidence themselves as a widely diverging cone of light apart from the main beam, lighting up the ground around the projector. It will be understood that this is very undesirable, and several methods have been adopted to prevent its occurrence. The latest and most successful consists of a number of concentric rings of sheet iron arranged outside the front screen of the projector.

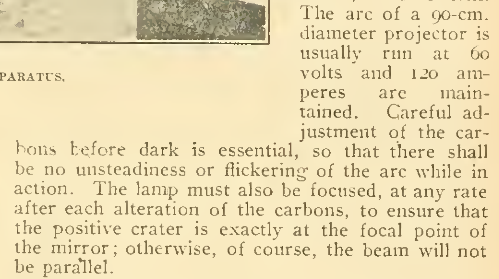

Fig. 1.

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* Electrical Review, February 28th, 1919.

The number, diameter, and depth of these concentric rings are so arranged that no ray except a parallel one can pass through them.

The telephones in use for searchlight work are of several types. For local work, such as communication between the spotters and the projector controller, a combined "buzzer" and speaking set is often used, but for other work, ringing sets of various types are employed.

For front-line defences, insulated ground lines are generally used, and provide plenty of work for the would-be fault-finder. Since these lines are laid across streams, hedges, bridges, on poles over roads, and so on, and since, moreover, "faults" always seem to occur at night, the man who is chosen to repair searchlight telephone lines does not usually consider himself lucky. A lineman has a little better time in back areas, where overhead lines are in use, since here, even in the dark, he can, with the aid of a torch, usually localise any breaks or shorts. If, however, this back area happens to be under shell fire, overhead lines may prove a source of considerable trouble. It is really marvellous what a number of faults will be caused by a comparatively small amount of shelling. Of course, much of the damage is due to the force of explosions in the neighbourhood of the wires, but it is surprising how often poles and wires are actually hit by flying particles; being such relatively small things, one would have thought they would surely have been missed. However, better damaged telephone lines and poles than other things!

Organisation.—The unit of the searchlight personnel on anti-aircraft work of the Royal Engineers is the section which may consist of either 20 or 28 members, according as it is responsible for the operation of two or three lights. The crew of a "light" consists normally of eight men, two of whom are N.C.O.'s. For the section there are in addition an officer, batman, A.S.C. driver, and a staff-sergeant mechanist; the duties of the last are purely technical. The discipline and organisation of the section are in the hands of the two (or three) N.C.O.'s in charge of the lights, the senior of whom is a sergeant.

The control of these units for fighting purposes is guided by two main principles. If the anti-aircraft defence of some base town, ammunition dump, railway works, or other important point is in contemplation, it is usual to adopt what is termed the "group" system. Here, all searchlight stations are connected telephonically—generally by overhead lines—to the anti-aircraft gun stations with which they are co-operating. These gun stations are in turn connected to "control" headquarters, which usually coincides with the battery headquarters of the artillery. The "controls" can, of course, be connected to any point on the army telephone system, so that a complete system of communication is established. By this means, warnings and orders can be transmitted from one A.A. station to another, no matter how distant from one another they may be, and the general policy is for front-line defences to warn all the rear defences over which enemy aircraft would be likely to pass. Notwithstanding this, a constant look-out is kept by each station individually, the crew of eight men performing this duty, as well as providing three men for duty on the generating set, throughout the night.

For front-line defence, each station is usually entirely independent, though local telephone communication with the gun station may be provided by means of insulated ground lines in cases where the conditions allow of it. In anything approaching mobile warfare, however, telephonic communication of any kind is very difficult, and local communication is usually provided by means of "runners."

The two problems which confront the searchlight operator are, first, to locate, and then to hold his "target." By constant application a man may become very efficient at locating aircraft without any external aid; two main devices are, however, now in use to aid the naked eye and ear, the first being specially arranged binoculars, and the second an apparatus termed a "sound locator." The first of these is designed for use on moonlight or starlight nights, when it has been proved that, by the use of ordinary binoculars it is quite possible to discern aircraft without any artificial illumination. The difficulty, however, has been that, to direct the searchlight beam on to the right spot, the eyes have to be taken away from the binoculars, and the target is consequently lost. To overcome this, the binoculars are mounted on a post on a level with the operator's eyes. These binoculars are free to rotate on either a horizontal or a vertical axis, and attached to them is an open sight as well as two pointers; the latter, in conjunction with two graduated scales, give horizontal and vertical readings in degrees. A "reader" accompanies the spotter, and directs the beam either by means of the sight or by calling out bearings and elevations.

The "sound locator" consists of four trumpets, two in line vertically and two in line horizontally. To understand the action of these it is necessary to appreciate to some extent the operation of the human "sound locator." If a sound is coming from the north, and the head is turned, say, east, the sound waves emanating from the source of sound will not reach the two ears exactly simultaneously; in this case they will reach the left ear slightly earlier than the right; this is not the whole theory, but will serve our purpose. To locate the source of sound, the natural action is to turn the head slowly to the left until a perfect balance is obtained. Our perception of vertical differences—*i.e.*, whether the sound is at an angle of, say, 15 deg., or one of 60 deg.—is much less acute, but it is effected by a similar balance in reference to the bones of the head. The four trumpets in a sound locator merely magnify these differences, and so enable a greater degree of accuracy to be obtained. Officially they work to an accuracy of 3 deg. or less, though much depends on the operators, of whom there is one to each pair of trumpets. Here again, it is observable that better results are obtainable in a horizontal plane than vertically. It will be obvious that the point located by this means is the point from which the sound emanated, and to locate the actual aeroplane allowances must be made for the speed and direction of its flight.

Once the target has been located by the spotters, the problem is then to hold it, and to do this it is necessary that it shall be constantly visible to the projector controller. With the "bar" type of control referred to in a previous article, the operator is some 12 ft. from the projector itself, and it has been found that with the target at normal distances, the angle between his line of sight and the line of the beam is sufficient to enable him to see the target if it is kept on the "near" edge of the beam; that is to say, since he is on the right-hand side of the projector, the target must also be kept on the right-hand edge of the circle of light. If the 'plane is travelling to the left and tending to enter the field of illumination, this is a comparatively easy matter, but if the machine is travelling to the right and tending to leave the field of light, the utmost skill is necessary to hold it in this position without losing it. The projector controller is provided with a telescope fitted to his control bar, to aid him in picking up and holding targets.

The methods of searching and holding given above apply to searchlights when used in conjunction with A.A. artillery, but lately searchlights have been much used as an aid to defensive aircraft patrols. For this purpose a constant patrol of small fighting 'planes is maintained, and the lights in conjunction with which they are operating are arranged in groups of three. Several lines of searchlights are used, and on hearing enemy aircraft, the front line opens out, and, by means of the sound locator, "lays" on the sound as accurately as possible. Each small group of three lights arranged triangularly, endeavours to indicate as correctly as possible the position of the enemy aircraft, but makes no special effort to pick them up with the beam. When the defensive planes have, by means of the directing searchlight beams, located the enemy aircraft, a prearranged signal is given, on seeing which all lights except those which would illuminate the target from the front either shut down or get to work on some other target. In the event of the target not having been located before it has passed over the front-line lights, the second line takes on the duty of indicating the position of the enemy aircraft, while the front line is at liberty to "search" in the ordinary way.

A recent innovation in searchlight equipment is the machine gun, which is mounted on the control bar near the projector. This is provided as a defence against the fighting planes which accompany enemy bombing squadrons, and whose duty it is to give special attention to A.A. guns and lights. This gun is of little use, however, mounted on the control bar as it is, if the enemy planes come very low, since it cannot be moved independently of the projector, and the projector controller 12 ft. away cannot move the projector and gun round fast enough to keep pace with the aircraft. Nevertheless the Lewis gun is a very acceptable possession for a searchlight crew, who are otherwise defenceless.

All times and observations are carefully recorded by the telephonist, and essential reports are made over the telephone to "control" from time to time. The records of bearings and elevations, taken in conjunction with approximate estimates of the height of the planes, enable a track chart to be plotted of the course of the aircraft. In this way fairly reliable data are arrived at with regard to methods and objects of attack, and the whole defensive system can be kept up to date and capable of coping with any fresh developments on the part of the enemy.

With regular tours of duty, frequent "alarms," telephone systems and plant to maintain during the daytime, to say nothing of fresh emplacements to dig as the light is moved about, it will be seen that the time of a searchlight crew is amply occupied, and that everything is done to render the system of anti-aircraft defence as efficient as possible.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Electric Valve-Closing Apparatus.

Messrs. Thacker, Bell & Co., Ltd., of 44, Leadenhall Street, E.C. 3, are introducing an electric valve-closing device patented by Mr. James Tate, of Bradford, which effects its purpose by a very simple method. It is intended to enable engines, turbines (steam or water), and other motors to be stopped instantly at will, from any distance, or automatically, in case of over-speed, at the same time destroying the vacuum of a steam engine to prevent water from backing up to the cylinders.

In applying the device to an engine, the wheel, spindle, and cover of the stop valve are replaced by a new wheel, spindle, and cover, with which is combined the stop apparatus. This consists of a powerful spring, controlled by an electrically operated pawl; when the stop valve is opened, the spring coiled round the spindle is put under tension just as a watch is wound up, and by pressing a button which closes the circuit of an electromagnet, the spring can be released, closing the valve. A pair of small governors, driven from the main shaft, effects the same operation automatically in the event of the speed becoming excessive. An air valve, connected to the condenser by tubing, and to the engine side of the stop valve, simultaneously opens automatically, admitting air to the condenser, and thus destroying the vacuum.

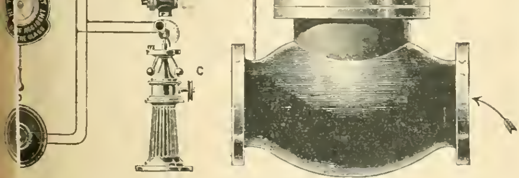

Fig. 1.—Tate's Electric Stop Device.

A, apparatus attached to stop valve; B, patent air valve; C, auxiliary governors; D, open push for daily use; E, safety push for use in workrooms; F F F, Leclanché battery and wiring.

The apparatus, which is illustrated in fig. 1, thus provides for the quick stopping of the engine in case of emergency, saving life or preventing personal injury, as well as avoiding damage to machinery through accident or overspeed, secures the safety of the engine and reduces the insurance premium thereon, and protects the owner against the operation of the Employers' Liability Act. A small primary battery suffices to actuate the device.

New Fiat Electric Generator and Motor Starter.

Advantage was taken of the Lyons Sample Fair, which opened on March 1st, to present to the public the first of the Fiat cars built in accordance with the post-war programme. This model, officially known as Model 501, is rated at 12-16 H.P., and is a light car supplied complete with electric lighting and starting, and all accessories. A new feature is the adoption of a silent chain for driving the camshaft and the electric generator. This chain passes round the camshaft and the electric-generator pinions, and can be adjusted in a very simple and ingenious manner by the latter. The electric generator, which is of circular section, and has its shaft mounted eccentrically, is received in an extension of the crankchamber, and passes through this into the timing-gear housing. By turning the generator in its housing, the chain can be adjusted, and in order to make this adjustment accurate and simple a worm and screw control is provided.

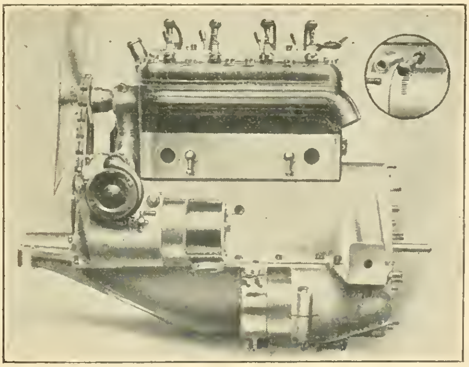

Fig. 2.—Valve Side of New Fiat 12-16-h.p. Engine, showing Neat Mounting of Electric Generator and Starting Motor.

as shown in fig. 2. White the camshaft is driven by chain, the Fiat engineers have retained the transverse shaft for the magneto and water pump. This gives complete accessibility, for the magneto distributor and breaker box are outwards.

The whole of the electrical set used on this car is built in the Fiat factory. The equipment comprises the positively driven electric generator, an electric motor placed on the left-hand side of the engine base chamber, and having a sliding pinion engaging with a ring gear on the flywheel, a battery carried in a box on the frame, and head, side, dash, and tail lamps. Starting the engine is effected simply by pressing a button on the dashboard. The details of the electrical system have received very careful attention, all the electric wires being carried in metal conduits.

Elmbank Electrical Specialities.

We have received from Messrs. James Allan, Senr., & Son, Ltd., of Elmbank Foundry, Glasgow, a catalogue illustrating electrical heating apparatus designed on novel and efficient lines. The adaptable one-unit fire (Robinson's patent) should prove a most useful and convenient device. In fig. 3 the fire is arranged as a grill or toaster; in fig. 4 it is shown as a radiator for warming a room; while in such a position as seen in fig. 5 it will boil or fry. The fitting has an electro-plated copper finish, and is complete, including 6 ft. of flexible cable.

With regard to the hot-water warming apparatus seen in fig. 6, this consists of an electric boiler with one "Gloworm" element of 1-unit capacity connected to three 6-ft. lengths of 2-in. cast-iron hot-water pipes with a 3-way branch siphon which allows for filling and expansion. This boiler is suitable for connecting to either pipes or radiators. It is supplied with either flow or return tappings for screwed pipes or sockets for caulked joints.

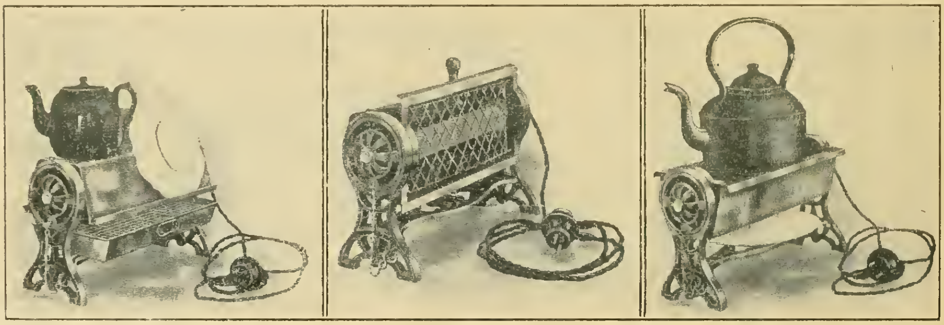

Fig. 3. Fig. 4. Fig. 5.

Robinson's Adaptable One-unit Fire.

The "Gloworm" immersion heater for use with the above boiler has been designed to work within a metal tube without danger of the resistance ribbon coming in contact with the tube. There is therefore no necessity for placing heat-resisting material over the heating ribbon for insulating purposes. Single or three varying degrees of heat are given; the heat operating on the metal tube which readily transmits it to the water on its outer surface. The body of the element is made of glazed heat-withstanding and non-hygroscopic porcelain. The tube is made a fixture in the tank, with one end open to admit the heating element. The flanged end of the latter closes up the aperture; the terminal connections are outside this flanged piece, and a threaded porcelain cap protects the terminals. The sectional construction of the element enables it to be made up in various lengths, the whole of the parts being securely held together by a bolt through the centre. The design and construction of "Gloworm" elements enable them to be used for a large variety of industrial purposes.

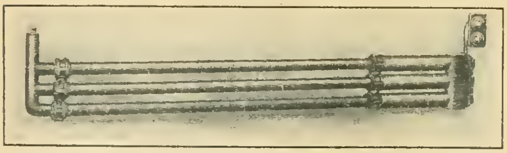

Fig. 6.—Hot-water Warming Apparatus.

London's New County Hall.—The London County Council has decided to proceed immediately with the work of finishing the new County Hall.

THE ELECTRICAL DEVELOPMENT ASSOCIATION.

We give below particulars of the constitution and objects of the Electrical Development Association, which has been established to promote general propaganda and publicity for the benefit of the electrical industry as a whole. In December, 1917, the President of the Institution of Electrical Engineers, Mr. C. H. Wordingham, realising the necessity for such an organisation, called a meeting of the representatives of all sections of the industry, to consider the matter. A Committee was formed to carry out the preliminary work, consisting of the following members, representing the bodies named :—

Institution of Electrical Engineers.	Messrs. C. H. Wordingham, W. A. Chamen, and W. A Gillott.
British Electrical and Allied Manufacturers' Association.	Messrs. C. O. Bastian, C. R. Belling, A. F. Berry, T. Clifford Palmer, D. N. Dunlop, and F. H. Williams.
The Incorporated Municipal Electrical Association.	Messrs. F. Allen, J. H. Bowden J. Christie, A. C. Cramb, S. E. Fedden, and E. E. Hoadley.
Conference of Chief Officials of London Electric Supply Companies.	Messrs. R. S. Downe and E. J Walker.
The Incorporated Association of Electric Power Companies.	Messrs. E. T. Ruthven-Murray and W. B. Woodhouse.
Electrical Contractors' Association.	Messrs. Duncan Watson and Rashleigh Phipps.
Cable Makers' Association.	Mr. Ll. B. Atkinson.

From this body an Executive Committee was formed, comprising Mr. A F. Berry (chairman), Mr. D. N. Dunlop (vice-chairman), Mr. A. C. Cramb, Mr. R. S. Downe, Mr. E. T. Ruthven-Murray, Mr. Duncan Watson, Mr. F. H. Williams, Mr. W. A. Gillott. and Mr. Ll. B. Atkinson.

The industry has been approached through the various institutions or associations by their representatives on the Committee, in order to obtain subscriptions to an initial fund ; these endeavours have met with success, and sufficient support to the scheme has already been given to justify the Committee in incorporating the Association. It is intended to establish and incorporate the Association under the name of "The Electrical Development Association," and offices will be taken in a central position in London.

The primary objects of the Association are to encourage engineers, architects, builders, &c., and to educate the public generally, to make the fullest possible use of electricity; to collect, co-ordinate, and distribute data of interest to members of the Association.

The Association will work through its Executive Committee, which will be composed of representatives of the Institutions or Associations named above, and others who may be identified with any branch of the electrical industry.

Members of the Association will consist only of those interested in the manufacture of electrical plant or apparatus, supply authorities, and installation contractors.

The revenue of the Association will be derived from each contributing section of the industry in a manner most suitable to the constitution of such section—*e.g.*, by donations, subscriptions, sale of pamphlets or other propaganda matter, &c. A complete range of posters, pamphlets, and literature will be available for distribution either by the members themselves or by the Association.

It is evident, from the success already achieved, that a concentrated and determined effort only is needed to replace by electrical methods the older services for industrial and domestic purposes. This is the main object of the Electrical Development Association. By the cordial and enthusiastic co-operation of all sections of the electrical industry its position can be greatly strengthened, resulting in a considerable increase in the volume of business in all branches of electrical trade.

As stated in our leading article last week, Mr. J. W. Beauchamp has been appointed Director of Development, and under his able guidance we anticipate that valuable results will be obtained, when the organisation of the Association has been completed and the machinery has been got into working order.

THE CORROSION OF CONDENSER TUBES.

Part III of the Report to the Corrosion Committee of the Institute of Metals, by Dr. Guy D. Bengough and Dr. O. F. Hudson, deals with the subject of corrosion under practical conditions as it appears to the authors. They express the view that corrosive attack on condenser tubes is more diverse in character and complicated in nature than has been generally supposed. The first action is one of chemical oxidation, and secondary actions are of great importance. No one single remedy is likely to be found effective for all the different kinds of attack which occur in practice. The nature of the tube used and the protective measures chosen should be dependent on the particular set of conditions.

The following is a set of conditions under which a 70 : 30 brass condenser tube should have a minimum life of twenty years:—

(*a*) Only clear water to enter the tubes, or water which will not deposit suspended matter.

(*b*) The water must be free from gases in suspension, and must not contain more than the normal amount of air in solution.

(*c*) The water must be neutral or not more than very slightly alkaline. It must be free from ammonia and certain other specially harmful substances, which are, however, of comparatively rare occurrence in technical waters.

(*d*) The temperature of the cooling water in the hottest part of the condenser should not exceed 35 deg. C.

(*e*) The velocity of the water should be about 5 or 6 ft. per second.

(*f*) The steam should be properly distributed in the condenser, according to the best modern practice.

A water supply which varies considerably in composition at different times of the year involves special problems and must be excluded from the above statement at present.

In practice tubes fail sooner than the period stated, because the normal slow roughening of the tube by chemical oxidation is locally speeded up by factors which are for the most part independent of the tube. A preliminary attempt is made to gather the more important of these factors into a tabular statement, which is given below. In practice factors set out separately in the table may act jointly. Causes of corrosion are not arranged in the table in order of importance, since this order varies in different types of installation. The effect of water velocity on the rate of corrosion varies with the nature of corrosion.

The effect of the presence of a scale on the rate of corrosion is considered to be of great importance. Of the substances that commonly occur in scale, calcium carbonate is one of the most important. Its effect varies with its physical condition. It may exert almost any kind of effect, from a considerable degree of protection to a serious attack.

Some observations are described on the effect of a form of electrolytic protection (the Cumberland process) at the Southwick power station of the Brighton Corporation, which is under the charge of Mr. J. Christie, who has placed many facilities at the authors' disposal. The conclusion is reached that the process ensures a prolonged life for the tubes under Southwick conditions, provided that it is applied to new tubes, *i.e.*, to tubes that have not begun to corrode before the process is put in operation. The process should be applied continuously and not intermittently. The authors consider that the thin uniform scale which is maintained on the tubes by the process is an important factor in preventing serious corrosion. One of the important functions of the scale is to prevent contact between the tubes and harmful deposits and products of corrosion; in addition, it slows down, but does not entirely prevent, the general oxidation of the tubes. The authors consider that further evidence is necessary before the value of the process can be estimated as regards prevention of corrosion in certain types of water other than seawater. Other possible methods of protection are briefly considered, and a preliminary account is given of a pre-oxidising process for reducing the rate of corrosion.

Hydro-electric Work in Italy.—The need for finding employment for discharged soldiers and others has induced the Italian Government to set aside a milliard lire for the execution of public works, the principal of which are hydro-electric installations. The increase of the subsidies to railways and tramways has also been decided upon, while financial assistance will be granted to construction firms to complete contracts under way. As an illustration of the progress made in the development of the country's water-power resources, it is observed that concessions have in recent months been made to the extent of 500,000 H.P. for industrial purposes, and more are to follow. The employment of water power will be stimulated in every possible way, and capitalists are asked to help the Government in this work.

Causes of Condenser Tube and Ferrule Corrosion. (Water side only considered.)

Cause.	*How Produced.*	*Nature of Action.*	*How to be Remedied.*
A. Foreign bodies carried in and accumulation of products.	A1. By ferric hydrate flakes from water ends. A2. By ashes, clinkers, &c. A3. By sludge of sorts in water supply.	Complete corrosion.	A1. Paint the pipe line and water ends. Increase water velocity. A1, A2, and A3. If worth while, trap the water supply or pass it through a screen. In some cases increase water velocity.
B. Acid or other bad or variable water supply.	B1. Some river supplies, *e.g.*, Tyne. B2. Some canal supplies, *e.g.*, ship canal. B3. Some well supplies. B4. Some estuarine supplies. B5. Some cooling tower arrangements.	Complete corrosion and rapid general thinning.	Keep water supply slightly alkaline. Use special tubes adapted to the special conditions.
C. Temperature in condenser too high.	C1. Hot inlet water, *e.g.*, tropical.	C1. Dezincification.	C1 and C2. Use special tubes.
	C2. Low water velocity.	C2. Dezincification.	C2. Increase water velocity.
	C3. Partial blocking of tubes.	C3 See A3.	C3. See A3.
D. Undue aeration.	D1. Errors in pump and pipe-line arrangements.	D1. Complete corrosion.	D1. Remedy air leaks, &c.
	D2. Eddies near inlet causing water-line effect.	D2. Complete corrosion.	D2. Special ferrules. Possibly increasing velocity of water with modified design of water end.
E. Unsuitable composition of tubes.	E1. Zinc or impurities in too great amount.	E1. Varies.	E1. In manufacturing.
	E2. Surface of tube not sufficiently copper rich.	E2. Dezincification.	E2. Probably by attention to details of annealing and pickling during manufacture.
F. Defective packing of tubes.	F1. Leaks caused by perishing of the packing material, especially in acid water.	F1. Varies.	F1. Use good tape packing. Red lead is sometimes useful to prevent leakage.
	F2 Collapsing of tubes.	F2 Varies	F2 Do not crush tubes when inserting them
G Physically bad surfaces of tubes, *e.g.*, bad spills and laminations.	Foreign bodies caught and trapped which would otherwise be swept away	Complete corrosion	During manufacture
H. Thermo-electric action in condenser.	By steam impinging directly on tubes, or being improperly distributed.	Dezincification	Only occurs in condensers of old design when steam is not properly distributed.
I. Too low water velocity.	Gases given off inside tube and not immediately swept away.	Complete corrosion near inlet end.	Increase velocity of water. Do not use main condenser for auxiliary machinery in port.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Rotor Currents of Slip-ring Motors.

As an inspector of electrical plant, I feel indebted to "Rotor" for raising this question, and fully endorse his, and also Mr. Jones's, remarks. I have personally experienced much difficulty when testing, or investigating, motor defects, and have often expressed surprise that British manufacturers should make no sort of reference whatever to rotor volts or amperes. Some even give very incomplete particulars as to stator current, H.P., and speed, while usually no reference is made to efficiency, power factor, or hourly rating. Mr. Jones remarks that he has known *no* manufacturer give any such data, except by request; I have seen many German motors, of A.E.G. manufacture, giving very full and accurate data, as to rotor amperes, volts, power factor, efficiency, rating, &c., and consider it quite time we followed yet another German example.

N. W. Walker, A.M.I.E.E.

Sheffield, *April 12th*, 1919.

Telephone and Telegraph Line Construction.

With reference to the above appearing in this week's issue of the ELECTRICAL REVIEW, I wish to say that the overhead telegraph and telephone wires from London to St. Margaret's Bay, and thence by cable, &c., to Paris, caused me much amusement and astonishment some years ago.

I have *not* been down to Dover or St. Margaret's Bay for many years, so do not know whether this matter has been rectified or not; however, when I was last there all the wires were overhead, and the Post Office was going to the enormous expense of putting all telegraph wires, &c., to Birmingham and Glasgow underground. I believe Glasgow and Edinburgh have since been connected up in this way.

The numerous wires going to the Continent, with the strong winds of the South Downs, and the possibility of tampering with them, especially in such times as we have just passed through, seemed to me, and do seem, absolutely ludicrous. We shall probably be *fully* awake some day.

D. R. Broadbent.

London, S.W. 1, *April 19th*, 1919.

The E.P.E.A. Award.

Will any of your readers who are engaged in power-station work be good enough to state whether they actually *know* of anyone who has received the 20 per cent. plus £90 award? In the district from which I write, we have received nothing save specious promises; our local committee cannot give us any satisfaction, and monotonously stated month after month that "Well, we *must* get it next month," and that the award will *have* to be paid, including 12 months' arrears. Now, Mr. Editor, "next month" is conveniently like unto "to-morrow," in that it never comes; whilst, when dealing with an association absolutely without pluck or power, there is *no* "*will have to be paid*" about the matter at all. Our chiefs and committees realise this, act upon it, and give us—nothing. The present attitude of the E.P.E.A. reminds one very painfully of the dignified non-committal attitude of the jellyfish.

Connaught T. Smith.

The Definition of Electrical Resistance.

In your reviewer's remarks concerning "Electricity and Magnetism for Engineers," by Harold Pender (your issue of April 11th), he expresses regret at the growing custom of explaining resistance by reference to the heat equation $\mathrm{JH} = i^2\mathrm{R}t$.

He suggests that this method of approaching the matter is clumsier than that derived from Ohm's law, but since resistance is a physical property of a conductor by virtue of which energy is dissipated when the conductor carries a current of electricity, I hardly feel in agreement with him. It seems better for students to look on resistance as a physical property of a conductor rather than as the ratio of two other electrical quantities. . . .

One surely should not expect this view of resistance to lead to such errors of definition as that pointed out in the review of the book, remembering that Joule's law is susceptible of simple experimental demonstration using given conductors.

As this question of the best method of presenting this matter to the student may be of interest to both students and teachers, your reviewer may feel willing to say more about it.

Charles H. Wright.

Glasgow, *April 16th*, 1919.

LEGAL.

UNWIN *v.* ARNOLD & SONS.

IN the City of London Court, on April 15th, before Sir John Paget, Bart., K.C., Deputy Judge, Mr. Frank J. Unwin, electrician, trading as F. J. Unwin & Co., 6, Lythos Road, Hampstead, claimed £6 5s. against Messrs. Arnold & Sons, surgical instrument makers, Giltspur Street, E.C., for supplying five medical electrical batteries. Plaintiff said that the defendants made certain complaints, and he admitted that certain details wanted rectification. He exchanged them and sent five new batteries which were in perfect order. Nothing was said until over a month after, when he applied for the account. Defendants then said they were going to return the batteries because they were faulty. In that time the batteries would have been partly weakened if not run down, and he refused to have them back because he knew they were in perfect order before they were sent out. He had tested them before they went out, and they showed the regular standard of 1.5 volts. He was willing to supply the defendants with a better battery, and submitted samples. They refused to look at them until he took back the five batteries. The batteries now in dispute were well known in London. He supplied them to firms who supplied hospitals. It was the cheapest kind of battery that he made. Although the work was not all that could be obtained in pre-war time, they were good batteries, and good value.

The DEPUTY JUDGE: Does it affect the efficacy of the current?

Plaintiff said it did, and that defendants knew it. Defendants had been satisfied with the batteries which he had supplied for £2 each. Those in dispute cost £1 5s. Defendants asked for a cheaper battery, and they got it. But apparently they did not like it. In cross-examination, plaintiff said defendants' buyer did not say that the batteries now sued for were unworkable. He would hardly have sent them to hospitals. He did not know the purpose for which they were required. He exchanged them without admitting that they were unmerchantable. No doubt there was some roughness about the cases, but he had not the workmen to-day that he had formerly.

Mr. S. C. PEELING, defendant's buyer, said he had been dealing in electrical coil batteries with the plaintiff for some time. When he gave the order he carefully gave no price, knowing the present-day difficulties. When plaintiff sent the first five batteries they were badly finished and unsaleable. With each coil there was a slide to increase or decrease the current. In no instance would the slide of plaintiff's coil move. He offered a better price for a better article, but the second lot were worse than the first.

Mr. A. HAMPTON, general manager to the defendants for 35 years, said that four out of five of the batteries sued for were unworkable. The platinum points were not in their position, which was vital with a coil battery.

The DEPUTY JUDGE thought that 25s. was very low in price for a battery. They were, in fact, extraordinarily cheap.

WITNESS said that that was the wholesale price.

The DEPUTY JUDGE: Ah! We poor people have to pay a great deal more.

WITNESS: Thirty-five shillings. They used to be made in Germany. Defendants produced the coil batteries, and plaintiff made some of them work, in which condition they were put on the bench for the Court's inspection.

Mr. E. H. WILLIS, electrical engineer, said he had examined the coils, and he considered they were not at all merchantable. The construction was quite faulty. They could only be altered by an expert. None of the platinum points were in apposition. He admitted that the difference between the cost of manufacture and the selling price to the public was extreme, because the goods passed through two or three hands before they were bought by the public, and all "wanted a bit."

The DEPUTY JUDGE said he knew something about electrical batteries. One could not get for 25s. what one might expect for £3. Judgment for the plaintiff, with costs. Defendants did not complain in time.

BRITISH THOMSON-HOUSTON CO.'S TUNGSTEN PATENT.

MR. JUSTICE SARGANT, in the Chancery Division, on April 16th, gave judgment in an application by the British Thomson-Houston Co., Ltd., to allow them to amend the specification of an invention relating to their process for the treatment of metallic tungsten, and for the manufacture of electric filament lamps therefrom.

There were several opponents, the chief being Messrs Duram, Ltd., against whom the applicants unsuccessfully brought an action for infringement in 1916. This decision was finally ratified by the House of Lords. Messrs. Duram, Ltd., had also presented a petition for the revocation of the patent.

Mr. COLEFAX, K.C., arguing in support of the application, said that the proposed amendment would have the effect of more clearly defining the scope of the invention.

Mr. TERRELL, K.C., appeared for the opponents, Messrs. Duram, Ltd. He submitted that the amendment should not be allowed, on the ground that it was in effect an attempt to introduce totally new subject matter.

Mr. Colefax, in the course of his argument, read a number of affidavits relating to working arrangements which had been made with other companies, and the manner in which those arrangements had been carried out, and he quoted extracts from a number of advertisements which had appeared in the Electrical Review warning people against infringement of the patent.

Mr. Terrell, K.C., complained that some of the advertisements referred to were based upon a judgment obtained in default of defence by the British Thomson-Houston Co., against Messrs. Duram, Ltd. Upwards of 30 actions were brought during the years 1913 to 1915, and he alleged that the advertisements had been issued by the British Thomson-Houston Co. in maintenance of their policy of threatening the trade. He argued that there was no subject matter in applying heat to coherent metal which would justify an amendment. The claim was really merely for heating metal. The House of Lords had held that there was no subject matter for the patent.

Mr. Colefax repudiated a suggestion that he had deliberately caused delay so that he might in the meantime threaten defendants by advertisements in the Electrical Review and other trade papers. Not a soul, he said, had come forward connected with the trade to say that he had been terrorised.

His Lordship dismissed the application with costs. The contention of the opponents was, he said, well founded. He did not think that the amendment was authorised by the Act as the proposed alteration would substantially alter the invention. In any case, he did not think that the amendment, if allowed, would save the patent if it were challenged.

Lake Hotel Co., Ltd., v. Kerry Electric Supply Co., Ltd.

At Killarney Quarter Sessions, Judge Dromgoode heard this action for recovery of £1 14s. 4d., money alleged to have been illegally and improperly claimed by defendants and paid to them by plaintiffs under protest. It was explained that plaintiffs regarded the case as raising an important question of principle. Mr. John Hilliard, managing director of the Lake Hotel, stated that his company had been getting electric light since 1897, and that at first the charge was 5d. a unit, which was afterwards increased to 6d. The defendants made a demand last September quarter for 7d., and he sent them a cheque for 6d. per unit. He had had no intimation that prices were being raised; but in November a circular was sent out stating that the price was being raised from 6d. to 7d. The hotel was outside the urban area.

During the arguments, contention was made that the money was paid on foot of an illegal contract—as it was illegal to supply energy without Parliamentary sanction or Board of Trade licence—and was, therefore, irrecoverable; and, again, that, if the contract were legal, the undertakers were at liberty to make any agreement with the consumers.

Mr. J. McDonnell, manager of the Electric Light Co., said a circular was sent out in April, 1918, increasing the price from 6d. to 7d.; two or three people outside the urban area paid 7d., as well as some people in the town.

His Honour held that the supply to the hotel was illegal, and that nothing could be recovered on foot of any contract. That left Mr. Hilliard in the same position as if he were defendant and not plaintiff—that was, the money might be recovered from him. Accordingly, he would give a decree for the amount claimed.

Workmen's Compensation Case.

At Bolton County Court, last week, his Honour Judge Spencer Hogg gave judgment in a case in which compensation was sought from the Bolton Corporation for the death of Mr. Clough, an assistant turbine engine driver, which occurred at the Back-o'-th'-Bank Electricity Works. It was suggested at the hearing, on behalf of the Corporation, that the death might be due to suicide, and it was contended that Clough's work did not require him to go near the tail race, where he was drowned. His Honour said that on the evidence he entirely rejected the suggestion of suicide. The deceased's duties included seeing that everything was in order, and to do that it was part of his duty to be about the pump house, near which he was drowned. He found that the accident arose out of the employment, and awarded the plaintiff £300 compensation.

A New Photometer.—A new type of photometer was devised by the Illuminating Engineering Society, at the invitation of the Government, to give a rapid reading of the light given off at any moment by a brilliant source like a star shell or flare. It consists of a small tube with a tiny electric lamp inside it at one end. An opening is cut in the tube lengthways to admit a strip of metal stencilled with the letters of the alphabet. When the lamp is on, each letter of the alphabet is illuminated in a descending scale according to its distance down the tube. If the light which falls on the instrument from the outside happens to be the same as the internal illumination of any particular letter, that letter will vanish.

BUSINESS NOTES.

Export Prohibitions.—A further list of alterations in export prohibitions appears in the *London Gazette* for April 15th.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act, appear in the *London Gazette* for April 15th.

Copper Sulphate Order, 1918.—The Minister of Munitions has suspended the operation of the above order as from April 15th, 1919.

The B.E.A.M.A.: New Members. — We are informed that the following firms have been elected members of the British Electrical and Allied Manufacturers' Association:—Accumulators (Birmingham), Ltd., Birmingham; Brolt, Ltd., Birmingham; Davies, Kent & Stewart, Ltd., London; Ebonestos Manufacturing Co., Ltd., London: Hightensite, Ltd., London; Holden & Brooke, Ltd., London; Jenson & Nicholson, Ltd., London; Chas. Joyner and Co., Ltd., Birmingham; Arthur Lyon & Wrench, Ltd., London; F. & A. Parkinson, Ltd., Leeds; T. E. Slaughter & Co., London; L. Vandervelde, London; Wardle Engineering Co., Ltd., London; H. Wiggin Co., Ltd., London.

C.A.V. and Standardised Orders.—We are informed that C.A.V. lighting and starting sets are now standardised on the following all-British cars:—Austin, Arrol-Johnston, Daimler, Humber, Sunbeam, Vauxhall, Wolseley, besides several others. This fact bears testimony to the excellence of Messrs. C. A. Vandervell's products, and the public demand for the equipment of cars with these adjuncts.

The C.M.A.: New Member.—It is announced that, as from April 2nd, 1919, the Liverpool Electric Cable Co., Ltd., Bootle, Liverpool, became members of the Cable Makers' Association.

Plant for Disposal.—Aldershot U.D.C. invites offers for 17 open-type twin-carbon Oliver arc lamps complete, 24 Watson prepayment meters, 18 Angold magazine flame arc lamps, 32 5-amp., 50 10-amp., and 29 25-amp. Reason maximum demand indicators.

Rhondda U.D.C. electricity works has for disposal a complete suction gas plant, consisting of one 22-b.h.p. Fielding & Platt gas engine, gas-producing plant, dynamo, and switchboard. For further particulars, see our advertisement pages to-day.

The Copper Market.—Addressing shareholders of the Rio Tinto Co., Ltd., recently, Sir Charles W. Fielding, K.B.E., said that fuel still continued at too high a price to enable them to resume steam shovel work, and a great many of their locomotives remained idle, but sufficient were at work to produce their immediate demands of ore. Regarding the future, the Allied Governments took copper under direct control, and, as a very reasonable precaution, saw that the supplies at hand and coming forward for delivery would be ample. The termination of hostilities had left large stocks to be disposed of, and the stagnation of manufacturing that had come between war and peace had increased those stocks. Even with considerable world reduction of output, copper would exist in excess of demand for months to come, but the cost of production generally having increased—and he expected to some extent that increase would be permanent—the old very low prices were not likely to return for a long time. Especially would this be the case, as the American producers realised that they could sell practically as much of their output—and of the United States Government stocks which they controlled—at a price leaving them a reasonable profit, as they could dispose of at a loss. The cost of producing copper in America after the transition period was therefore likely again to be the chief factor in regard to the company's profits. He was not anxious on this head in regard to the future, although the present year would naturally suffer from the large stocks of copper and the slowness in re-establishing trade.

Lead.—In their weekly report Messrs. James Forster and Co. state:—"Government controlled lead is £25 ex warehouse; American lead, April shipment, is offering at £24 10s.; forward (July-August) has been done (50 tons) at £24, and there are sellers over. A few weeks ago a deputation of American metal dealers interviewed the Minister of Commerce to urge the removal of all restrictions on exports to and imports of metals into Europe. The Minister addressed a few salutary words to the deputees which may be repeated here. His advice was to give the people on the other side a chance of disposing of their war stocks, and he asked them to remember that England, France, and Italy were hung up with huge stocks largely imported from America. We need similar plain speaking here. In the case of lead the Government have approximately 100,000 tons, or ten times more than any stock held in pre-war times. Until that stock is reduced to within reasonable limits, no encouragement should be given on the Metal Exchange to any selling of American lead. The drop in price of the last three weeks has cost the Government £300,000, and no extra quantity of lead has been sold in consequence. No free dealing in forward lead is possible so long as the huge stock remains, as the trade will continue to buy from hand to mouth; the conditions practically prohibit speculation, but offer an easy inducement to manipulate the market such as we have recently experienced."

Catalogues Wanted.—The Electrical Equipment and Installation Co., 10 Eastcheap, E.C. 3, wish to receive catalogues of every description of electrical apparatus.

The Victor Engineering Co., Ltd., have commenced business at 18, Holland Street, Glasgow, to carry on general engineering (small work) and millwrighting work, electrical power work (A.C. and D.C. for collieries and factories). Manufacturers or agents are invited to forward catalogues of their specialities.

Messrs. W. Arthur Kerr & Co., consulting engineers, factory and works designers, have moved to larger offices at 7, West George Street, Glasgow. Manufacturers issuing revised catalogues of goods in which they are interested are invited to send them copies.

Trade Announcements.—Mr. W. H. Miller, late engineer and manager of the Fleetwood Electricity Works, and Mr. A. B. Farrell, late resident station superintendent of the Belfast Electricity Works, have entered into partnership in business as consulting and contracting electrical and mechanical engineers as Miller & Farrell at Albert Street, Fleetwood. Manufacturers and vendors of electrical plant and apparatus are asked for catalogues, &c.

Messrs. Williams (Birmingham), Ltd., have held special meetings, at which they have altered and extended the company's objects, and they will carry on business as electricians, electrical contractors, constructors, &c., of electrical installations, manufacturers of electrical plants, &c., as set forth in the terms of resolutions which appear at length in the *London Gazette* for April 15th.

Catalogues and Lists.—It may be understood, as a general rule, that copies of publications mentioned in this section may be obtained on application to the firm or company at the address given.

Messrs. James Allan, Senr., & Son, Ltd., Elmbank Foundry, Glasgow.—Four-page illustrated list, giving particulars and prices of their "Elmbank" electric specialities, including the adaptable one unit fire (Robinson's patent), the "Gloworm" interchangeable immersion heater, and domestic electric hot-water warming apparatus.

The B.E. Co. (of London and Birmingham), Ltd., 57, Upper Thames Street, London, E.C. 4.—Advance price-list (five sheets) of their Birmingham-made electrical supplies, including adaptors, ceiling roses, cut-outs, fuseboards, tumbler switches, bayonet lampholders, wall plugs and sockets, hand lamps, and flexible cords.

Messrs. Newton & Wright, Ltd., 72, Wigmore Street, London, W.—Price leaflet giving corrected prices of "Snook" apparatus appearing in Section 3 of their catalogue.

The Parsons Motor Co., Ltd., Town Quay Works, Southampton.—36-page publication, entitled "Industrial Installations," being a collection of illustrations and designs showing Parsons engines used in numerous types of stationary and portable plants, including self-contained electrical sets, electric welding, pumping, air compressor, agricultural, electric power station, and other plants.

The Belgian Charleroi Electrical Works.—According to a Brussels newspaper, the Société des Ateliers de Constructions Electriques de Charleroi had the good fortune of finding its works almost intact after the retreat of the enemy. The oldest works—the Marcinelle Works—produces switchboards, tramway motors, &c., whilst the most recent and more important works at la Villette turns out all kinds and sizes of electrical machinery. It comprises mechanical shops, bronze foundry, cable factory and copper drawing plant, enemy damage having been caused only in the cable factory. Thanks to the practical immunity from damage owing to the Germans having utilised the works for their own purposes, it was possible for the company to resume working very soon, and 700 men are now employed, with the prospect of the number being increased to 1,000 shortly. The company had a turnover of the value of £1,000,000 in 1913, which would have risen to £1,200,000 in 1914 if the war had not occurred.

The Retreat Through Belgium.—The *Times* special correspondent at Brussels, in the course of an article on the wastage of material during the German retreat from Belgium, mentions that at the Ateliers des Constructions Electriques, at Charleroi, one of the largest in the country, is lying more than a million pounds' worth of electrical plant. "It seems that all dynamos and motors, whether brought from Germany or looted from Belgium, were sent here for repair. Here, also, are many British tools captured from us and recaptured from the enemy."

The Athens Exhibition.—The Austin Motor Co., Ltd., of Northfield, Birmingham, have secured an order for an Austin electric lighting set for the lighting of the All-British Exhibition to be held in Athens in September next.

Peace Celebrations.—While no official announcement has been made with regard to the lighting concessions that will be granted for the celebration of the signing of terms of peace, we have been informed on excellent authority that the lighting restrictions will be relaxed for a period of four days.

French Working Hours.—A protocol has been signed by the French Union of Employers of the Metallurgical, Mining, Hardware, Electrical, and Metallic Industries and the Federation of Workers in Metals for an eight-hour working day without reduction of wages, to come into force on June 1st.—*Times.*

Deed of Assignment.—W. Cox and W. R. Childs (Cox and Childs), plumbers and electricians, 64, Stockwell Gate, Mansfield.—Last day for claims for a first and final dividend April 21st. Trustee, Mr. P. J. Bradfield, Bishops Chambers, Mansfield.

"Welcome Home" at Hornsey.—On the evening of April 16th, at the Hornsey Electricity Works, the Borough Council Electricity Department held a smoking concert to give a hearty welcome to those members of the staff who had returned from the war. Councillor Moritz, chairman of the Electricity Committee, presided, and he was supported by Councillor Wood, the vice-chairman. In his address of welcome the chairman gave a brief record of the services of each man, and spoke of the satisfaction which the Committee felt in not having one of the warriors killed or permanently injured, although some of them had borne the stiffest of the fight. The hall was tastefully decorated, and a stage had been erected for the purpose of the entertainment, which included songs, recitations, and a dramatic turn, given by members of the works' staff and friends. Before the war the department held many staff smoking concerts, and it is hoped to resume these.

The Holidays.—Everybody who can afford it—and some who cannot—will be wanting a good holiday this year. Doubtless, however, many are waiting on the Peace celebration arrangements before they decide when to go. The demand on the railways will be extremely heavy, and it is desirable that, for the convenience, comfort and safety of all, the peaks should be flattened out. It is hoped that business houses will be able to arrange their holiday programmes so that there shall be more use of the railways in May and June, so as to avoid a repetition of the pre-war rush of the succeeding months. There is still a shortage of rolling stock. Those who can go away on Tuesdays, Wednesdays, Thursdays or Fridays, should do so.

Bankruptcy Proceedings.—W. H. Wilson, consulting engineer and a director of limited companies, Tower Buildings, Water Street, Liverpool, formerly a partner in T. L. Miller, Wilson and Pegg.—Last day for receipt of proofs for dividend May 3rd. Trustee, Mr. L. Nicholas, 19, Castle Street, Liverpool.

William T. Smith, electrical and mechanical engineer, Victoria Street, and 60, Hampden Street, Bolton, Lancs.—At the adjourned public examination held last week at Bolton, the Official Receiver said there had been successive adjournments of the case, but they were no further forward than they were 15 months ago. They had given the debtor every facility to realise the values of his inventions. The debtor was the patentee of what he believed were valuable improvements in ring spinning machines, and he was confident he would eventually raise a substantial sum of money. The debtor signed a proposal submitted by the Official Receiver to pay 7s. 6d. in the £, as to 2s. 6d. down and two instalments of 2s. 6d. each when he was able to pay them. The examination was concluded.

A Siemens Social.—Last week a successful dinner and smoking concert was held by the employés of the machine shop and tool room of Messrs. Siemens at the Vine Hotel, Stafford, and there was a very large attendance. Mr. M. Kenworthy, shop engineer, who presided, threw out a suggestion that not only should they have dinners and parties in the winter, but an annual trip to a popular resort in the summer. If other people could travel on "Bass," they certainly ought to do so on "Electricity." Mr. W. H. Parker, general manager, appealed for mutual confidence, goodwill, and trust in one another.

Social.—The Victory Social given by the "Z" Electric Lamp Manufacturing Co., Ltd., at St. Mary's Hall, Putney, on Monday evening, April 14th, to their Southfields employés, was an unqualified success. The entertainment consisted of a concert and dance. The artistes were drawn entirely from the employés. The guests numbered about 400.

To Develop Italian Foreign Trade.—Under the auspices of the Minister Ciuffelli and the principal Italian credit institutions, there has been formed at Rome a large financial institution with the object of financing and developing Italian foreign commerce. The style of the new institution is Istituto Italiano di Credito per il Comercio Estero. The mode of operations will be the granting of credit to the Italian imports and exports, and the opening of branches of the bank in foreign countries to serve the financial needs of Italian trade abroad.

The Tramway Industry.—The foreign edition of the *Brill Magazine*, issued by the J. G. Brill Co., of Philadelphia, opens with the following "Look Forward":—"It needs no prophetic mind to see that out of the confusion and waste of war will arise the most substantially constructive era the world has ever known. Reconstruction of that which has been destroyed will be followed and paralleled with the development and upbuilding of old and new fields at a rate of progress that will make unprecedented demands upon all industries. The street railway industry will be among the first to be vigorously re-established and expanded, as the time and strength of workers must be conserved, and all of the normal activities of urban life, released from the constraint of years of war, must be provided with means of transportation. Public welfare in general, as well as business life in particular, are too dependent upon quick and convenient communication to permit of inadequacy in any department of this service, and it is more than probable that tramway managers will have an extremely diffi task to keep abreast of requirements."

Agencies Wanted.—A Chilean subject, possessing many years' experience of Chilean trade, having been in the employ of various United States firms and a British bank, is now starting in business for himself in Valparaiso or Santiago, and is paying a visit to the United Kingdom with a view to getting into touch with manufacturers and exporters of electrical fittings and accessories who desire to be represented in the Chilean market. (Reference No. 700.) Particulars from the Department of Commercial Intelligence, 73, Basinghall Street, E.C.

Dissolutions and Liquidations.—Blackwall Engineering and Welding Works, Ltd., West Ferry Road, Millwall, E.—Under the compulsory liquidation of this company, which was formed in June, 1917, to carry on the business of mechanical and electrical engineers, accounts have been submitted showing total liabilities £3,155, of which £1,135 is unsecured; assets, £1,281; and a deficiency of £3,595 as regards contributories. Mr. W. J. Warley, Official Receiver, reports that in August, 1917, Mr. George Steel (director) sold to the company for £900, in fully paid preference shares, certain plant, implements, tools, and other effects, and subsequently the company acquired for £600 in cash (part of which was returned in payment for shares), certain machine tools, the interest in the tenancy of the works, and a motor-car. The company's operations appear to have been principally confined to manufacturing and supplying mine chambers to the Government under contract. The loss in carrying on the business is estimated at £2,728. Debentures for £2,000 had been issued, and in June, 1918, Messrs. R. W. Walker and W. T. Botwood were appointed Receivers of the company's property. The Official Receiver adds that there is no prospect of a surplus of assets becoming available for the unsecured creditors.

Merton Metallurgical Co., Ltd., and H. R. Merton & Co., Ltd.—Claims must be sent in by October 31st, to the Liquidator, Sir Woodburn Kirby, 2, Metal Exchange Buildings, London, E.C.

Accuratact Magnetos, Ltd.—Meeting, May 19th, at 115, Finsbury Pavement House, London, E.C., to hear an account of the winding-up from the liquidator, Mr. J. J. Sneddon.

Rashleigh Phipps & Co., electrical engineers, 147, Oxford Street, W.—Messrs. A. Rashleigh Phipps and J. R. Bedford have dissolved partnership. Mr. A. Rashleigh Phipps will attend to debts and continue the business under the same style.

Robinson & Laird, steel letter cutters, die-sinkers, and electrical engineers, Hill Cross, Coventry.—Mr. H. Robinson and Mr. G. A. Laird have dissolved partnership.

Beck Engineering Co., Ltd., Eden Works, Hayes End, Middlesex.—Winding-up order made April 15th.

Balcke & Co., London, E.C.—First and final dividend, 20s. in the £, payable at 33, Carey Street, W.C. 2.

Universal Cheap Cables, Ltd.—A meeting is called for May 20th, at 30, Bush Lane, London, E.C., to hear an account of the winding-up from the liquidator, Mr. H. E. Oldham.

Fire.—The *Times* states that at the Walker shipyard, Newcastle-on-Tyne, of Sir G. W. Armstrong, Whitworth & Co., on April 15th, an electrical fitting shop and rigging store were damaged by fire.

Book Notices.—*Elementary Manual of Magnetism and Electricity.* By Andrew Jamieson. Revised by Ewart S. Andrews, B.Sc.Eng. Tenth edition. London: Charles Griffin & Co., Ltd. Pp. xiv + 372; many figures. Price 5s. net.—The late Prof. Jamieson's various manuals have had so wide a vogue and passed through so many editions that they need no introduction to the public; the author's lucid methods of exposition and the speaking illustrations with which the text is illuminated combine to render the subject interesting and to facilitate the absorption of information by the student. In the present edition no material change has been made in the contents of the book.

"Useful Information for Electrical Engineers." Pp. 32; 1 fig. Price 1s. net. 1919. Newcastle-upon-Tyne: J. H. Holmes & Co.—The title of this booklet is sufficient indication of its nature. The first portion is devoted to the care of electrical machinery, followed by particulars of standard cables and cable sizes for various distributions. Driving by belts and ropes is considered, and many useful tables and formulæ are included.

"Science Abstracts." Sections A and B. Vol. XXII. Part 3. March 31st, 1919. London: E. & F. N. Spon, Ltd. Price 1s. 6d. each.

"The Design of Alternating-Current Machinery." By C. C. Hawkins, S. P. Smith, and S. Neville. Pp. xv + 392; 97 figs. London: Sir Isaac Pitman & Sons, Ltd. Price 18s. net.

"Post Office Electrical Engineers' Journal." Vol. XII, Part 1. April, 1919. London: "Electrical Review," Ltd. Price 1s. net.

"The Engineer's Year-Book for 1919." Compiled and edited by H. R. Kempe. Pp. xciii + 2,513; illus. London: Crosby Lockwood and Son. Price 25s. net.

The Spring number of the *M. & C. Apprentices' Magazine* contains special articles on the "Education of Skilled Craftsmen," by Mr. A. P. M. Fleming, Mr. A. E. Berriman, Prof. Mellanby, and Mr. A. W. Davies, as well as the usual variety of interesting items which gives this publication its unique position amongst such works magazines.

"Heat Treatment Bulletin," No. 9, of Automatic and Electric Furnaces, Ltd., consists of an interesting article by Mr. F. C. A. H. Lant[illegible] on "The Location of Hardening-Shop Faults," in which the theory of hardening is briefly explained.

In the current issue of *Salvage*, it is announced that the disposal of all salvage and surplus commodities is now centralised under the Ministry of Munitions and Supply, and the journal will henceforth have a much wider scope, probably under a new title.

LIGHTING AND POWER NOTES.

Aberystwyth.—Street Lighting.—The T.C. has decided, subject to satisfactory terms, to have the streets lighted with electricity, on the basis of a scheme submitted by Mr. E. P. Perkins.

Arbroath.—Street Lighting.—The Arbroath E.L. and P. Co. has indicated to the T.C. that it is prepared to light the streets formerly lighted with 1,000-c.p. lamps at £21 per lamp per annum. The gas manager is to report on the cost of lighting the streets as effectively with gas.

Australia.—E.L. Schemes.—The Harden and Murrumburrah Municipality has decided to borrow £7,000 for an E.L. scheme. The Corowa Council has decided to borrow £4,000 for additional plant at its electricity works. The Coburg Council has received sanction to borrow £13,000 for the completion of its E.L. scheme. The Sale Council has decided to take advice on the question of an E.L. undertaking for the district. The Bankstown Council is considering an E.L. scheme, and is arranging to borrow £50,000 for this and other public purposes. The power station which supplied the town of Culcairn with electricity has been destroyed by fire.

Water Power.—The Wairarapa Hydro-Electric Investigation Committee has presented its report to the Government; the scheme is estimated to cost £175,000.

Tasmania.—Electrolytic Zinc.—The chairman of the Electrolytic Zinc Co. states that he is satisfied that all anticipations with regard to the Risdon plant have been realised. The company is to enlarge its works so as to ultimately require 30,000 h.p., which the Hydro-Electric Department has agreed to supply. As opportunity offers, the output will be increased to 100 tons per day. The establishment of subsidiary interests, such as the treatment of zinc oxides, the production of lithophone, and the erection of zinc rolling mills, are being proceeded with.

Aylesbury.—L.G.B. Inquiry.—An inquiry was held last week into the application of the T.C. for a loan of £50,500 for extensions to plant at the electricity generating station, and this was amended to £52,500. There was no opposition.

Bantry (Co. Cork).—E.L. Scheme.—The Town Commissioners have decided to consider the question of purchasing under compulsion the electrical machinery for the lighting of the town.

Birmingham.—Extensions.—The E.S. Committee has decided to erect a sub-station at Bournville, for the supply of electricity for power and lighting, and for the proposed new tramway to Rednal. For the Nechells generating station now being built, a large order for boilers has been given.

Bradford.—Electrical Showrooms.—The T.C. has approved the recommendation of the Electricity Committee to purchase, for £16,500, property in Sunbridge Road and Millergate, for the purpose of establishing stores, offices and showrooms. Local traders, especially those in the electrical trade, have contended that the showrooms would become salerooms in unfair competition with the traders. The chairman of the Electricity Committee held that the Committee's policy was one which helped the electrical traders. The Corporation showed everything electrical, and gave local electrical contractors as much discount as it could get from the manufacturers.

Bury.—Peace Celebrations.—The Electricity Committee has decided to supply free electricity for illumination purposes on the occasion of the Peace celebrations.

Canada.—Water Power.—Government Bills have been introduced in the Nova Scotia Legislature to create a hydro-electric system for the development and distribution of electrical power.—*The Times.*

Castlerea (Co. Roscommon).—E.L. Scheme.—The Castlerea Milling and Development Co. is about to introduce a scheme for the electric lighting of the town. The consulting engineers are Messrs. J. P. Tierney & Co., of Dublin.

Chesterfield.—Price Increase.—The T.C. has further increased the price of electricity, for all purposes, by 15 per cent. on pre-war charges.

Crook.—E.L. Scheme.—The Chamber of Trades has decided to approach the E.L. Co. to see if there is any immediate prospect of electric light being installed in the town.

Dover.—Proposed Loan.—The T.C. has applied for a loan for electricity services. Consumers taking electricity by contract are in future to be supplied at ordinary rates for the first 5,000 units, and afterwards at 4½d. per unit, less ½d. rebate, for lighting, 3½d. for power, and 2½d. for heating.

Dundalk.—Proposed Mortgage.—As the U.D.C. electricity department is now indebted to the Council to the extent of £7,799, the Town Clerk has been instructed to apply to the Irish L.G.B. for a mortgage of £2,000.

Dundee.—Proposed Extensions.—The Electricity Committee has sanctioned a scheme for the extension of the electricity undertaking, involving an expenditure of £250,000. It is proposed to increase the present output by between 60 and 70 per cent. by the installation of four additional multi-tubular boilers, with mechanical draught apparatus and economisers, and two

6,000-kw. turbo-alternators. It is hoped that a portion of the new plant will be in operation within 12 to 15 months, and it is expected that the extensions will carry the departmeut on for two or three years.

Epsom.—Expert Advice.—The U.D.C. has decided to engage the services of a consulting engineer to report on the future of the electricity undertaking, and on the installation of Diesel engines in place of the present steam plant.

Exeter.—Proposed Price Increase.—The Electricity Committee has recommended the T.C. to increase the charges for electricity to 50 per cent. over pre-war rates.

Faversham.—Price Increase.—The T.C. has decided to advance the price of electricity for lighting to the maximum of 7d. per unit, and to apply to the B. of T. for an order to extend the area of supply to Ospringe, Faversham Without, North and South Preston. Davington, Luddenham. and Sheldwick, and for authority to increase tbe maximum price from 7d. to 10d. per unit.

Grays.—Loan Sanction.—The U.D.C. has received sanction to a loan of £600 for electricity mains, services and meters.

Grimsby.—Proposed Extensions.—The E.L. Committee has passed estimates for £118,000 for the extension of the electricity undertaking.

Harrogate.—Price Increase.—The T.C. has increased the charges for electricity by a further 15 per cent. for ordinary supply, and by 16⅔ per cent. for supplies under the rateable value system.

Haslingden.—Bulk Supply.—The Accrington and Rawtenstall T.C.'s have arrived at an agreement for the supply of electricity to Haslingden, and have forwarded the proposals to the Haslingden T.C.

Hornsey.—E.L. Charges.—The Middlesex C.C. has withdrawn its opposition to the application of the B.C. for permission to increase its charges for electricity from 8d. to 10d. per unit.

Irvine.—Workhouse Lighting.—The directors of Cunningham Combination Poorhouse have agreed to install electricity for lighting and power purposes, at an estimated cost of £1,200.

Isle of Wight.—Street Lighting.—The U.D.C. has accepted the offer of the Isle of Wight E.L. Co. for street lighting at Sandown, at £64 per quarter, plus 4½d. per unit, for three years.

Killarney.—E.L. Charges.—The U.D.C. has decided to oppose the Kerry E.S. Co.'s application to the B. of T. for permission to increase its charges for electricity from 6d. to 8d per unit.

Kirkcaldy.—Proposed Extensions.—The T.C. is considering a scheme for the construction of a new generating station, at an estimated cost of £290,000. A deputation has been appointed to interview Government officials in London on the matter.

Lerwick.—E.L. Scheme.—The T.C. is considering the question of lighting the town with electricity in place of gas.

Lichfield.—E.L. Scheme.—The T.C. has appointed a Committee to consider a proposal for a supply of electricity for the city from the Wolverhampton T.C.

Limerick.—Strike.—Business was interrupted, last week, as the result of a general strike in protest against the town being proclaimed a special military area. Electricity and gas supplies were cut off on April 14th.

London.—Woolwich. — Proposed Loan.—The B.C. has decided to apply for a loan of £94,200 for electricity purposes. It is proposed to extend the plant and buildings at Woolwich and to convert the Plumstead generating station into a sub-station.

Bermondsey.—Loan Sanction.—The L.C.C. Finance Committee has recommended that sanction be granted to an application of the B.C. for a loan of £1.209 for electricity mains.

St. Marylebone.—Loan Sanction.—The L.C.C. Finance Committee has recommended that the application of the B.C. for a loan of £22.385 for the installation of two boilers and accessories at the electricity works be granted.

Ocker Hill.—Extensions.—The plant of the Midland Electric Corporation for Power Distribution, Ltd., is to be extended by about 12,500 h.p.

Radcliffe.—Price Increase.—The U.D.C. has decided to increase its charges for electricity, as from July 1st, as follows: Private and public lighting, 20 per cent., making a total increase of 60 per cent.; small power users on h.p. scale, bioscope arc lamps, and heating, 10 per cent., a total of 60 per cent.; consumers on sliding scale, 10 per cent., a total of 20 per cent., plus operation of the coal clause; consumers on maximum demand, an addition of ·05d. per unit to the rent charge, making a total of 1·3d. per unit, plus the coal clause, in addition to £1 per kw.

Ripon.—Prov. Order.—The T.C. has decided to apply to the B. of T. for a prov. order for electric lighting in the town.

Rochdale.—Year's Working.—The net profit of the Corporation electricity department during the past year amounted to £706; this is to be added to the reserve fund, which now stands at £2,800. The income of £79.235 shows an increase of £4,894, and the expenditure of £52,931, a decrease of £1,371, while last year there was a net deficiency of £3,674. There was a reduction in the cost of coal of £1,500, owing to 2,500 tons less being consumed than in the previous year.

Rhymney.—Overhead Wires.—The U.D.C. has consented to the Rhymney Iron Co. utilising overhead wires for the supply of electricity to the district north of the parish church and the church itself.

Southend.—New Boiler.—Subject to L.G.B. sanction to the necessary loan, the T.C. has accepted the tender of the Niclausse Boiler Co., at £12,000, for a 30.000-lb. boiler and accessories.

Southport.—Price Increase.—The Electricity Committee has recommended increases in the charges for electricity, as follows:—Lighting: Maximum demand system for business premises, from 6½d., 4½d., and 2½d. per unit to 8d., 6d., and 4d.; private houses, flat rate, from 5d. to 7d.; and other purposes, from 1½d. to 2¼d.

St. Anne's.—Proposed Loan.—The U.D.C. has applied to the L.G.B. for sanction to borrow £13,310, for the purpose of providing plant, cables, &c., in connection with the proposed bulk supply of electricity to Lytham.

Sunderland.—National Electricity Supply.—The Electricity Committee has asked the T.C. to pass a resolution of protest against the proposal to transfer the control of electricity supply to the Ministry of Ways and Communications.

Swinton.—Price Increase.—The Lancs. E.P. Co. has informed the U.D.C. that the price of electricity supplied in bulk will be increased by 15¼ per cent., as from February 1st last.

Swanscombe.—E.L. Scheme.—At the monthly meeting of the Parish Council, last week, a letter from the Kent Electric Power Co., relating to the Council's application for electric light for the village, and cost, was read, stating that the company, having no mains near Swanscombe, was not in a position to quote. The Gravesend B.C. desired to know the number of lamps required, also their positions. It would be a help to the B.C. if the number of proposed consumers was secured. The matter was eventually referred to a committee.

Trim (Co. Meath).—E.L. Scheme.—The U.D.C. has decided to consider the introduction of an E.L. scheme for the town.

Warrington.—Loan Sanction.—The L.G.B. has authorised the T.C. to borrow £11,011 for the purpose of developing the electricity undertaking. The electrical engineer has been instructed to proceed with all applications for lighting installations. Action with regard to prospective demands for power purposes has been deferred, pending an interview with the B. of T.

Waterville (Co. Kerry).—E.L. Scheme.—A public meeting has approved of an E.L. scheme for the town.

Wolverhampton.—Proposed Loans.—The T.C. has applied to the L.G.B. for sanction to a loan of £25,000 for electricity purposes, as follows:—Mains, £17,500; transformers, £5,000; switchgear, £2,500.

The electricity department is to apply for sanction to a loan of £6,747 for the conversion of premises in Red Lion Street into showrooms.

TRAMWAY AND RAILWAY NOTES.

Belfast.—Tramcars Wrecked.—Following an attempt of 500 shipyard men to board the last three of a long line of tramcars at Castle Junction on Monday last week, the cars became so densely packed that they were unable to move. The police were called, and in the struggle the cars were wrecked.

Bradford.—Year's Working.—The financial statement of the Tramways Department for the year ended March 31st, 1919, shows traffic receipts amounting to £451,877, an increase of £89.964 on the preceding year; receipts on the railless service were £15,122, an increase of £2.873; parcels receipts were £11.974, a decrease of £1.156. The number of passengers carried decreased by 7,709,793, the total being 76.419.459. The car-mileage was 5,269,834, a decrease of 635,522. The receipts per car-mile were 22·06d., an increase of 6·12d. The number of units of electricity used for traction was 11.027,312, a decrease of 1,372,202. At present there are an average of 140 cars running, as against the normal 180. Twenty-six new cars are on order.

New Track.—The Tramways Committee has decided to lay new track in the Manchester Road section, at a cost of £52,503.

Tramcar Motors.—The Tramways Committee has decided to order 52 tramcar motors, in addition to 52 ordered a few weeks ago.

Bath.—Fare Revision.—The L.G.B. has sanctioned the increase of the tramway fares by 50 per cent.

Continental.—Belgium.—Railway Electrification.—A Royal Decree of March 22nd provides for the appointment of a Commission to examine the question of the electrification of railways, and to submit proposals for the execution of the scheme. The projected scheme is to electrify main trunk lines on the overhead trolley system. New carriages and motors would be supplied for the purpose, but trains would be so constructed as to be suitable for steam haulage over non-electrified lines. Carriages would be of the "coupé vent" bogey, metropolitan type, interconnecting, and would have two doors on either side. The object aimed at would be to use trains over scheduled distances—*i.e.*, trains would run backwards and forwards on such routes as Antwerp-Brussels, or Arlon-Ostend. Auxiliary lines might be electrified later. The idea is to use German railway material pending its replacement by new rolling stock.—*Board of Trade Journal.*

Croydon.—Conductresses.—Conductresses have disappeared from the Corporation tramways, all having now been replaced by men.

Dewsbury.—Extension of Time.—The Corporation has decided to apply to the B. of T. for a prolongation of the periods for the completion of the works authorised by the Dewsbury Corporation Tramways Orders, 1911 and 1912.

Edinburgh.—Fare Revision.—The B. of T. has informed the T.C. that it cannot sanction the proposed increase of the tramway fares from 1d. to 1½d. until information regarding the loss which the recent award to tramway employés has been submitted to the Board.

Tramway Electrification.—The T.C. has adopted the recommendations of the Tramways Committee for the electrification of the tramways on the overhead system.

Farnworth.—Lightning Accident.—During a thunderstorm, last week, the supply of electricity and the tramway services were disorganised, owing to the generating station and a street cable box being struck by lightning.

Glasgow.—Proposed Fare Revision.—The general manager of the Corporation tramway department is advocating the abolition of the 1½d. fare. The wages bill, which was £412,000 in 1913, is estimated at £850,000 for the current year.

Halifax.—Year's Working.—The working of the Corporation tramway department for the year ended March 31st last resulted in a net profit of £9,457, compared with £16,837 in the preceding year. The total income was £149,648, against £129,679, and the expenditure was £140,191, against £112,842. Interest and income-tax amounted to £14,480, against £11,968, and sinking fund to £13,392, against £13,265. The car-mileage decreased from 1,869,357 to 1,850,513, while the number of passengers carried increased from 22,822,341 to 24,516,973.

Keighley.—Railless Traction.—It is stated that out of 10 railless cars owned by the Corporation, only one is capable of taking the road at present. The cars were made on the Continent, and the lack of facilities to have them repaired is the cause.

Light Railways.—Up to December 31st last applications to the Light Railway Commissioners for the sanctioning of schemes under the Acts of 1896 and 1912 represented a total of 5,051 miles of lines. Applications had been granted by the Commissioners for 2,272 miles, while the orders confirmed by the B. of T. authorised the construction of lines aggregating 2,101 miles. Only about 900 miles have, however, been actually constructed, of which 550 are on lands acquired and 350 on roads.

London.—Tramway Fares. The L.C.C. Highways Committee has reported that, in order to meet the increase in working expenses and the extra cost of renewals, it will be necessary to obtain an additional revenue of about £1,000,000 during the current year. The recent reduction of employés' working hours alone will cost £360,000. It is estimated that about £566,000 will have to be raised by increased fares, and that the remainder will be obtained by running 5,000,000 additional car-miles and carrying more passengers. It is proposed to reduce the average length of penny stages from 1·8 miles to 1·5 miles, with a maximum fare of 4d. for a continuous journey, and, as regards workmen's return fares, to charge 2d. for a 2-mile return journey, 3d. for 3 miles, 4d. for 4 miles, and 5d. for journeys over 4 miles. This increase in fares is estimated to produce £416,000, of which £321,000 is in respect of ordinary fares, £55,000 in respect of workmen's fares, and £40,000 in respect of improved methods of fare collection. On the present basis, there is an annual loss of £160,000 on workmen's fares, which, under the new basis, would be reduced to £105,000. The Committee is to reconsider the matter in six months' time, and should the present proposals be insufficient to balance the expenditure and revenue, further proposals will be submitted to prevent the undertaking becoming a charge upon the rates.

The fare increases will come into force, south of the Thames, Sunday next.

At a meeting of the Council, on the 15th inst., the recommendations of the Committee were carried.

Tube Subways.—Statutory notice is given by the Electric Railway Co. of its intention to apply to Parliament for powers to extend its subway in the Charing Cross district, and to provide exits and approaches in Northumberland Avenue and Victoria Embankment.

Brentford.—At the first meeting of the newly-constituted District Council held on April 17th, the clerk reported that he wrote to the B. of T. pointing out dangerous portions of the tramway track. That letter was sent to the Tramways Co., which had replied that the Council was well aware of the position of affairs under the Tramway Bill of last year. A sum of £400,000 was to be spent on reconstruction, which would be commenced as soon as possible. The surveyor said that he had been assured that three gangs would be kept at work on the track keeping it in order until the reconstruction commenced. The fees of the advisers on the Tramway Bill of last year were £264 and £284 respectively. It was understood that £272 would be paid by the authorities attending the conference. The clerk reported having attended a conference at the B. of T. on the question of the increase of tramway fares, when it was decided that a committee of five should go into the statistics and report. That report had been sent to the B. of T., which would consider it. The chairman said that he thought the fares would go up: the Tramways Co. had pressed for higher fares in order to carry on. No decision had been given by the B. of T.

Derailments.—Late at night on Friday last a tramcar failed to take the points at Kew Bridge, and was derailed. Traffic was held up for some time. On Monday morning another car at the same spot jumped the metals and fouled a passing car, slightly damaging it.

Manchester.—Estimates.—The estimates which the Tramways Committee has submitted to the T.C. show that wages have increased by £400,000 per annum, or 117 per cent., over pre-war rates. During the past five years the number of passengers carried has increased from 200 to 250 millions. Last year £111,000 was contributed from the receipts to the city fund, and £109,000 was added to the renewals fund.

Northampton.—Working Hours.—The application of the tramway employés for permission to work their eight hours' day without a break has been acceded to by the Tramways Committee, and employés will take their meals on the cars.

Power for Tramways.—The Tramways Committee has recommended the T.C. to accept, for a period of five years, the offer of the E.L. and P. Co. to supply electricity for the tramway service. It is now estimated that the annual saving will be £2,000 per annum.

Pontypridd.—Year's Working.—The past year's working of the Corporation tramway undertaking resulted in an increased revenue of approximately £8,932. The receipts were £37,236, against £28,303 in the previous year, and passengers carried numbered 7,202,402, against 6,642,399.

Rochdale.—Year's Working.—The past year's working of the Corporation tramway department resulted in a surplus of £662; this it is proposed to place to the renewals fund, which now stands at about £32,270. The total income for the year was £118,033, an increase of £9,561. Working expenses were £60,710, an increase of £4,118, and other charges £58,596, an increase of £13,767, of which £11,516 was increased war bonus, and £1,787 increased income-tax. Last year's profit was £8,351. The capital outlay on the undertaking now totals £368,214.

TELEGRAPH AND TELEPHONE NOTES.

Argentina.—A wireless concession has been granted to the Siemens firm, under date March 15th, on behalf of the Berlin Co. owning the Telefunken system. The concession is for 30 years, commencing on the date of the approval of the plans, and is solely for foreign messages. Power will be supplied by 400-KW. high-frequency Telefunken machines; the wave lengths will be 10,000 metres and upwards. The tariff between Argentina and Germany is to be two-thirds less than cable rates, and the tariff for all Government services 50 per cent. less than the public charges. The State reserves the right to exact that all the employés shall be Argentinos. The concession does not give the company a monopoly. The company has three months in which to present the general and 12 months in which to present the definite plans. A public service is to be given within two years.

Belgium.—When the Germans destroyed the telephone system of the country, they calculated that it would take two years to restore it. The two chief central exchanges at Brussels were entirely removed, and the third was destroyed. The heads were cut off 50 underground cables, each made up of from 200 to 400 wires, while separate wires were cut in several places in such a way as to make them especially difficult to repair. Equipment was torn down and removed; one of the big "multiples" was entirely destroyed. The whole telephone installation will have to be rebuilt; the work is going on.

Exchanges in other towns have suffered the same fate. The wires in private houses have been cut, and in many cases the instruments have been removed. The same conditions prevail at the Central Telegraph Office. The great switchboard serving as an exchange for the whole of the country was stripped. The main instrument room was left simply empty. At the end of last month there was *no* cable communication with England, except by way of Holland and France. There was only one wire working between the French frontier and Paris. It was four-and-a-half months before the Germans succeeded in discovering, although it had been laid by Siemens, how the Belgians had managed to keep the underground telephone line from Antwerp working surreptitiously for days after the occupation.—*The Times.*

Cable Censorship to be Withdrawn.—The daily Press states that as the outcome of an agreement between the Allied Governments, the censorship on all cable communication between Allied and the Orient and S. American and European countries, excepting Germany, Austria and Hungary, and that part of Russia controlled by the Bolshevists, is about to be withdrawn. Formal approval of the British Government has not been given to the agreement; but it is expected to be notified this week.

Germany.—A report from Paris states that the Associated Governments have authorised the resumption of postal, cable, and wireless communication between Germany and neutral countries to a limited extent, in order to facilitate the Brussels Food Agreement of March 14th. Communications regarding imports are confined to foodstuffs, and those regarding exports may not contain references to forbidden articles. All correspondence will be censored, and wireless will only be permitted if Germany consents to the setting-up of central censorship machinery.

According to a Press correspondent, it is said that it has now been decided that the following cables will not be restored to Germany:—Emden-Vigo; Emden-Brest; Emden-Teneriffe; Emden-Azores (two lines); Azores-New York (two lines); Teneriffe-Monrovia (West Africa); Constantinople-Constanza; Monrovia-Pernambuco (Brazil); Chifu-Tsingtau-Shanghai; Yap (Caroline Islands)-Shanghai; Yap-Guam (Pacific); Yap-Menado (Malay Archipelago).

India.—During disturbances the rioters at Amritsar cut the telegraph lines, and at Ahmedabad the city telegraph office was burned down. Destruction of the railway and telegraph lines is said to be, perhaps, the most distinctive feature of this widespread disturbance, as was the case also in Egypt.

Isle of Man.—The telegraph service between the Isle of Man and the mainland, interrupted by a breakage of the submarine cable, has been restored. Since the breakage took place on February 25th, communication has been maintained by wireless.

Spain.—The Government is making every effort to re-establish telegraphic and telephonic communication, which ceased at midnight on April 18th, owing to a political strike.

A later *Times* report states that the Cabinet has approved a Bill making it a penal offence for telegraphists to leave work. Official communications have been restored in the principal Provinces. Several provincial capitals where the telegraphists are still at work are able to communicate with each other and with the different localities in their respective districts.

Telegraph Operators.—At the first conference of the Cable Telegraph Operators' Association, held in London on Saturday last, a programme was decided upon which includes a six-hour day, optional overtime, revision of the pension scheme, voluntary retirement at 50 and compulsory retirement at 55, and equal pay for equal work irrespective of sex.

Underground Telephone Cables.—Two of the schemes for placing all the telephone wires of Leeds and district underground are already in hand. The general scheme, planned before the war, includes, besides many big centres, practically the whole of the wires acquired from the National Telephone Co. in 1912. Practically all the plans have been made, and all the contracts made for the underground schemes. The greater part of the underground cable in Leeds itself will also be down before the end of 1919. It is estimated that the whole programme will take between two or three years to complete. The first important underground telephone cable to be started upon was the one to London, but this will not be the first one to be completed.—*The Times.*

United States.—Restrictions in the United States upon the use of wireless receiving stations, other than those for commercial traffic, were to have been removed on April 15th.

Organised telegraph and telephone workers are taking a vote, to be completed by May 5th, on the question of a general strike.—*The Times.*

Wireless Operators' Threat.—Regarding the wireless operators' threat to strike unless payment was made of the £3 a month war-risk bonus, the Shipping Controller held a conference with representatives of the Shipping Federation and the Marconi Co. at the Ministry of Shipping on April 14th, and a decision was come to, which, however, the men's association regards as not altogether satisfactory.

The Marconi Co. has granted the demands of the Association of Wireless Telegraphists for the payment of the bonus to date back from October 7th last.

Wireless Restrictions Removed.—The ban on all wireless messages for the public is to be removed on May 1st, Mr. Godfrey Isaacs stated at a meeting of the Marconi Co. last week. From that date wireless installations on all vessels will be reinstated.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Australia.—BRISBANE.—May 15th. Department of the Treasury. H.T. switchboard, storage battery and motor-generator set for the electric power house, Inkerman Irrigation Area, Townsville. Specifications from the Hydraulic Engineer, Brisbane.

June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.) from the offices of the company at Brisbane.—*Tenders.*

MELBOURNE.—May 14th. Victorian Railway Commissioners. Cells, renewals, caustic soda and mineral oil for caustic soda batteries. (Contract No. 32,194.)

SYDNEY.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

Bedford.—May 3rd. Electricity Department. Meters for 12 months. (April 18th.)

Birr (King's County).—May 1st. Birr Electric Light and Power Co., Ltd. Hydraulic turbine and accessories, electric generator, reducer set and motor booster, switchboards, alterations to P. & G. storage battery, overhead distributing lines, wooden poles and fittings. (April 11th.)

Chorley.—April 28th. B. of G. Electric lighting installation at the Poor Law Institution, Eaves Lane, Chorley. Specification from Mr. R. E. Aspden, Clerk, 7, High Street, Chorley.

Dundalk.—April 29th. U.D.C. Electricity Department. Replating of storage battery. (April 11th.)

Ilford.—April 26th. Tramway Committee. 100 tons steel tramway rails, 140 pairs fishplates and fishbolts, 300 copper rail bonds, 28 tramway standards.—Mr. L. Harvey, Tramways Office, Ley Street, Ilford.

London.—BATTERSEA.—May 1st. Electricity Department. One water-tube boiler, superheater, economiser and mechanical stoker, induced-draught plant for main flues. (April 11th.)

L.C.C.—May 12th. 5,000 driving-wheel tires, and 3,500 trailing-wheel tires for electric tramways. General Manager, L.C.C. Tramways, 23, Belvedere Road, Lambeth, S.E.

Metropolitan Water Board.—May 22nd. Two Diesel engines, gearing and centrifugal pumps. Chief Engineer's Department, South Place, Finsbury Pavement, E.C.

Salford.—1,000 yd. of i.r. insulated electric cable, and one 20-B.H.P., D.C. electric motor. Particulars from Mr. W. Woodward, Engineer, Gas Offices, Bloom Street.

South Shields.—April 29th. Corporation. Rails, copper rail bonds, bonding of rails. Particulars from Mr. J. C. Whiteby, tramway manager.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Australia.—MELBOURNE.—City Council:—

Five electric motors, £423.—British General Electric Co., Ltd.
Six circuit breakers, oil brake type, £315.—Warburton, Franki, Ltd.

P.M.G.'s Department, N.S.W.—

20,000 porcelain insulators, £591.—Firebrick Insulator & Pottery Co. (Pty.), Limited.

P.M.G.'s Department, Queensland—

10,000 porcelain insulators, £297.—Firebrick Insulator & Pottery Co. (Pty.), Limited.
Material for automatic telephones, £404.—B.I. & Helsby Cables, Ltd.

P.M.G.'s Department. Tasmania—

3,000 porcelain insulators, £89.—Firebrick Insulator & Pottery Co. (Pty.), Limited.

Prime Minister's Department—

One induction motor for ship construction purposes, £405.—Noyes Bros. (Melbourne), (Pty.), Ltd.

Victorian Railways Department—

Electric lamps, 600 C.P., 240 volts, gas-filled screw caps, 14s. 3d. each; 300 C.P. do., bayonet cap, 11s. each; 200 C.P. do., 7s. 6d. each; 400 C.P., 230 volts, 12s. 5d. each; 16 C.P., carbon filament, 220 volts, 1s. 4d. each.—Noyes Bros. (Melbourne), (Pty.), Ltd.—*Tenders.*

Barnsley.—T.C. Switchgear. New Switchgear Construction Co., £159.

Glasgow.—Tramways Department:—

Axles.—Glasgow Railway Engineering Co., Ltd.
Phono trolley wire.—Bridgeport Brass Co.
Galvanised steel wire.—Whitecross Co., Ltd., and J. Stewart [illegible] Ltd.
Drop forgings for jacks.—A. Harper, Sons & Bean, Ltd.
Commutators.—P. R. Jackson & Co.

Government Contracts.—The undermentioned contracts were placed during March, 1919:—

War Office.

Spares for generating sets.—M. L. Magneto Syndicate, Ltd.

Post Office.

Protective apparatus.—Automatic Telephone Manufacturing Co., Ltd.
Telegraph apparatus.—Creed & Co., Ltd.
Telephone apparatus.—Automatic Telephone Manufacturing Co., Ltd., Peel Conner Telephone Works, Ltd., Telephone & Microphone Co., Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telegraph and telephone cable.—Western Electric Co., Ltd.
Jointing compound.—Dussek Bros. & Co., Ltd.
Cords for telephones.—London Electric Wire Co. & Smiths, Ltd.; Phœnix Telephone & Electric Works, Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.; Gibbs & Canning, Ltd.; H. R. Mansfield; G. Skey & Co., Ltd.; Sutton & Co.; T. Wragg & Sons, Ltd.
Lamps for telephones.—General Electric Co., Ltd.
Laying conduits.—Sevenoaks-Tunbridge Wells, R. M. Parkinson; Motherwell-Hamilton, W. Dobson; Motherwell, W. Dobson.
Manufacturing, supplying, drawing-in, and jointing cables.—London-Stanmore corner, Callender's Cable & Construction Co., Ltd.; Glasgow-Motherwell, Siemens Bros. & Co., Ltd.; Liverpool-Manchester, W. T. Henley's Telegraph Works Co., Ltd.
Amplifying valves.—Marconi Wireless Telegraph Co., Ltd.

India Office—Stores Department.

Accumulators.—Chloride Electrical Storage Co., Ltd.
Boiler tubes.—A. Everitt & Sons; W. Bayliss, Ltd.
Cable.—W. T. Glover & Co., Ltd.; General Electric Co., Ltd.
Generating sets.—Lancashire Dynamo, &c., Co., Ltd.

H.M. Office of Works.

Engineering works.—Electric wiring, Ministry of Pensions, Regent's Park, Tredegars, Ltd.

Board of Public Works, Dublin.

Electrical work and supplies, Dublin District.—Handley & Robinson.

London.—Poplar.—Electricity Committee. Recommended :—

One boiler, 36,000-lb. evaporative capacity, complete, £11,758.—Clarke, Chapman & Co., Ltd.
Rotary feed pump, £657.—G. & J. Weir, Ltd.
Seven patent automatic coal weighers, £2,363.—W. & T. Avery, Ltd.
One balancer-booster set, complete with spare parts, with starter and regulator, £1,287.—Mather & Platt, Ltd.
Renewing existing battery, £248.—Hart Accumulator Co., Ltd.

Taunton.—T.C. Three electric vehicles, Edison Accumulator Co., Ltd., £1,304 each, one with interchangeable body, £300 extra.

FORTHCOMING EVENTS.

Society of Technical Engineers (North-Western District).—Friday, April 25th. At 7.15 p.m. At Milton Hall, 241, Deansgate, Manchester. District mass meeting.

Junior Institution of Engineers.—Friday, April 25th. At 7.30 p.m. At 39, Victoria Street, London, S.W. "Commercial Flying," by Mr. J. D. North (of Boulton & Paul, Ltd.).

Friday, May 2nd. At 7.30 p.m. At 39, Victoria Street. Lecturette on "Engineering at the Front," by Capt. G. B. Paterson, A.I.F.

(North-Eastern Section).—Tuesday, April 29th. At 7.15 p.m. At the Mining Institute, Newcastle-upon-Tyne. Paper on "A.C. Diagrams and their Systematic Development," by Mr. M. M. Hall.

Industrial Reconstruction Council.—Tuesday, April 29th. At 5.30 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Incentives to Efficiency in Scientific Management," to be opened by Mr. H. Atkinson.

Institution of Civil Engineers.—Tuesday, April 29th. At 5.30 p.m. At Gt. George Street, Westminster, S.W. Annual general meeting.

Faraday Society and the Roentgen Society.—Tuesday, April 29th. From 5 to 7 p.m. and 8.30 to 10 p.m. Joint meeting. At Burlington House, Piccadilly, W. (See "Institution Notes" this issue.)

Royal Society of Arts.—Wednesday, April 30th. At 4.30 p.m. At John Street, Adelphi, W.C. "Trueman Wood" lecture on "Glass and some of its Problems" by Sir H. Jackson, F.R.S.

Royal Institution of Great Britain.—Friday, May 1st. At 5.30 p.m. At Albemarle Street, W. Lecture on "Energy Distribution in Spectra," by Prof. J. W. Nicholson, F.R.S.

Institution of Electrical Engineers.—Thursday, May 1st. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Lecture on "Magnetic Storms," by Dr. C. Chree, F.R.S.

North-Eastern Centre).—Monday, April 28th. At 6.45 p.m. At the Mining Institute, Newcastle-upon-Tyne. Lecture on "Electric Welding," by Dr. J. H. Paterson.

(North-Midland Centre).—Tuesday, April 29th. At 7 p.m. At the Metropole, King Street, Leeds. Papers on "Electric Furnaces."

Institution of Mechanical Engineers.—Friday, May 2nd. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Mechanical Properties of Steel, with some Consideration of the Question of Brittleness," by W. H. Hatfield.

NOTES.

Government Pledges to Labour.—In the House of Commons last week the Minister of Labour (Sir Robert Horne) presented the "Restoration of the Pre-War Practices" Bill. We print below the four opening paragraphs:—

1.—(1) Where, in any establishment to which this Act applies, any rule, practice, or custom obtaining before the war in any industry or branch of an industry (hereinafter referred to as a trade practice) has, during and in consequence of the present war, been departed from, the owner of that establishment shall be under an obligation, at the expiration of one month from the date when such notice as is hereinafter mentioned is served on him, to restore or permit the restoration of the trade practice so previously obtaining, and for one year after such restoration is effected to maintain or permit the continuance of the trade practice.

(2) Where any industry or branch of industry, which before the war was not carried on in an establishment, commenced to be carried on in the establishment during the war and continues to be carried on therein after the termination thereof, or where an establishment is one which commenced to be worked after the beginning of war, the owner of the establishment shall be under the obligation, at the expiration of one month from the date when such notice as is hereinafter mentioned is served on him, to introduce or permit the introduction of, and for one year after such introduction is effected to maintain, or permit the continuance of, such trade practices as obtained before the war in other establishments where that industry or branch was carried on under circumstances most nearly analogous to those of the establishment in question.

(3) An obligation under this section shall not become binding on the owner of any establishment unless within three months after the termination of the war there is served on the owner by or on behalf of a majority in the establishment of the class or grade of workers whose custom it was before the war to maintain the trade practice in question, a notice in the prescribed form requiring the observance of the obligation, and specifying the nature of the practice to which the obligation relates, and if the change of practice was made in pursuance of an agreement, specifying also the agreement.

(4) If the owner of the establishment is not prepared to comply with the notice or is in doubt as to the nature of the trade practice to be restored or introduced, he shall within 14 days from the service of the notice on him serve on the sender of the notice a counter notice in the prescribed form to that effect.

The full copy of the text of the Bill was printed in the *Times* on April 21st. The Act will apply to establishments in which munitions work within the meaning of the Munitions of War Acts, 1915 to 1917, has been carried on, and any other establishment in which the departure from the practice was made in consequence of the agreements; also to Crown establishments.

Educational.—The British Science Guild has issued a memorandum urging the Government to appoint a Departmental Committee to inquire into the provision for University and higher technical education in this country, and a Consultative Committee, consisting mainly of representatives of industry, to advise the Board of Education on matters affecting the relationship of science and industry to education.

Scientific Research in Canada.—A resolution for the appointment of a Special Committee to consider scientific research has been adopted by the Canadian House of Commons.—*The Times*.

Institution and Lecture Notes.—Joint Meeting of the Faraday Society and the Röntgen Society.—A general discussion on "The Examination of Materials by X-rays" will be held on Tuesday, April 29th, in the rooms of the Royal Society, Burlington House, London, W. 1, from 5 to 7 and from 8.30 to 10 p.m. The chair will be taken by Sir Robert Hadfield, Bart., F.R.S., President of the Faraday Society, who will introduce the discussion.

Prof. W. H. Bragg, C.B.E., F.R.S., will deliver an address on "Radiometallography."

Prof. Alfred W. Porter, F.R.S., will give short abstracts of the following papers,* translations of which will be presented by Sir Robert Hadfield :—(*a*) "Investigation of Metals by Means of X-rays," by F. Janus (Munich) and M. Reppchen (Cologne). (*b*) "The Principles Governing the Penetration of Metals by X-rays," by Dr. G. Respondek (Helensee).

M. H. Pilon and Mr. Geoffrey Pearce will give a brief description of the "Apparatus Used for Radiometallography," illustrated by lantern slides.

Capt. R. Knox and Major G. W. C. Kaye will present a paper on "The Examination of Timber by X-rays."

Sir Robert Hadfield, Bart., F.R.S., Mr. S. A. Main, B.Sc., and Mr. J. Brooksbank, B.Sc., A.R.C.S., will read papers on :—(*a*) "Testing the Absorption Power of Different Steels under the X-rays"; (*b*) "X-ray Examination as Applied to the Metallurgy of Steel"; (*c*) "Radiographic Examination of Carbon Electrodes Used in Electric Steel-Making Furnaces"; (*d*) "A Method of Testing an X-ray Tube for Definition."

Lieut.-Colonel C. F. Jenkin will contribute a note on "The Detection of Hair Cracks in Steel by Means of X-rays."

Mr. F. F. Renwick will read a paper on "The Behaviour of Photographic Plates Exposed to X-rays, Considered in Relation to the Radiography of Metals."

Dr. R. E. Slade will read a paper on "Contrasts in X-ray Photographs."

M. E. Schneider (Le Creusot), President of the Iron and Steel Institute, will present a paper on "Radiometallography."

Prof. A. W. Hull, Mr. C. T. Heycock, F.R.S., Mr. A. A. Campbell Swinton, F.R.S., Mr. F. W. Willcox, Capt. Leslie Aitchison, Mr. Donnithorn, and others will contribute to the discussion.

Major C. E. S. Phillips will exhibit apparatus used at the War Office X-ray Laboratory for testing definition of X-ray bulbs.

Exhibits and demonstrations will also be given by M. Pilon, Messrs. Newton & Wright, Watson & Sons, Cox & Co., and the British Thomson-Houston Co., Ltd.

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* Proofs on application to Sir Robert Hadfield, 22, Carlton House Terrace, S.W. 1, or to the Secretary of the Faraday Society.

Institution of Electrical Engineers.—On April 14th, the second informal meeting of the Institution was held, Mr. R. Rankin presiding. Dr. R. D. Gifford introduced a discussion on "Electrical Instruments," with an excellent review of the principal types in general use, describing the leading features of each type briefly but clearly, and maintaining an attitude of impartiality which drew a high compliment from a well-known instrument maker in the subsequent discussion. In the course of his paper, Dr. Gifford was greatly assisted by the "mirrorscope," in the hands of Mr. W. E. Bradshaw, by means of which the images of drawings and diagrams were projected on a translucent screen. As a feat of condensation without loss of breadth the paper left nothing to be desired.

The attendance was not so good as at the first meeting, but the discussion was well maintained. The chairman described a hunt with a Megger for an intermittent earth at a public institution, which eventually became a dead earth and was localised in the mortuary! A naval officer gave interesting details of his experience with instruments on warships, urging that they should be provided with brass cases instead of cast-iron, because the *matelot* was taught to paint everything except brass, and consequently he painted the ironclad instruments black—including the glass. Another speaker remarked that this did not really matter, as delicate instruments were speedily put out of order on board ship, and might just as well be blacked over. The pranks of beetles and spiders in the interior of electricity meters were described, and one speaker gave an account of a meter which first refused to start, afterwards refused to stop, and finally, when left going all night, gave no record: it was eventually found that the meter stopped soon after the staff left the test room, and started again next morning just before they arrived, this behaviour being due to the fact that a motor in an adjoining room stopped and started at those times, and the vibration caused by the motor reduced the pivot friction just enough to allow the meter to run. Another naval officer described some measuring instruments employed in connection with wireless telegraphy. Altogether the meeting was thoroughly successful.

The annual general meeting of the SCOTTISH CENTRE of the I.E.E. was held at Glasgow on April 8th, Mr. J. F. Nielson in the chair. The new Committee was elected, as follows:—

Chairman.—Mr. W. B. Hird.

Vice-Chairmen.—Messrs. Alex. Lindsay and J. E. Sayers.

Past-Chairmen (*Ex-Officio* Members of Committee).—Messrs. J. K. Stothert, Arch-Page, J. F. Nielson.

Chairman of Students' Section.—Mr. F. H. Whysall.

Ordinary Members of Committee.—Messrs. Sam Mavor, E. T. Goslin, A. S. Hampton, W. Wood, R. B. Mitchell, Frank Anslow, W. J. Belsey, Capt. J. M. Scott-Maxwell, Messrs. J. A. Bell, John Prentice, D. S. Munro.

Hon. Sec. and Treasurer.—Mr. Joseph Taylor.

Assist. Hon. Sec.—Mr. Wm. F. Mitchell.

The annual report showed that while the average attendance this session had not been large, the Committee was satisfied that much good work had been done. The discussions had showed that interest was generally well maintained. A proposal was at present before the Council to hold special summer or autumn meetings at Aberdeen and Dundee, with a view to interesting residents in those neighbourhoods. The session ended with a total membership of 380, an increase of 31 on the previous year. In moving the adoption of the report the chairman said that no definite arrangements had yet been made for the special meeting at Dundee, but it had been practically decided to meet at Aberdeen on June 6th. That meeting would take the place of the summer meetings they had had in the past. The meeting would be purely a Scottish Centre meeting, and there were hopes that the president of the Institution (Mr. Wordingham) would be present. Details would be announced later. The report was adopted, and Mr. M. B. Field gave a lecture on the "Navigational (Magnetic) Compass as an Instrument of Precision."

Royal Institution.—The lecture arrangements for after Easter, include the following:—

Friday, May 2nd. At 5.30 p.m.—"Energy Distribution in Spectra," by Prof. J. W. Nicholson, F.R.S.

Friday, June 6th. At 5.30 p.m. "Atomic Projectiles and their Collisions with Light Atoms," by Prof. Sir Ernest Rutherford, F.R.S.

Tuesdays, May 27th and June 3rd. At 3 o'clock.—"Listening Under Water," by Prof. W. H. Bragg, F.R.S.

Thursdays, May 1st and 8th. At 3 o'clock.—"Clutches," by Dr. H. S. Hele-Shaw, F.R.S.

Saturdays, May 3rd and 10th. At 3 o'clock. "Chapters in the Psychology of Industry," by Prof. H. S. Foxwell.

Birmingham Electric Club.—At the final meeting of the session, on April 12th, a paper was read by Mr. J. Gold upon "Electric Converting Plant," in which the author gave an account of the theory, design, and practice of the three principal types at present in use—the motor-generator, the "La Cour" motor converter, and the rotary converter. The design, construction, and performance of each type were fully discussed, together with the modification in design of rotary converters, their installation, starting up, and control. Test figures were given of three types under varying loads. In each case the rotary converter had an advantage in efficiency over the other two; and as the initial costs were also lower, the author held it proved that the future lay entirely with the rotary converter.

Institution of Civil Engineers.—At the meeting of the Institution on April 9th, a paper was read by Mr. George Hughes on the electrical and mechanical equipment of the all-metal cars of the Manchester-Bury section of the Lancashire and Yorkshire Railway. In the motor bogie, he said, the best locomotive practice had been adopted, and the design was the outcome of the development of the built-up frame bogie. Each bogie was fitted with two motors, geared to the axle through spur gearing. The motors were 200-H.P., and had been designed on the experience gained on the Liverpool and Southport line. The temperature rise of these motors was 55° C. after an hour's run at full load.

The vacuum brake equipment was of the simplest possible form. In the design of the brake valve the "dead man's" handle was incorporated, which applied the brakes and cut off current to the main motors. The motors, of 5-H.P., for driving the pumps were series wound, and ran at 1,000 R.P.M. on a 100-volt circuit. This pump was operated through a switch in the brake valve and an automatic regulator.

Association of Mining Electrical Engineers.—At a meeting of the Yorkshire Branch, at Leeds, on April 12th, a paper on "Some General Types of Electrical Apparatus" was read by Mr. Fred Sims. In reference to the relations existing between colliery managers and electricians, Mr. Sims said that in quite a number of cases the electricians were looked upon as a "necessary evil" by the managers, and treatment was meted out to them accordingly. Mutual sympathy and understanding were in the highest degree necessary for the smooth working of the plant, and especially with regard to the colliery electrical apparatus. The present condition of affairs was deplorable, and he trusted that in the near future suspicion and jealousy would be removed, and a real and lasting amicable understanding would be instituted.

IRISH WATER-POWER RESOURCES.—In a lecture by Mr. H. N. Walsh, under the auspices of the COMMERCE SOCIETY, University College, Cork, a list of sites was given showing that there were very few places in Ireland at which electricity might not be generated for transmission to the cities, or for electrochemical purposes. Many of these, said Mr. Walsh, were suitable for all kinds of factories requiring up to 500 or 1,000 H.P., and there were districts all over the country where power could be got from streams for working flour and woollen mills and farm machinery. Particulars were given of places in South Kerry where power ranging from 25 to 250 H.P. was available for a 10-hour day in a very dry season, and it was pointed out that in a number of cases facilities were available for storing winter floods, and using the excess water to augment the summer supply.

U.S.S. Tennessee.—What is described as the world's largest battleship, the U.S.S. *Tennessee*, which is to be electrically propelled, will be launched at Brooklyn, U.S., next week.

Appointments Vacant.—Charge engineer (75s.), for the Coventry Corporation tramways; shift engineer, for the Birkdale and District Electric Supply Co., Ltd.; junior shift engineer (£186), for the Crewe Corporation Electricity Works; assistant electrical engineer (£300 + £120), for the Government of Nigeria; junior mains assistant, for the Leith Corporation Electricity Department; shift engineer (79s.), meter tester and repairer (71s. 6d.), cable jointer (69s. 6d.), for the Dewsbury Corporation Electricity and Tramways Department; instructor for test room work (£5), assistant instructor (70s. to 80s.), for the Erith Technical Institute; shift engineer, for the Kingston-on-Thames Corporation Electricity Department; charge engineer (£214), for the Heston and Isleworth U.D.C. Electricity Works; chief electrical engineer (£800), for the Corporation of Southampton Electricity Department; cable jointer, for the Borough of Haslingden Tramways Department. See our advertisement pages to-day.

Fire at the House of Commons.—On Tuesday last, a slight fire occurred in a corridor of the House of Commons, due to the ignition of an electric fuse-box. No serious damage was done.

The Threatened Lock-out.—In order to avoid a rupture in the dispute with regard to the employment of non-union men, the employers sent a circular to every member of the Electrical Trades Union, stating the facts. Mr. Leonard Tate, Secretary of the London Masters' Association, said that his Association was anxious to arrive at an amicable settlement of the dispute, and would go a long way towards meeting the wishes of the men. The Union is opposed to the employment not only of non-union men, but also of members of the National Association of Supervising Electricians, and declares that Rule 1 of the London working rules, which is relied upon by the employers, was never formally accepted by the Union. A mass meeting of the men was held on Wednesday last week, when Mr. J. Rowan, general secretary, and other members of the executive attended; about 2,000 members were present. It was decided to continue the strike at Messrs. Rashleigh Phipps & Co.'s works.

Fatalities.—It is reported that Clarence Oxley, aged 21, an employé of the Appleby Iron Co., Ltd., was found at Goosehole grasping an electric wire (220 to 250 volts), which had been fixed 25 ft. from the ground, but had broken and fallen.

The *Times* reports that in a boating accident on the River Crouch, on Monday, J. G. and P. Teasdale, aged 19 and 18 respectively, sons of Mr. J. H. Teasdale, electrical engineer, of Althorne and London, were drowned.

Electric Furnaces for Mexico.—Electrical furnaces, it is said, are destined to become one of the chief items of electrical export from the U.S.A. to the Spanish-speaking countries. This is true, according to the *Electrical World*, because of the large amount of low-priced scrap metal there available, and the abundant supply of hydro-electric power in most of those countries. Ten Bailey brass furnaces, of the tilting type, and rated at 105 KW., 1,500 lb. hearth capacity, and 600 lb. per hour melting rate, formed a recent shipment to Mexico.

Submarine Detection by Wireless.—An interesting account was recently given in the *Times* of the part played by the flying boats stationed at Harwich in the detection and destruction of enemy submarines. Incidentally it may be mentioned that it was at Harwich that the hydrophone for detecting submerged submarines was evolved. Flying boats were, of course, fitted with wireless equipment, and it was by this means that the presence of enemy submarines was revealed. When they reported to Germany by wireless the signals were picked up by two widely separated direction-finding stations in England, which each obtained a bearing of the submarine. The base line between the two English stations was known, and when the two bearings were plotted out, a triangle was formed, and the apex, where the two bearings crossed, gave the exact position of the U-boat. But the submarine took few chances in sending these signals. The two jumping wires which ran from end to end of the boat, passing over the conning tower, and forming a protection against nets, hawsers, and mines, were fitted as an auxiliary aerial, and therefore the submarine could wireless without setting up an aerial mast, and was in trim to dive immediately if any danger threatened. The Zeppelin patrols were carried out on orders direct from the Admiralty, the position, course, and speed of the aircraft being determined by wireless methods in the same way as the submarines were spotted. Besides this work the flying boats carried out long reconnaissances from lighters, which could be towed behind destroyers. In order to keep the engines of the flying boats dry and warm, special padded covers were made and electric heaters fitted. The heating current was supplied from the destroyers to the lighters through waterproof cables. In the same manner electric heating was provided in the cramped cabins in the bows of the lighters used by the crews.

The destruction of the wireless station, which intercepted messages about the movement of U-boats, was the object of the German submarine's bombardment of St. Kilda, Outer Hebrides, in May last year. The submarine fired 4-in. shells and battered the wireless station to ruins. Before leaving the island the Germans landed marines to make sure that the destruction of the station was complete. The station was rebuilt.

Hydro-electric Power Development in Portugal.—A recent American commerce report notes that a movement is on foot for the utilisation of the hydroelectric power in the whole of Portugal. The number of applications for concessions pending would imply an expenditure of not less than £10,000,000 in plant, but most of these are nothing further than an expedient form of acquiring rights and eliminating competition. As regards the north of Portugal, three great electric power systems are to be considered, viz.: (1) the International Douro, where this river divides Portugal from Spain, 300,000 to 400,000 H.P.; (2) the Portuguese Upper Douro, 60,000 to 100,000 H.P.; and (3) the Upper Cavado, 40,000 to 60,000 H.P. All the above are more or less under study and negotiation, but so far as can be ascertained nothing of a definite character has been concluded. The international Douro scheme is dependent on some arrangement with the Spanish Government, while the national Douro system more or less competes with the former. The Upper Cavado remains strictly Portuguese in nature, and is situated close to one of the most important tungsten mines in the world, worked by a Belgian concern. Work on a fourth system, the upper Lima at Lindoso, where this river enters Portugal, is well advanced. A 10,000-H.P. turbine of Swiss manufacture is installed and the company is now waiting for electric machinery purchased in the United States. This concession is in the hands of an important Spanish company, and will prove valuable since it immediately serves a densely populated province where many new industries can be introduced, and a system of electric railroads established with all prospects of success. About a dozen other minor electrical units are available in the north of Portugal, of which one or two are already in operation. It will be remembered that our special correspondent in Spain referred to the River Douro Co.'s operations in the Electrical Review for April 11th, 1919, p. 427.

Accurate Timing in Electrical Tests.—In conducting short-time tests of electrical apparatus it sometimes happens that the precision of the apparatus under test exceeds that of the ordinary stop watch with which the test is made. In such a case, unless the observer is on his guard, the error he may assign to the apparatus may be mainly attributable to the unsuspected error of his timekeeper. This possibility is clearly presented in an article in the *Electrical World* by Prof. F. A. Kartak. Two methods of obviating the difficulty are described, one involving an improved form of stop watch, the other a cycle counter converted into the equivalent of an accurate timekeeper through the intervention of a carefully-adjusted tuning fork. It is certain that electrically driven forks are coming into more generally recognised use. A tuning fork, properly constructed, is a wonderfully reliable timekeeper, and, unlike an ordinary pendulum, its frequency is nearly independent of its amplitude of vibration unless the amplitude is unusually large. The precision in time obtainable with tuning-fork control is easily one part in a thousand, and without much difficulty can be raised to one part in ten thousand. With the stroboscopic fork, which is another well-known laboratory adjunct, the precision with which a steady speed of rotation can be measured is also of the third or fourth order.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—When the Electricity Committee of the County Borough of Southampton recommended the appointment of Mr. H. S. Ellis, electrical engineer of South Shields, in the place of Mr. H. F. Street, who has resigned, the Mayor, as chairman of the committee, said the appointment was recommended though it created a precedent. The post had not been advertised for in the usual way. What happened was that the tramways manager suggested that Mr. Ellis, who was a long-standing friend of his, was the ideal man for Southampton. The Mayor interviewed Mr. Ellis, the committee interviewed him, and a deputation that visited South Shields reported favourably on him. Mr. Ellis was one of those first-class men who would not apply if the post were thrown open to competition. The committee's recommendation was strongly opposed in the Council, and an amendment that the post be advertised in the usual way was carried by 22 votes to 19.

Mr. Harry Heath, on leaving the Sheffield Corporation tramways department, to take up an appointment with a private firm at Sheffield, was presented by the staff with a silver tea kettle. Mr. A. R. Fearnley, the manager, made the presentation.

Exeter T.C. has referred back to the Electricity Committee for reconsideration a recommendation to increase the salary of the electrical engineer, Mr. H. D. Munro, to £768 per annum, without a suggested bonus.

Rochdale Corporation Tramways Committee has recommended that the salary of the general manager, Mr. George Webster, be increased from £500 to £600 per year.

Mr. J. M. Calder, chief assistant engineer of the Reading Corporation tramways, whose services had been lent to the Southampton T.C., has been presented on his return to Reading with an attaché despatch case.

Taunton T.C. has increased the salary of the electrical engineer, Mr. A. J. Howard, by £120 a year.

Major Barker, borough electrical engineer at Barnsley, hopes to return to duty by May 1st.

Epson U.D.C. has informed Captain Gilling, electrical engineer, that they do not consider it necessary at present for him to take any active steps in connection with his return to civil life so far as the electricity department is concerned as the question of the position of the undertaking and procedure are under consideration.

The Dublin Corporation, on the motion of Alderman O'Connor, seconded by Alderman Byrne, adopted the recommendation of the Electricity Supply Committee for the appointment of Mr. L. J. Kettle to the position of chief city electrical engineer, in place of Mr. Mark Ruddle, resigned. Alderman McCarthy said Mr. Kettle was the right man for the post, but asked for further information in regard to salary. Mr. F. J. Allan, secretary of the committee, said that Mr. Kettle's income as deputy engineer was £600, plus 28s. 6d. war bonus, plus 12½ per cent. The total was £748. With the adoption of the report he would receive about £905. Alderman T. Kelly objected to the promise of an increased salary based on results in the course of a few months, and moved that the word "twelve" be substituted for "few." This was seconded by Mr. Mahon, and agreed to by 32 votes to 8.

General.—Mr. A. F. W. Richards, who has for 13 years been on the staff of Messrs. W. T. Glover & Co., Ltd., and previously had many years' experience in electricity supply, is about to join Mr. A. Murray Coombs as partner in the practice of advisory engineer, which the latter has carried on for some ten years at 31, Charing Cross, London. Mr. Coombs, an Old Faradian, had at the outbreak of war a large circle of clients in connection with electrical undertakings abroad, in addition to his consulting practice at home; during the war he served in the R.A.F., and has recently been demobilised. His experience, together with the wide knowledge of cable problems which Mr. Richards has acquired, forms a happy combination, and the new firm has our best wishes. Mr. Richards remains at his present address until June 30th.

A financial daily states that Sir John Aspinall, ex-general manager of the Lancashire and Yorkshire Railway, has joined the board of the English Electric Co., Ltd.

Mr. Henry William Allen, F.C.I.S., director (formerly secretary), and Mr. William Walter Bradfield, C.B.E., director (formerly manager), have been appointed joint general managers of Marconi's Wireless Telegraph Co., Ltd., and the Marconi International Marine Communication Co., Ltd. Mr. H. W. Corby, F.C.I.S. (formerly assistant secretary), has been appointed secretary of the companies.

Mr. Murray D. Scott has resigned his position as electrical manager to Messrs. Medway's Safety Lift Co., of Deptford, S.E., and has accepted the managing directorship of Messrs. Marryat & Scott, Ltd., 28, Hatton Garden, E.C., a company which has been formed to conduct the lift, crane, and hoist business of Messrs. Marryat & Place and Joseph Richmond & Co.

The King has granted permission to Mr. A. E. L. Chorlton, C.B.E., to wear the Cross of Officer (Order of the Crown of Italy), which has been conferred upon him in recognition of his valuable services.

We understand that Mr. Robert Nelson, H.M. Electrical Inspector of Mines at the Home Office, has, in order to take up another appointment, tendered his resignation, and that it has been accepted.

At the Dock Offices, Grimsby, on 11th inst., Mr. J. L. H. Cooper, B.A., A.M.I.E.E., A.M.I.Mech.E., was presented with a wrist watch by his late colleagues on the Great Central Railway on resigning his position as assistant electrical engineer to the company in the Immingham and Grimsby district, to commence practising as consulting electrical engineer in Grimsby. The presentation was made by Mr. Hellyer, the assistant portmaster, who, after referring to the cordial relations existing between Mr. Cooper and the heads of the various railway departments at Immingham and Grimsby during the six years of his connection with the company, and expressing the sense of loss felt by all upon his resignation, conveyed to him the heartiest wishes of his late colleagues for his success in the new career upon which he had entered. In his reply, Mr. Cooper said that in the new branch of his profession which he was taking up he hoped it would still be his privilege to meet from time to time the local officers of the Great Central Co.

Obituary.—Mr. W. J. Lineham.—We regret to record the death, which occurred at Brighton on April 17th, at the age of 60 years, of Mr. Wilfrid James Lineham, B.Sc., M.I.M.E., M.I.C.E., M.I.E.E., &c. He was the author of the well-known "Text-book of Mechanical Engineering," and editor of the "D.U." technical series of publications.

Will.—The late Mr. Frederick Ward, London manager of the Commercial Cable Co., left £20,438.

NEW COMPANIES REGISTERED.

United Electrical Works, Ltd. (154,152).—Private company. Registered April 5th. Capital £2,000 in £1 shares. Electricians, mechanical and general engineers. Directors: J. G. Shaw and C. R. Shaw, both of Crypto Electrical Co., Ltd., Acton Lane, N.W. (10), electrical engineers; J. C. F. Smith, 30, Eastcombe Avenue, Westcombe Park, S.E., electrical engineer; and C. R. Bates, 27, Martins Lane, E.C. (4), electrical engineer. Office: 159, Bermondsey Street, Bermondsey.

Ferro-Arc Welding Co., Ltd. (154,108).—Private company. Registered April 4th. Capital, £10,050 in 10,000 preference shares of £1 each and 1,000 ordinary shares of 1s. each. Manufacturers and suppliers of electrodes, fluxes, and apparatus for use in electric welding or other processes, metal workers, and founders, wire drawers, dealers in precious metals, makers of electrical and scientific apparatus, &c. The subscribers (each with one share) are: L. J. Yeoman, 20 Copthall Avenue, E.C.2; A. C. Hyde, Perivale Lodge, Perivale. First directors are to be appointed by the subscribers. Solicitor: C. C. Tarelli, 62, London Wall, E.C.

Barnes & Morris, Ltd. (154,137).—Private company. Registered April 5th. Capital £30,000 in £1 shares. To acquire the business of scientific instrument makers formerly carried on by F. Barnes and H. R. Morris at 182-3, Temple Chambers, Temple Avenue, and 172, Pentonville Road, N. Directors: Major F. Barnes, 7, Brixton Hill, S.W. 2; H. R. Morris, 66, Fairholme Road, Baron's Court, W. Office: Audrey House, Ely Place, Holborn, E.C.

Fluxio Welding Co., Ltd. (154,199).—Private company. Registered April 8th. Capital, £5,000 in £1 shares, to carry out, on the company's own account, or for customers, oxy-acetylene, electrical, or other welding and re-welding, also work in connection with railway, motor and other vehicles, shipping, aircraft, &c. First directors: T. A. Cotton, 5, Rawcliffe Street, South Shore, Blackpool; J. P. Schofield, 15, Holmecliff Road, Blackpool; Dr. H. E. Cockcroft, 15, Holmecliff Road, Blackpool. Registered office: 5, Rawcliffe Street, South Shore, Blackpool.

Premier Electrical Engineering Co., Ltd. (154,226).—Private company. Registered April 8th. Capital, £5,000 in £1 shares. To carry on business as indicated by title. Directors: J. Broadhurst, Woodside Villa, Mottram Road, Stalybridge, yarn agent; J. E. Hardy, 10, Stonecliffe, Stalybridge, coal merchant's manager. Registered office: 33, Market Street, Stalybridge.

Insulation & Metal Filaments, Ltd. (154,202).—Private company. Registered April 8th. Capital, £50,000 in £1 shares. To acquire certain patents relating to the construction of insulating sheets, with a hard face, and to metal fitments, &c. The subscribers (each with one share) are: F. Snelling, 89, Dovercourt Road, S.E.22, law clerk, and B. H. Gower, 136, Colney Hatch Lane, N.10, solicitor's managing clerk. The directors are to be appointed by the subscribers. Registered office: 6, Old Jewry, E.C.

Charles Bingham & Co., Ltd. (154,197).—Private company. Registered April 8th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electrochemical products and apparatus. The subscribers (each with one share) are: C. H. Bingham, junr., 2, Kingswood Road, Upper Norwood, S.E.19, engineer, and A. Somerville Young, 7, Upper Hornsey Rise, N.19, merchant. First directors: C. H. Bingham, junr., A. Somerville Young, and Evelyn A. Bingham. Registered office: 11, Queen Victoria Street, E.C.4.

Marryat & Scott, Ltd. (154,254).—Private company. Registered April 9th. Capital, £2,000 in £1 shares. To adopt an agreement with H. Marryat for the purchase of that part of the business carried on by him under the title of Marryat & Place, which comprises the manufacture and erection of electrical and other lifts, hoists, cranes, and similar machinery. Life directors: H. Marryat, 28, Hatton Garden, E.C., engineer; M. D. Scott, 49, Hamley Gardens, Ravenscourt Park, W., engineer. Solicitor: F. W. Arnold, 35, King Street, Covent Garden.

Ashdown & Wright, Ltd. (154,161).—Private company. Registered April 7th. Capital, £500 in £1 shares. Electrical and mechanical engineers, &c. Directors: H. C. Wright, "Forest Lodge," Mayfield Road, Moseley, Birmingham, engineer; H. E. Ashdown, 8, Osborne Road, Handsworth, Birmingham, engineer. Registered office, 137a, Gilford Street, Birmingham.

Tok Manufacturing Co., Ltd. (154,333).—Private company. Registered April 12th. Capital, £10,000 in £1 shares. Electrical, mechanical, constructional, and general engineers, &c. First directors: F. F. Sharp, 109, West Side, Clapham Common, S.W. 4, electrical engineer; H. H. Holmes, 14, Queen's Road, Leytonstone, E., electrical engineer. Registered office: 6, Earl Street, S.W. 1.

Hall & Town's Instrument Co., Ltd. (154,238).—Private company. Registered April 9th. Capital, £5,000 in £1 shares. To acquire the business of scientific instrument makers and repairers carried on by H. T. Hall, W. B. Towns, and B. Wortman; also to carry on the business of makers and repairers of instruments, watches, clocks, and cinematograph machines, mechanical, motor, electrical, and illuminating engineers, &c. The subscribers (each with one share) are: B. Wortman, 42, Waterloo Street, Hammersmith, W., aircraft designer and constructor, member Royal Aeronautical Society of Great Britain, member of Society of Chemical Industry, &c.; H. T. Hall, 42, Waterloo Street, Hammersmith, W., patentee and manufacturer of scientific and kinematograph apparatus. First directors: H. T. Hall, W. B. Towns, and B. Wortman (manager).

Walishaw Clock Co., Ltd. (154,183). Private company. Registered April 7th. Capital, £20,000 in 10,000 preference shares of £1 and 20,000 ordinary shares of 10s. each. Manufacturers of and dealers in electrically operated and other clocks, &c. The subscribers (each with one ordinary share) are: G. I. Bassett, 34, St. Paul's Road, Canonbury, N., clerk; C. J Willcocks, 17, Ravensbourne Gardens, West Ealing, W., clerk. First directors: A. G. Wallace (permanent managing director) and Agnes B. Shaw. Solicitor: F. P. Wood, 7, Bucklersbury, E.C.

Llanelly Electrical Engineering Co., Ltd. (154,322).—Private company. Registered April 12th. Capital, £4,000 in £10 shares. To carry on the business as title. The subscribers (each with one share) are:—A. E. Atkins, 19, Coleshill Terrace, Llanelly, electrical engineer; J. T. Penybryn, Llanelly, brewer; J. P. Hughes, Rosslyn, Llanelly, builder. The first directors are to be appointed by the subscribers. Solicitor: M. R. Richards, Goring Road, Llanelly.

Boulton Magnetos, Ltd. (154,395).—Private company. Registered April 15th. Capital, £4,000 in £1 shares. To take over the business of magneto manufacturers carried on by A. H. & J. H. Boulton as A. H. Boulton & Sons, at Old Hall Street, Wolverhampton. The subscribers (each with one share) are:—P. Thomas, York Avenue, Wolverhampton, brassfounder; A. H. Boulton, 146, Waterloo Road, Wolverhampton, magneto manufacturer. First directors: A. H. Boulton, P. Thomas, and C. W. Parkes, Church Hall, Tettenhall. Solicitor: A. C. Skidmore, Imperial Chambers, Lichfield Street, Wolverhampton.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Russell & Sons, Ltd.—Deposit on March 27th, 1919, of deeds of freehold, copyhold, and leasehold properties at and near Wednesbury, to secure all moneys due or to become due from company to Lloyd's Bank up to £50,000.

Penrith Electric Supply Co., Ltd.—Satisfaction in full on December 5th, 1918, of mortgage dated June 3rd, 1912, securing moneys owing to Parr's Bank.

Harry W. Cox & Co., Ltd.—Particulars of £5,000 debentures created February 13th, 1919, of which £4,000 were issued on March 27th, charged on the company's property, present and future, including uncalled capital.

Duroglass, Ltd.—Equitable mortgage on leasehold premises at Walthamstow, and the company's general assets, to secure all moneys payable by the company to the Minister of Munitions under a loan agreement.

Lobito, Benguella & Catumbella Electric Light and Power Co., Ltd.—Supplemental trust deed dated April 2nd, 1919, to secure £10,000 6 per cent. first mortgage debenture stock (1916), ranking *pari passu* with £10,000 issued under the original deed of June 6th, 1916. Property charged: As per original trust deed. Trustees: Lord Waleran and Lord Rotherham.

Nuneaton Electrical Contracting Co., Ltd.—Deposit on April 1st, 1919, of deeds of freehold premises at Nuneaton, to secure all moneys becoming due from company to Barclay's Bank.

Power Specialty Co. (1,711F).—Particulars filed April 12th, 1919. Capital, $270,000 in $100 shares. Registered in New York on February 8th, 1900, to manufacture and deal in machinery. Principal office: Manhattan, New York. British address: 315-317, Oxford Street, W., where J. N. D. Heenan (London manager) and R. Dunn (secretary) are authorised to accept service.

CITY NOTES.

Consolidated Electrical Co., Ltd. Mr. H. Allen stated at the annual meeting, on April 17th, that the company had more than held their own in the matter of income during the war. They had kept in hand portion of the profits as a safeguard against contingencies. The total depreciation of their assets was less than 10 per cent. of the pre-war value. Subject to political influences, he was confident that the current year would see a recovery in value of their investments which had been most depreciated. The altered value of money had put an entirely different aspect on the business of trust and investment companies of the orthodox order. Such companies used to issue a lot of 4 per cent. debenture stock or 5 per cent. preference stock, or both, and a comparatively small proportion of ordinary. The whole capital was then turned over in loans, investments, underwriting, and so forth, at an all-round rate of 6 per cent. or more, and the result was a very nice dividend on the ordinary shares. This was precisely what they themselves had had in contemplation. But a glance at the price list of trust investment securities would show how the war had altered all that. There was still no difficulty in getting the 6 per cent. business, but investment and finance companies would not find it easy now to issue debentures of their own at much less than 6 per cent., or preference shares at less than 7 per cent. This meant that an issue of ordinary shares in such companies as theirs was now out of the question, and it also meant that the policy of the board in regard to their pre-war scheme of rearrangement and enlargement must be reconsidered.

W. T. Henley's Telegraph Works Co., Ltd. During 1918 a profit of £203,411 was made. £55,357 is deducted for directors' and auditors' fees, debenture interest, depreciation on buildings and machinery, and for postponed repairs. £112,042 was brought forward, making £206,096. There was deducted: £36,586 for income tax; £25,000 for reserve; £9,000 for preference dividend. Dividend on the ordinary shares 3s. per share, less tax, for the year, £60,000; put to staff pension fund, £7,500; carried forward, £122,009. Provision has been made in the accounts in respect of liability for excess profits duty to end of 1918. Provision has again been made for special depreciation on machinery due to the war, and for machinery which has been bought specially for war purposes which will be useless or of problematical value after the war, also for postponed repairs of machinery and plant which it has not been possible to carry out during the war. The company has been enabled to reinstate in their former positions all of its employés who have up to the present been demobilised and have applied for re-employment. The losses in the war number 112, and inquiries are being made to ascertain the position of dependents to enable the company to give assistance where it is desirable. The total staff and workmen with the Forces numbered 968, and there were 342 casualties. The transfer of the motor tire business to a new company has been completed, the profits of the business having been taken over by the new company as from August 1st, 1918, and only the previous seven months' profits are included in the present accounts. Annual meeting: April 25th (to-day).

Amalgamated Wireless (Australasia), Ltd.—For the last half of 1918 the net profit was £4,018, plus £224 brought forward. A dividend at the rate of 5 per cent. per annum absorbs £3,500, and £743 is carried forward. The reserves stand at £29,217. No revenue was received from wireless telegrams. The restrictions upon the transmission and receipt of public wireless telegrams to and from ships within the range of Australia and New Zealand were removed at the end of December, but there will be no immediate benefit to the company, owing to the continued disorganisation of shipping. The net profit for the corresponding half of 1917 was £3,596, and 1916, £4,540.

Madras Electric Tramways (1904), Ltd.—The gross profit for 1918 was £31,697. After debiting interest and London office expenses, making provision for the debenture stock sinking fund, and putting £10,000 to depreciation and renewal account, the balance is £14,444, plus £3,957 brought forward. Preference dividend, less tax, £6,000; ordinary dividend 8 per cent., free of tax, £4,580; to general reserve, £3,000; carried forward, subject to excess profits duty (if any), £4,820. The traffic receipts increased by 11.2 per cent. over 1917. The expenditure in Madras consequent upon higher rates of wages and further increases in the prices of materials was 20.1 per cent. greater than in 1917.

Cuba Submarine Telegraph Co., Ltd.—Total receipts for 1918, £82,185; expenses, £21,881; cable repairs, £5,574; income tax, £4,524; excess profits duty for 1916 and 1917, £14,927; balance, £35,279 plus £21,907 brought forward; £15,000 to general reserve and £2,500 to pension fund. Preference dividend, 10 per cent., less tax; 5 per cent. and a bonus of 4s. per share, free of tax, on the ordinary shares; £22,486 carried forward subject to taxation for excess profits duty. Several cables have been repaired at a cost of £5,574, and they are now in good working order.

Melton Mowbray Electric Light Co., Ltd.—Mr. W. J. New presiding at the annual meeting, said that the load connected had increased from 929 to 963 KW.; motors connected were 391 H.P. The profit was £1,591, against £1,956 for 1917. Out of the available balance of £832, £600 has been placed to reserve and £232 is carried forward. The speaker said that owing to their difficulties a minimum charge of 13s. 4d. per quarter to every consumer would be necessary.

Bell Telephone Co.—The report for the year ended December 31st last shows that the revenue increased by $1,048,383, while the operating expenses, taxes, depreciation, &c., increased by $1,517,338. During the year 18,944 new stations were installed, and 2,888 miles of wire were added to the long-distance system. The long-distance lines now operated total 85,303 miles, in addition to 6,615 miles of underground and submarine cables.—*Canadian Electrical News.*

Victoria Falls & Transvaal Power Co.—According to the *Financial Times* the net earnings, including those of the Rand Mines Power Supply Co., for the quarter ended December 31st amounted to £210,853 before providing for taxation in South Africa and the United Kingdom.

Stock Exchange Notice.—Application has been made to the committee to allow the following to be quoted in the Official List:—

White (J. G.) & Co., Ltd.—180,000 7 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 180,000), partly in lieu of the preference shares quoted.

Fairbairn Lawson Combe Barbour, Ltd.—Dividend of 5 per cent. on the ordinary shares for 1918, against nothing for 1917. Carried forward £19,920, after putting £21,647 to reserve.

Edison Swan Electric Co., Ltd.: New Issue.—The *Financial Times* stated yesterday that underwriting arrangements have been in progress this week in connection with an issue of 200,000 ordinary shares which are to be offered at par, in the first place to existing shareholders.

Argentine Tramways & Power Co.—After payment of interest and sinking fund on debenture stock, and providing £4,000 as reserve for renewals, accounts for year ending September 30th, 1918, show profit of £2,620, which increases debit balance to be carried forward to £3,399.—*Financier.*

Marconi International Marine Communication Co., Ltd.—The resolution increasing the capital to £1,500,000, as already announced here, was approved at the meeting on April 16th. The restrictions under which the company has suffered for 4½ years will be removed on May 1st.

Tynemouth & District Electric Traction Co., Ltd.—To reserve £1,000. Dividend on ordinary shares 8 per cent. Carried forward £1,940.

The Fuller Issue.—It is stated that the issue of Fuller's United Electric Works, Ltd., 8 per cent. participating preference shares was over-subscribed.

Potteries Electric Traction Co., Ltd.—Dividend of 5 per cent. for the year on the ordinary shares.

Monte Video Telephone Co., Ltd.—Interim dividend on the ordinary shares at the rate of 6 per cent. per annum, free of tax.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets found a very fair accumulation of orders awaiting them after the Easter holidays. Industrials attracted most of the interest. The oil boomlet started again. There is some speculation in the Stock Exchange as to what effect the formal declaration of Peace may have upon prices, and the general opinion is that it will make little difference beyond a stiffening of values in gilt-edged stocks. There are men who look, however, for a further outburst of animation in the issues of commercial companies. Greatly-daring spirits talk of a possibility that home railway stocks may improve.

Central London ordinary and Underground incomes are better; the latter rose to 97, but lost a point, and the price is 1½ higher on balance. The buying is due, of course, to the interest being paid free of tax. Speculators are picking-up the company's income certificates, which stand at eighteenpence. A very "long shot," these. East Londons remain at 4½.

Electricity supply shares have already begun to feel the annual dulness inevitable to this market upon the approach of summer. A few of the higher-priced shares have eased off slightly. City of London, Westminster, Metropolitan, Brompton, and County are amongst the ordinary shares showing small declines. There is little business doing in any, but the tendency is heavy.

Dealings began on Tuesday (to-day) in the 6 per cent. cumulative preference shares of £1 each in the Shropshire, Worcestershire & Staffordshire Electric Power Co. The shares are offered at 17s. 6d., free of stamp-duty into the buyer's name. Dividends are due on March 31st and September 30th. The yield comes to 6¾ per cent. on the money, and the shares carry no participating rights. Those to whom such an investment appeals will be interested in the last five years' figures, which are as follows:—

Year.	Units sold.	Gross revenue.	Expenses including debenture and other interest.	Profit.	Dividends on ordinary.
1914	14,474,140	£56,708	£42,325	£14,383	3 %
1915	20,797,771	75,936	56,852	19,084	3½ %
1916	44,614,872	159,725	132,964	26,761	4 %
1917	55,678,354	217,964	184,328	33,636	5 %
1918	62,259,766	*291,000	*249,420	*41,600	*5 %

* Estimated.

The reserve fund at December 31st, 1917, was £67,000, and it is anticipated that this will be increased this year to at least £84,000. The dividend on the £50,000 7 per cent. preference and the £150,000 6 per cent. preference shares amounts together to £12,500, which, on the basis of the above profits, is amply covered.

The above figures are taken from particulars issued by a well-known firm in the Stock Exchange.

Henley's ordinary are a good market at 48s. 9d. on the report, which shows a dividend of 15 per cent. for the year, against 25 per cent. a year ago, before the capital was doubled. The increase, therefore, is equal to 5 per cent. on the old capital, and this in spite of the fact that the gross earnings at £203,400 are £35,000 down on the previous year. The net profit of £148,000 is £14,900 lower, but a very large balance was brought in from last time, and the carry-forward is again the substantial amount of £122,000. India-Rubber shares are ⅛ down at 16⅝. Telegraph Constructions change hands round about 24, at which there are buyers in the market. Increased dividend on the doubled capital is already anticipated. The price of British Insulated has hardened to 2 1/16, and buying comes from well-informed circles in the North. British Aluminiums at 33s. 3d. have not recovered the dividend deducted last account-day.

In Marconis there was a good deal of profit-taking before Easter, and the prices of the various shares gave way on the selling. Buyers picked up Marines, however, and considering the sharpness of the previous rise, the fall has been trifling. Cable stocks are all steady. Anglo "A" hardened to 22, and Eastern ordinary gained a point. West India and Panama have fallen back to 30s. Globes are unchanged. Cuba Submarines strengthened on the repetition of last year's dividend.

The foreign group is out of favour. Brazilian Tractions, however, hold their recent recovery. British Columbia Electrics are flat. Mexicans are disposed to ease off, although great things are hoped from the extra session of the Mexican Congress called for May 1st, while the death of a noted guerilla leader is reported. On the other hand, fresh fighting has broken out in some parts. Anglo-Argentine Tramways 5 per cent. debenture has risen to 68½, at which the yield is rather over 7¼ per cent. on the money. The Hydro Electric Power and Metallurgical Co. (Melbourne) is taking steps for the issue of 115,000 10 per cent cumulative participating preference shares.

London and Suburban Traction preference are an unusually active market about 7s. 6d.; apparently there is a tip out to buy the shares, because we hear of gossip about the ordinary getting a dividend. A very tall order, this, at any rate, so far as the immediate future is concerned, and the price of 3s. shows what the market thinks of the airy optimism. London United Tramways debenture was sold the other day at 39½. Business in British Electric Traction ordinary is recorded at prices round about 43, and in the preference on the basis of 76¾, while the 5 per cent. first debenture is 83¼, and the 4½ per cent. second debenture 68.

Automatic Telephones have risen to 32s. American Telephone capital stock is 2½ up at 110, and the company's bonds have also improved. Iron and steel shares are better on balance. In the rubber market, business is tame, but prices show trifling recoveries.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price April 22, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary	10	8	6⅜xd.	−¼	£5 8 16
Charing Cross Ordinary	4	4	3½	—	6 14 4
do. do. do. 4½ Pref.	4½	4½	8¼	−⅛	6 18 4
Chelsea	5	8	8⅜xd.	—	4 1 1
City of London	8	8	11¾	—	6 16 2
do. do. 6 per cent. Pref.	6	8	10	—	6 0 0
County of London	7	7	10⅛	−½	6 18 3
do. do. 6 per cent. Pref.	6	8	9¾	—	6 3 1
Kensington Ordinary	7	6	5⅞	—	5 2 2
London Electric	Nil	Nil	1⅛	—	Nil
do. do. 6 per cent. Pref.	5	6	3⅞	—	7 14 10
Metropolitan	4	5	8⅛	−⅛	8 0 0
do. 4½ per cent. Pref.	4½	4½	8¼	—	8 18 6
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	5	5	2¾	−⅛	7 6 6
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6⅛	−⅛	6 8 1
Telegraphs and Telephones.					
Anglo-Am. T l. Pref.	6	6	99½	—	6 0 7
do. Def.	1½	63/6	22	+½	7 10 0
Chile Telephone	8	8	7¾	—	5 8 6
Cuba Sub. Ord.	7	7	11¼	+¼	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	162	+1	*4 18 6
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	22	22	81	—	7 2 0
Indo-European	13	13	57½	—	5 13 0
Marconi	20	20	4 13/16	−1/16	4 3 0
Oriental Telephone Ord.	10	15	2 7/16	—	6 3 0
United R. Plate Tel.	8	8	7⅛	—	*5 1 7
West India and Panama	1/3	1/3	1½	−⅛	*4 8 4
Western Telegraph	8	8	16¾	—	*4 15 10
Home Rails.					
Central London Ord. Assented	4	4	63½	+1	8 6 0
Metropolitan	1	1½	26½	—	4 14 7
do. District	Nil	Nil	23½	—	Nil
Underground Electric Ordinary	Nil	Nil	8¼	—	Nil
do. do. "A"	Nil	Nil	9/3	—	Nil
do. do. Income	4	5	96	+1½	*5 1 2
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	Nil	8¼	—	—
do. do. 2nd Pref.	—	—	3¼	—	—
do. do. 6 Deb.	6	5	68½	—	7 8 5
Brazil Tractions	—	—	56	—	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	59	−3	8 10 0
do. do. Preferred	Nil	Nil	40	—	Nil
do. do. Deferred	Nil	Nil	37½	−3½	Nil
do. do. Deb.	4½	4½	61	—	6 19 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds	Nil	Nil	62	—	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	68	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	6¾	—	4 0 0
British Aluminium Ord.	10	10	1 21/32xd	—	6 0 10
British Insulated Ord.	25	12½	2 1/16	+1/16	6 1 1
British Westinghouse Pref.	7½	7½	2½	—	6 3 0
Callenders	25	25	10	—	6 6 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	3¼	—	6 8 1
Edison-Swan, "A"	—	—	1 1/32	—	7 6 6
do. do. 5 per cent. Deb.	4	5	75½	—	6 12 3
Electric Construction	10	10	1¼	—	8 0 0
Gen. Elec. Pref.	6	6½	10⅜	—	6 5 4
do. Ord.	10	10	17⅞	—	*5 12 0
Henley	25	25	2 7/16	+⅛	5 2 6
do. 4½ Pref.	4½	4½	4	—	5 12 8
India-Rubber	10	10	16⅝	−⅛	*6 0 4
Siemens Ord.	—	10	6⅝	—	*7 11 0
Telegraph Con.	20	20	21	—	5 0 0

Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, April 23rd.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	,,	£78	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£48	..
a Copper Sulphate	,,	£42	..
a Potash, Chlorate	per lb.	1/9	..
a ,, Perchlorate	,,	1/9	..
a Shellac	per cwt.	£11	..
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers	,,	£31	..
a ,, Lump	,,	£23	..
a Soda, Chlorate	per lb.	11d.	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	11⅝d.	..
c ,, Tubes (solid drawn)	,,	1/2½ to 1/2¾	..
c ,, Wire, basis	,,	1/-	..
c Copper Tubes (solid drawn)	,,	1/4	..
g ,, Bars (best selected)	per ton	£114	..
g ,, Sheet	,,	£114	..
g ,, Rod	,,	£114	..
d ,, (Electrolytic) Bars	,,	£81	£3 dec.
d ,, ,, Sheets	,,	£161	..
d ,, ,, Wire Rods	,,	£91	£3 dec.
d ,, ,, H.C. Wire	per lb.	11 5/16d.	7/16d. dec.
f Ebonite Rod	,,	8/-	..
f ,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	11/-	..
h India-rubber, Para fine	,,	2/4½	1d. dec.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l ,, Wire, galv. No. 6, P.O. qual.	,,	£40	..
g Lead, English Pig	,,	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e ,, ,, ,, medium	,,	5/- to 10/-	..
e ,, ,, ,, large	,,	12/6 to 25-/& up.	..
d Silicium Bronze Wire	per lb.	1/3½	½d. dec.
r Steel, Magnet, in bars	per ton		..
g Tin, Block (English)	,,	£223 to £224	£3 to £4 dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Technical Inspection Association.—A new Association, called the Technical Inspection Association, has recently been formed, which should appeal very strongly to many technical men throughout the Empire who are in any way interested in inspection work. It is the outcome of the Ministry of Munitions Inspection Department, and has been formed for two main purposes:—(1) To maintain intercourse and promote mutual assistance among its members, and (2) to conserve and co-ordinate for the national use the experience brought together by the War, and generally to develop the progress and standardisation of inspection in the engineering, chemical, and allied industries.

Owing to the stoppage of war work, the services of large numbers of men, most of whom possess high technical qualifications, and who have spent several years on the inspection of Government contracts, are now available. A list of such members is held by the honorary secretary, who will be glad to supply particulars to any of our readers who may be interested.

It is intended in the near future to make arrangements for series of meetings, at which papers on subjects connected with inspection will be read and discussed.

Membership is not confined to officials of the Ministry of Munitions Inspection Department, but is open to officers of similar status in any other Government Department whose work is purely inspection or mainly connected with technical and scientific subjects in which inspection is concerned, also persons of standing in the engineering and allied professions who are interested in inspection matters. Mr. W. Haynes Smith is hon. secretary, and until permanent offices can be obtained the postal address of the Association will be the Hotel Metropole, Northumberland Avenue, London, S.W. 1.

Business Training for Engineers.—In the University courses for training engineers in the United States and Germany, a certain amount of business training is given, with the result that in those countries there are many more engineers directing and administering engineering concerns than is the case in Great Britain. At the suggestion of the Dean of the Faculty of Engineering of the University of Bristol (Dr. Wertheimer), the Senate has decided that in future the curriculum for the B.Sc. degree shall include attendance at a course dealing with book-keeping, methods of administering and organising works, elements of commercial law, depreciation, estimating, costing, and writing specifications.—*The Times.*

"RULES" IMPOSED BY ELECTRIC SUPPLY AUTHORITIES.

By CHARLES A. BAKER, M.I.E.E.

(Concluded from page 451.)

The introduction into an agreement for the supply of electrical energy of a "rule" or "book of rules" to control the wiring of the consumer's premises is presumably due to a lack of confidence on the part of the managers of supply undertakings in the ability or willingness, on the part of wiring contractors, to do reliable work. I hold no brief to speak on behalf of either side, but I have always felt that the supply authorities should not endeavour to over-reach their statutory powers by hampering and interfering with the private enterprise of wiring contractors. Twenty to twenty-five years ago, when central stations were being equipped simultaneously in several towns and districts, the necessary wiring was taken up as a source of profit by local tradesmen, who bought cheap material, and put it up without sufficient regard to its life and durability; the supply managers, perhaps, desired to take steps to prevent this by issuing wiring "rules." The position at the present time is not the same, and if any serious difficulty were introduced by an incompetent firm, this could be dealt with by making the leakage test with a fairly high pressure, which would automatically closure such trouble.

Other rules concerning the wiring of consumers' premises may be briefly noticed:—

(*a*) "Temporary wiring not allowed." The dividing line between temporary and permanent work is sometimes a very thin one, and the supply authority has no jurisdiction to decide between the two.

(*b*) "The use of switch lampholders (unless sample is approved) is not allowed."

(c) "Samples of lead-covered or special cable must be approved."

The supply authorities have no right of approval or of expression of opinion in respect of the materials referred to in (*b*) and (c).

(*d*) "Dry joints not allowed." This appears to exclude the use of porcelain connectors in the cast-iron boxes of a draw-in conduit system.

(*e*) "Free access must be allowed to the premises . . . to examine, test, and inspect in any way deemed advisable the wiring, fittings, meters, and all other matters connected with the electric installation, and all reasonable and suitable facilities must be afforded by the consumers to enable this to be done." This principle has already been commented on; it is here quoted only because it more fully emphasises the right claimed by some supply authorities to intrude into all parts of consumers' premises. They have no such right of intrusion.

(*f*) The sectional areas of all conductors should be so proportioned that the maximum current will not exceed 1,000 amp. per sq. in. The fall of pressure at full load not to exceed 2 volts." The Institution of Electrical Engineers' carrying capacity is 4,000 amp. per sq. in. for wires carrying up to 20 amp.

(*g*) "All flexible cords to be insulated with vulcanised india-rubber only." Opinions differ on the wisdom of this practice; if the strands of the flexible are tinned they are apt to be unduly brittle, on the other hand, the presence of sulphur in the vulcanised insulation will tend to damage the copper if untinned, therefore pure rubber for flexibles is considered by many engineers the better practice.

(*h*) "In the event of the insulation resistance falling below the required standard the installation will be disconnected, with or without notice, according to the seriousness of the defect." This is a rule which in one form or another appears in many application forms; the Board of Trade Regulation No. 30 clearly defines under what conditions the supply authority may discontinue the supply after due notice has been given to the consumer; such notice must be endorsed to the effect that the consumer, if dissatisfied with the action of the supply authority, has the right of appeal to an Electrical Inspector.

Passing on to the value of the energy supplied, the following quotation will serve as an example: "Should the consumer dispute his account he may . . . have the meter officially tested by the London County Council, and . . . if the mean inaccuracy of the meter be found to be more than 5 per cent. the supply authority will pay the cost of testing; if 5 per cent. or less the consumer shall bear all the expenses of testing." This is an arbitrary assertion that appears in a few of the "rules"; it is difficult to account for the way that such a statement has ever found a place in the "rules" of any supply authority. Until the passing of the Electric Lighting Act, 1909, there was no definite determination of a "correct meter," and—except for a memorandum for guidance issued by the Board of Trade—it was left to the discrimination of individual Electrical Inspectors, appointed under the Provisional Orders, to fix the variations within which a meter could be passed as correct; a limit of variation of 2½ per cent. from absolute accuracy at any point of a meter's range from one-twentieth to full load was decided on by the Electrical Inspectors for the numerous "areas of supply" of the County of London. The second schedule of the Electric Lighting Act of 1909, which contains provisions to be applied instead of provisions previously enacted, states that "a meter shall be considered . . . capable of ascertaining the value of the supply within such limits of error as may . . . be allowed by the Board of Trade. . . ." Subsequent to the passing of the 1909 Act the London County Council drafted a proposal which was very carefully considered by the Board of Trade, and, after a conference, approved—in so far as the accuracy of meters is concerned—in the following form:—

Certification of Meters.

1. A meter will be certified if it is of some construction and pattern approved by the Board of Trade, and has been found by the inspector to be capable of ascertaining the value of the supply with continuous or single-phase current within the following limits of error:—

(*a*) Meters in which the maximum current for full load does not exceed 3 amp., the error at any point from one-tenth load to full load must not exceed 3½ per cent. plus or minus.

(*b*) Meters in which the maximum current for full load exceeds 3 amp., but does not exceed 50 amp., the error at any point from one-tenth load to full load must not exceed 2½ per cent. plus or minus.

(*c*) Meters in which the maximum current for full load exceeds 50 amp., the error at any point from one-twentieth load to one-tenth load must not exceed 2½ per cent. plus, and at any point from one-tenth load to full load must not exceed 2½ per cent. plus or minus;

And these limits of error for meters will now doubtless be used universally by the Board of Trade in pursuance of its powers under the 1909 Act. It will be observed that the limits of variation are graded according to the size of the meters, and it is therefore perfectly clear to any Electrical Inspector what is and what is not a correct meter, and he must make his examination on the basis of these figures without regard to any clause contained in the form of application which has been converted into an agreement. Moreover the "rule" above quoted sets out the conditions as to payment for the expenses of testing the meters; here again the supply authority has no voice at all in the matter. Section 57 of the Electric Lighting Clauses Act states ". . . that the Inspector shall also order by which of the parties the costs of and incidental to the proceedings before him shall be paid, and the decision of the Inspector shall be final and binding on all parties." This gives the Electrical Inspector some discretion, having regard to all the circumstances of each case brought before him, in dealing, for example, with meters which are irregular or not in proper condition for registering a supply, or are overloaded, &c.

The whole question of the supply of meters under the Electric Lighting Acts is less clear than is desirable. There must be many thousands of meters in use by the public, to record the annual consumption, which, according to a recent return prepared for the Coal Controller, reached 4,674,000,000 units for the year ending March 31st, 1918, but exceedingly few of these meters have ever been officially tested for accuracy; in this respect the supply and purchase of electricity differs from the basis of supply and purchase of most commercial commodities which take place with weights and measures that are without exception in all civilised countries stamped as accurate with a view to protecting the public. In the supply of electricity, the controlling clause in the Provisional Order reads: " . . . the value of the supply shall, except as otherwise agreed between the consumer and the undertakers, be ascertained by means of an appropriate meter duly certified, &c. . . ." Attention is drawn to this because it is usually held that the "application-form-agreement" of the supply authorities does so entangle the consumer that he "otherwise agrees," and is no longer entitled to claim a certified meter, but until a large account for the supply of electricity has been the subject of legal proceedings, and this point definitely determined by a judicial decision, the majority of the consumers must trust to luck that their bills are reasonable, although a meter occasionally slips through the manufacturer's hands with a dial so figured that ten times the amount used is charged for. If no agreement is signed, a certified meter must undoubtedly be provided. A well-known Council in London does not sign the usual application form in connection with the frequent additional supplies which it purchases in various districts of London. The following is a common form of the notice which is served on supply authorities when occasion requires:—

Council Offices.

To the .... (Supply Authority).

Under the provisions of the .... Electric Lighting Order (date), ... and the Electric Lighting Orders Confirmation (No.) Act (date) ....

The Council hereby give you notice that they require you to give and continue to give on and after the ...... (date) ...... a supply of energy in respect of the premises, and of the maximum power specified below, and to provide and let for hire on such premises the appropriate electricity meters duly certified in accordance with the provisions of the said Orders and Confirming Act.

Situation of premises ....
Maximum load ....
Dated this .... day of ....

(Signed) ....

Clerk of the Council.

The last few lines referring to "letting on hire the appropriate electricity meter" are comparatively new, but the Council in question has for many years insisted on all the electricity supplied to its premises being metered with certified instruments; from the point of view of public officials and auditors dealing with accounts in respect of electricity supplied, examination into the mathematical accuracy of such accounts becomes a farce when an uncertified meter has been used, and this is certainly common practice under the existing system of application forms and agreements. That existing uncertified electricity meters are usually kept in good working order and are so correct reflects the greatest credit upon the manufacturers of these instruments, and many of the supply authorities have well-equipped testing rooms in which great care is exercised in checking the condition and reliability of the meters installed on the consumers' premises, but the fact remains that the supply authorities are still the people who do the testing.

"The supply authority will fix the position of the meter and the point upon the consumer's premises at which the supply will be given." It is at once obvious that there are other interests to consider beyond those of the supply authority in determining the position of the service and the meter; in a building of any magnitude the economical centre of distribution is one for the decision of the man who designs the installation, and in new buildings, chases for conduits are frequently left in the walls as the work proceeds, which have been decided on prior to any negotiations with the supply authority. Officials are entitled to come on to the consumer's premises at all reasonable hours to inspect the meter or accessory apparatus, and it may be more convenient to admit them to one part of the premises than to another.

"Inaccuracies in the registration will be charged or allowed (as the case may be), but not previous to the quarter's account last rendered." Such wording as the foregoing is generally found amongst the "rules." In occasional examples where a meter with an incorrect ratio or a multiplying constant of "10" has escaped observation, or an ampere-hour meter is erroneously put on to a circuit of different voltage to that for which its calibration has been determined, the accounts should be adjusted for a longer period than that to which the consumer is asked to agree in this "rule."

"The supply authority shall not be held responsible for any damage, loss, or inconvenience arising from any interruption or discontinuance in the supply of electricity occasioned by the removal of faults from the mains of the supply authority by any accident that may arise or by any other cause whatever." By the last few words of this "rule" the supply authority relieves itself of every liability for penalties to which it is liable under the Provisional Order if the supply fails, viz., "40s. for each day on which the default occurs." Fortunately there is seldom cause to levy a penalty of this description, but it is not an asset that any party to an agreement would willingly and knowingly forgo, nor is it creditable to the supply undertakings thus to evade a responsibility put upon them by Parliament as one of the conditions upon which a Provisional Order is granted to them; it is one of the points that the consumer, who is important enough to employ a solicitor to advise him on the agreement, is apprised of and deletes; the smaller consumer trusting the big undertaking is deceived. This "rule" is not universally imposed, but looking through the London application forms, it is found in a sufficient number of them to justify drawing attention to it.

Quite a large number of the application forms—whilst binding the consumer to certain terms outside the Act—reserve to the supply authorities the benefits of the Act and of the agreement, as the following quoted "rule" will indicate:—

"Nothing in this agreement is to abridge or prejudice the rights and remedies of the supply authority under their Provisional Orders and Acts, and the Acts referred to therein or incorporated therewith."

If such equitable terms were made applicable to the consumer also there would be no agreement to abridge or prejudice, each side relying on the rights and remedies of the Provisional Orders, &c., and there would be nothing further to criticise; the ideal application form would, in the author's opinion, be arrived at, corresponding in brevity with the notice printed on the very numerous contracts entered into between the railway companies and their passengers every time a ticket is sold and purchased, and resembling the form already referred to which is used by one of the London Councils. What the exact terms of the Provisional Order and Confirming Act are, together with the correlation of other Acts and their interpretation, are matters for lawyers; even if the greater part of the clauses of the Provisional Order were reprinted on each application form the legal significance of the clauses could not be appreciated by the general consumer, therefore the omission of all quotations from the Electric Lighting Acts is advocated, and certainly all forms of illegitimate "rules." Suitable application forms, in blank, should be kept by every wiring contractor on which his own firm's name and address might be stated, and to suggest that every wiring contractor should be entitled to a commission on every such form sent in to the supply authority, for each new consumer that has been obtained for the mains, would only be applying to electricity undertakings a system that is approved in very many other undertakings where agents are on the look-out for the central authority, to the benefit of both. As an alternative to this proposal of the briefest possible application form, which it is recognised means practically abandoning a system which for a number of years has found favour with many of the supply authorities, the author suggests that the Institution of Electrical Engineers should draft a standard application form, which would be suitable for general purposes and fair both to the supply authority and to the consumer; the public would appreciate such a document, which would effect much economy of time to all those who, in ever increasing numbers, must in years to come be responsible for signing their names to an application form which could be read through and grasped in a very few minutes, whilst the supply managers would be strengthened in dealing with their boards or committees in removing the existing sets of "rules," which are open to so much adverse criticism.

SURFACE CONDENSING PLANT FOR LARGE POWER STATIONS.

At Birmingham, on March 26th, Mr. R. J. Kaula's paper (an abstract of which appeared in our last issue) was read and discussed before the South-Midland Centre of the Institution of Electrical Engineers.

Mr. R. A. Chattock, opening the discussion, said the paper did not, in his opinion, emphasise sufficiently the extreme importance of reliability in connection with condensing auxiliaries. Whilst he agreed that it was perhaps safe to use one circulating pump if sufficient spares were carried, he certainly thought that the driving of this pump should be in duplicate, as there was much more chance of breakdown on this portion of the apparatus. It was of vital necessity to provide against breakdown as far as possible. He was of opinion that tho best arrangement was to install two circulating pumps, each of about 60 per cent. of the full-load capacity, and to drive one of them by a steam turbine and the other by an electric motor. Both pumps would be run, and should one break down, the other could carry the load with a reduction of only 1 in. to 1½ in. in the vacuum. The amount of steam used by the small turbine was not excessive, and the whole of the latent heat in it could be recovered by heating the condensate before it was returned to the boilers, instead of being wasted as was the case with a turbine of full capacity. As regards air, water-extracting, and lift pumps, these being small and inexpensive, there was no objection to putting them in duplicate and each of full capacity. Also as their stoppage was not of serious importance for a few minutes, it was safe to risk driving them entirely by electric motors. He did not agree that A.C. motors should be used for this purpose; the speed variation that was obtainable with D.C. motors made the latter method preferable; also with A.C. machines there was another link in the chain to go wrong, and the possibility of a temporary stoppage was increased should anything fail on the main A.C. supply. He rather favoured the steam-ejector type of air pump, in which there were no running parts to get out of order, and it had been demonstrated that very high vacua could be carried with a proper arrangement, whilst the whole of the latent heat in the steam used could be recovered. Another advantage was that it was a simple matter to de-aerate the condensate and the make-up feed water by means of these ejectors, thus eliminating oxidisation in the feed pipes and boilers. Mr. Kaula's description of straining circulating water was interesting, but he thought that with most river waters it would be found that the strainers would very soon become choked up. With Thames water this took place in about 1 to 1½ hours, and it was obviously impossible to keep reversing the flow of such large pipes as frequently as that. He emphasised what a very valuable asset a big industrial city had in the filtered sewage effluent that was running to waste. At Birmingham it had been demonstrated that this effluent was even more suitable for surface condensing than ordinary water. He maintained that all large industrial centres should look very closely into the possibilities of utilising their filtered sewage effluent.

Mr. G. H. J. Parkinson said he had made a careful test on a Green's economiser to test the effect of increasing the velocity of water through the tubes. The economiser was divided into three sections all in parallel. He reconnected the economiser with the three sections in series, but although this increased the velocity in the ratio of 3 : 1, the final temperature was the same as with the sections in parallel. The experiment was carried on long enough to get a fair average reading, although it was impossible to guarantee exactly the same conditions; unless the increased efficiency due to high velocity was very marked the extra cost of pumping against the increased friction was a serious consideration. He had found the cleaning of scale from condenser tubes with hydrochloric acid a very dangerous proceeding if the tubes were cleaned *in situ*. The acid had a serious effect on the cast-iron water bonnets; after cleaning a condenser two or three times in this way the tool marks on one of the hand-hole doors, which had been machined on the inside, were still clearly visible, but on scraping the surface with a knife he found he could cut it away for a depth of nearly ⅛ in.; the iron had disintegrated, leaving a mixture of graphite and finely divided iron.

Mr. F. Forrest, referring to the author's fig. 1, said that if w lb. of water were to be cooled from T^2 to T^1, then w × (T[illegible]^1) heat units must be given up. Assuming that cooling to[illegible]rs were being used, the whole of these heat units would be expended partly in raising the temperature of the air passing up through the towers, and partly in evaporation, and if they knew the relative humidity of the external atmosphere and of the heated air were it left the top of the towers, they could calculate very closely the quantity of water evaporated under given conditions. With the average conditions prevailing at Birmingham, this evaporation amounted to approximately one gallon of water for every unit generated, and this figure gave the quantity of make-up water which was required for the cooling-tower ponds. The curve showing lb. of free air per 1,000 lb. of steam was not one that was likely to prove acceptable to purchasers. The usual figure of 0.8 lb. of air per 1,000 lb. of steam rejected to condenser might be used as a reasonable basis for turbine plant working under average modern conditions, and if some such figure as this were generally agreed to, then the condenser and the air pump could be tested together with calibrated air nozzles attached to the condenser casing to demonstrate that the air-pump capacity was easily capable of dealing with the normal quantities of air likely to be present.

Mr. P. R. Boulton said that Mr. Kaula stated that the heat transmission coefficient varied distinctly with the cooling water velocity; he did not, however, discuss the effect of the steam velocity on this figure. In testing condensers, the method of taking temperatures by inserting thermometer pockets at one point of the inlet and outlet pipes was not sufficiently accurate since the water left the condenser in layers of different temperatures. To obtain the average, either a number of pockets should be inserted, or a tube made of high-conductivity metal should pass diametrically through the centre of the outlet pipe. One end of this tube should be sealed, to prevent air circulation, and the bulb of a thermometer having a very long stem should make contact with the inside of this tube by means of metal foil; in this way the temperature could be taken at different points. He did not think Mr. Kaula had sufficiently emphasised the importance of efficient air extraction. With regard to the water velocities, the commercial economy of modern plant would be improved by adopting a lower velocity, with consequent reduction in pumping charges, and installing an increased condenser surface, in order to obtain the same vacuum. An effect, which Mr. Kaula had not mentioned, and which would operate in favour of the adoption of a lower minimum difference, was that of the higher rate of heat transmission per degree difference at higher water temperatures. With regard to the relative advantages of steam and electric driving for auxiliaries, he considered the argument of the advocates of steam driving, namely, that it was much better to ensure reliability in the operation of auxiliaries, was a very strong one. Usually, when an interruption of supply occurred, the engineer-in-charge had quite enough to do, without the additional anxiety as to what was happening to the condensing plant.

Railway Catenary Suspensions.—A number of new patents relating to catenary suspensions are referred to in *Elektrotechnik und Maschinenbau* of January 5th. An Austrian patent of the Siemens-Schuckert Works shows how the tension can be automatically adjusted according to variations of temperature. The same firm protects in German patents methods of suspending the overhead catenaries for two parallel tracks.

The Allgemeine Elektrizitäts Gesellschaft shows in German patents methods of suspending two catenaries over a track, when heavy current renders two wires desirable. These are hung in such a manner that the wires can be independently moved sideways. Other methods of hanging the wires are described in other German patents, which also refer to section insulators.

The Bergmann Elektrizitäts Werke describes a method of taking current from fixed overhead points by means of a wire stretched along the length of the train above the roof.

THE EFFECT OF AIR AND WATER ON MATERIALS USED IN ENGINEERING WORK.

By H. E. YERBURY, M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The author favours the electrolytic theory of corrosion, which is now almost universally accepted, and is the most convincing, since its effects can be demonstrated. The process is in full accord with modern thought based on the fact that all metals possess a solution pressure which may be termed its escaping tendency to pass into the dissolved state. The solution pressure varies with the solvent, may be positive or negative, and is calculable for every solution. Even in pure water, or under conditions where a film of water may condense upon them, metals have a tendency to pass into solution. Pure water is seldom encountered in ordinary engineering work, as water usually contains traces of salts—acids or bases—with consequently a still greater tendency for the metals to pass from the atomic condition into the ionic condition.

An electric current conducts electrolytically by the migration of ions. All those elements which produce negative ions act exclusively as oxidising agents. As metals can only produce positive ions, followed by the formation of negative ions (or the disappearance of positive ions by mutual attraction), the metals themselves are thereby oxidised.

The function of oxygen in the process of rusting and corrosion is to oxidise the layer of hydrogen on the surface of the metal, and also to precipitate the iron and so remove ferrous ions from the solution. A film of hydrogen gas offers a high resistance, the action being termed polarisation, and were it not removed it would arrest the further solution of the metal, and as the mass of metal and the solution are of opposite polarity the solvent action would cease were it not for other factors. The destruction of the hydrogen film in ordinary corrosion is accomplished by the oxygen of the atmosphere which is dissolved in the water or electrolyte, or it may be removed by water in motion.

It follows that any substance which dissolves or reacts with hydrogen accelerates corrosion. This is found in practice to be universally true.

By its lack of homogeneity in composition and structure the average steel surface in water as it occurs in nature presents all the conditions necessary for active electrochemical corrosion.

Wrought iron generally is more resistant to corrosion than steel. It contains from 0.06 to 0.15 per cent. of carbon. Steel containing pearlite is very readily attacked under the potential difference set up by that structural constituent. It provides cathodes to the anodes of the ferrite in solid solution. Non-homogeneity of a metal favours pitting and general corrosion, as it provides a large number of small anodes and cathodes, and therefore greater action than would be the case with one large electrode. It has been proved that corrosion of steel in either acidulated or salt water was greatest when it contained the maximum percentage of carbon.

Pure carbon steels contain larger grains than alloy steels, and as the ferrite (pure iron) is always attacked, it is assumed that the carbides (composed of carbon with a metal) act as negative electrodes or cathodes to the positive anode elements.

In addition to the chemical composition of steel affecting its rate of corrosion, thermal and mechanical treatment are factors which cannot be ignored. Ordinary commercial steels in structural work are subjected to stresses where bent and riveted, and anodic and cathodic conditions are set up. A properly annealed metal in contact with a cold-worked metal invites active galvanic action in the presence of moisture.

The comparatively large quantity of graphite in grey iron produces a good electrode to act in opposition to the ferrite which is near it; whereas in white iron nearly the whole of the carbon is in the combined state. It is unfortunate that there are foundry difficulties when white iron is used. It is also more crystalline and brittle and difficult to machine.

In the author's opinion, the time is fast approaching when engineers will specify the constituents of castings, including pipes, when they are to be used in special positions and under conditions where salt or acidulated water or other good electrolyte is present.

The natural resistance to corrosion by cast-iron pipes as compared with wrought-iron or steel pipes is due to the skin, or chill, on the external and internal surfaces which brings about a partial change to white iron.

Where pipes are buried, the nature of the soil should be studied, and their useful life may be extended many years if care is exercised. For instance, it is well known that where pipes are buried near or on ashes, and water is present, active corrosion and pitting is readily set up. Clayey character of soil leads to an increased retention of the electrolyte, and it is therefore advisable to lay pipes in a layer of sand or porous earth.

Lead pipes should be enclosed in wooden casing, and not exposed to the solvent action of lime, plaster, mortar, or cement, as a free alkali, especially when assisted by moisture, invariably attacks leads.

Some interesting cases of corrosion of cast-iron pipes and also lead sheathing of dry-core cable have been brought to the author's notice. In a recent instance a large portion of the lead had been destroyed, and pitting and general corrosion of the interior and exterior of the cast-iron pipe had also taken place. As this particular cable had been damaged in a similar manner near the same place some few years ago an analysis of the soil surrounding this pipe has recently been made. It contained 21.18 per cent. of water, the ash content was about 77· per cent., and the sample showed the presence of a strong ammonia compound of the following amount, 0.0252 per cent. as ammonia, or 0.0672 per cent. as ammonium carbonate. On heating there was an objectionable smell of urea, and undoubtedly urine had been percolating the soil at this place. When urine is exposed to the air fermentation sets in, and the urea is converted into ammonium carbonate. Some water had entered the interior of the pipe, and electrolytic action had taken place between the cast iron and lead, and the exterior of the cast-iron pipe had been attacked. Although a slight leakage current was indicated, the voltage was no higher than would be expected where self-corrosion is taking place. These pipes and cables had been in service 19 years. The general condition of the cast iron and lead was characteristic of slow electrolytic action, which could undoubtedly be produced by local action or self-corrosion in this strong electrolyte without any leakage current.

Another fault occurred on a 204-pair cable where the iron pipe was decomposed and perforated, the lead sheathing being badly pitted and parts eaten away, and the wet paper and copper wires exposed. This action was caused by a leaky steam pipe which crossed the telephone pipe at right angles, making the ground wet and hot, thus producing an electrolyte and vigorous electrochemical activity.

A case occurred at Sheffield where a 102-pair cable passed close to some steel furnaces, the outer wall of which bordered on the footpath. A fault developed on this cable, and it was found that the furnace heat had charred the paper to a carbonised state without in any way injuring the sheathing or pipe.

It has been noted by many observers that corrosion of steel is not accelerated by contact with other metals or alloys. For instance, steel rods or shafts sleeved with bronze do not set up serious electrolytic action even in salt water, and bronze and brass nuts can be easily screwed off steel bolts, whereas under similar corrosive conditions a steel nut could not be moved.

Boilers.—Internal pitting and corrosion in boilers and pipes, &c., are largely due to the presence of air in the feed water. The amount of air present will, of course, depend on the source of supply, and may be from 1.5 to 5 per cent. of the volume of the water, the chief gases dissolved being carbon dioxide, oxygen, and nitrogen. Carbon dioxide and oxygen expelled by boiling often set up a corrosive action in the tops of steam drums and near the water-line.

In the author's opinion the time is rapidly approaching when measures will be taken to eliminate as far as possible all air from boiler feed-water. It should be very thoroughly removed from condensers, preferably by dry air pumps, and the heat units from all auxiliary sources should be utilised so as to obtain the highest possible temperature of the feed water. Air dissolved in water can best be liberated by breaking the water up into as fine a spray as possible at a high temperature in a vacuum tank before pumping into the boilers. The most effective way of minimising the quantity of air in feed water appears to be in a closed system, whereby the de-aerated condensate and make-up water is pumped direct to the boiler feed-range. In this system the make-up water in a surge tank would, of course, be a component part of the closed system, and if the water were required to be measured this would be done by a Venturi tube.

Exterior corrosion of boiler plates and tubes is generally brought about by the sulphur in the coal forming sulphur dioxide, which, with the steam generated from the moisture in the coal, together with the water formed by the burning of hydrogen, produces an acidulated electrolyte. This, however, is inactive unless the temperature of the boiler is sufficiently low for moisture to be deposited. It may therefore be said that the action of pitting and corrosion is greater in a boiler which is warm than when the boiler is steaming at full capacity. Careful and systematic tests should be regularly made to ascertain if there are any leaky condensers, as many boiler troubles have been traced to that source. The simplest test is the electrical conductivity one, as the conductivity is proportional to the percentage amount of the substance dissolved in the water. Owing to the conductivity increasing with a rise in temperature, corrections for temperature should be made.

Tanks, &c.—Hot water feed-tanks—especially where exhaust steam is discharged and air liberated—are very susceptible to corrosion, and hard, close-grain cast iron is recommended for tanks in preference to steel plates. Steel stays are often attacked, but stays and bolts made of Low Moor iron are generally free from corrosion. The quality of bolts and nuts used in places and under conditions where corrosion may be expected is a matter of primary importance, since many instances may be cited where steam-pipe joints have given way, and it has been found that the bolts have been severely corroded, the electrolyte being condensed steam from leaky jointing material. Rustless steel is recommended for steam relay and double-beat valve spindles, as freedom of motion is often retarded by the film of oxide which soon covers spindles made of ordinary steel.

Where expansion joints or bellows pieces for water pipes have been made of iron or steel riveted together and galvanised, a very short life has resulted. Copper is recommended for expansion pieces, as its solution pressure is comparatively low.

Rotary Pumps.—Much trouble and expense has been occasioned by the failure of rotary pumps, and in the author's experience impellers have had to be renewed after about 12 months' working.

The principal trouble has been caused by pitting, corrosion, and cavitation, with the result that the efficiency has been impaired, and impellers and shafts have often been ruined in from one to two years when working with river water, and also when dealing with condensate containing air from surface condensers, more especially where pumps are running at a high speed.

If the design of pump does not permit the breaking up of the water, and all ports and passages are cleanly swept, corrosion and pitting are minimised, if not entirely prevented. High-tensile steel shafts should be encased in a brass or bronze watertight sleeve to prevent corrosion in ordinary river circulating water, as high-tensile steel tends to corrode more quickly than mild steel.

Shafts made of steel containing 14 to 19.5 per cent. of chromium are almost entirely free from corrosion in acidulated or salt water, and as a tensile test of from 45 to 48 tons can be obtained with good elongation, the use of rustless steel will doubtless be increased in the near future.

The hub or boss of cast-iron pump impellers is often attacked by general corrosion and pitting, and in the author's experience this destructive action has been so great during 12 to 18 months that hubs have been eaten into and the shaft attacked to such an extent that it has been almost impossible to drive off the impeller due to the volume of rust.

The action on other pump parts has been such that nearly all the ferrite has passed into solution, and the remaining so-called iron could easily be cut with a knife.

For the minimising of corrosion, cast-iron should be low in silicon and phosphorus and high in combined carbon, which closes the grain and hardens the iron.

Suction pipes should contain no air pockets, and the pump-suction lift should be as little as possible to obviate air leakage. In this connection drowned pumps are often preferred, although inspection is naturally more difficult.

Special attention should also be given to the design and maintenance of glands, as, from the design of some pumps, air naturally enters whenever the glands are not tight, or through imperfect water-sealing. The capacity of pumps is thereby reduced, and there is also a greater tendency to corrosion. It has also been found that circulating water when broken up in cooling towers has absorbed sulphur dioxide, chlorine, and ammonia from the atmosphere, and other soluble and insoluble substances in rain water, all tending to intensify the rate of corrosion, which is accelerated when the water is very hot.

The inlet river water should be admitted where it thoroughly mixes with the cooling-tower discharge water, so as to neutralise any concentrated acidity or impurity which might be brought about by the continual circulation of cooling-tower water only.

High-tensile bronze is recommended for impellers and pump shafts where the water is of a particularly corrosive nature.

Condenser Tubes.—Considerable trouble has been occasioned on land and sea by corrosion and pitting of condenser tubes. Apart from the usual pitting which often takes place from the inside of tubes by the action of water, &c., the author has recently investigated somewhat unusual cases of corrosion and pitting which have only taken place on that part of the tube over which the packing or grummet is fitted and retained by the ferrule.

This particular form of corrosion is started and continued from the outside surface of the tube until it is perforated, whereas in the majority of cases all pitting has started from the inside, and is fairly general over the entire surface exposed to the circulating water. It was noted that exterior corrosion and pitting occurred only on the in-flow ends of the condensers, that is, where the water is first broken up on entering the tubes, and also where the direction is reversed at the other in-flow ends of the condensers.

On taking an analysis of the cotton-tape packing after nine years' service it was found to contain :—

Carbonaceous matter	86.85 per cent.
Ferric oxide	11.2 per cent.
Zinc oxide	1.13 per cent.
Copper oxide	0.82 per cent.

The tubes were of standard brass of the usual 70 :30 mixture.

It will be observed from the analysis of the packing that the water must have been heavily laden with iron oxide, and it appears that some of the circulating water had penetrated down the sides of the screwed ferrules and underneath the packing, the latter acting as a filtering and retaining medium. It will also be seen that zinc and copper had passed into solution.

It is significant that on other condensers working under the same conditions no electrolytic action had taken place, the only difference being in the composition of the tubes, which were of Admiralty tube mixture, viz., 70 :29 :1.

The author believes that a more perfect amalgam or alloy is obtained if tin is present, and although tin will dissolve in water the action is much smaller than on zinc, lead, or copper.

Brass tubes tinned inside and outside are protected to a limited extent both mechanically and electrolytically, and have therefore a longer life.

In the case under review, wherever the packing allowed oxide of iron, air, and possibly slightly acidulated water to be retained, all elements were present for galvanic action to be set up. Care should therefore be given to the size of the hole in the tube plate and to the fit of the tube and ferrule, so that the packing may be kept as watertight as possible.

It has been demonstrated that where an extraneous current has been applied, as in the Cumberland process, thereby making all tubes cathodic, the trouble has been minimised, if not entirely prevented. A current density of about 0.1 ampere per sq. ft. of surface is recommended for this process.

Turbo-Generators.—The effect of moisture on electrical generators due to the application of wet-air filters has often caused trouble. It has been found that, partly owing to the fluctuating load on a generator, the temperature of the machine has varied so that when the machine is lightly loaded the temperature rise has been insufficient to dry the moist air from the filter, with the result that the insulation resistance has been reduced to a dangerous extent.

On the other hand, if the temperature is high, all moisture is quickly evaporated and undesirable salts are deposited on the windings, thus providing a path for leakage on extra-high-tension machines.

It appears that in order safely to withstand saturated air, generators should be impregnated under vacuum with an insulating varnish. By this process, with proper insulating materials, the general insulation resistance should be high enough to withstand satisfactorily the cumulative effect of a wet-air filter.

On extra-high-tension machines it is now deemed advisable to discard metal packing pieces, owing to their oxidising tendencies and conductivity, and to revert to wood or moulded insulating compounds.

Economiser Pipes and Boxes.—With water below 100 deg. F., corrosion is often set up on the outside of economiser tubes, whether of cast iron or steel, due to condensation of moisture from the passing gases. This moisture is an exceedingly good electrolyte, as it invariably contains sulphuric acid, derived originally from the sulphur in the coal forming sulphur dioxide during the process of combustion and combining with the vapour present. Unless the feed water is heated, at least one-sixth of the tubes are often corroded to about 18 in. from the bottom boxes, and the boxes also suffer badly. The obvious way to prevent external corrosion is to raise the temperature of the water by means of feed heaters or circulators fitted to the economisers, so that hot water is made to circulate from the lowest parts. With water at a temperature of 110 deg. F. and upwards, no trouble need be anticipated. Where internal corrosion is found, an analysis of the feed water is required, with suitable chemical treatment. Cast-iron economisers should be made of metal having the lowest possible percentage of free graphitic carbon.

Turbine Blades.—In the early days of turbine manufacture steel blades were found to be pitted and corroded badly, especially when a turbine was frequently stopped and started again after a lengthy period. It has also been found that where leakage of steam has taken place at a closed stop-valve, thereby allowing moisture to condense on the blading, electrolytic action is set up, resulting in blade erosion and loss in efficiency. Cases are on record where certain rows of blading have corroded where the steam temperature has dropped below dew point, and only at this stage in the length of a turbine has damage been done.

Corrosion of turbine blades has also been traced to carbon dioxide in the steam derived from unsuitable feed water, the remedy for such action being the elimination of the carbonates from the feed water by chemical treatment.

Injury to Non-ferrous Metals, &c.—The presence of vapour or water deposited on brass and other alloys often causes verdigris, which is the result of the metal passing into solution. The solution pressures vary greatly with the composition and state of the metal. Where it has been strained, say, in the process of bending, the corrosive effect is intensified. Sharp right angles should always be avoided and easy bends substituted.

Much damage has been done to extra-high-tension electrical machines and apparatus where a silent static discharge or sparking has taken place, nitrous oxide and ozone being formed, and in the presence of moisture corrosion has started, with serious results. Ozone is a very great oxidising agent and most metals are quickly attacked by it.

If an electrical discharge cannot be prevented, care should be exercised to see that moisture and condensation do not settle on these parts.

In the author's experience much trouble has resulted from vapour condensing on cold porcelain insulators enclosing brass contacts, causing serious oxidation, high resistance, and eventually open circuits. All extra-high-tension switchgear and auxiliary switch and fuse contacts should be enclosed, if possible, in oil. The quality of the oil is of supreme importance, and it should be free from every trace of water and acid.

Zinc having high electropositive characteristics, and lead also being electropositive to copper and brass, the author thinks that as alloys of copper and tin only—in the proportion of 91 per cent. of copper and 9 per cent. of tin—are now made (Morrison bronze), and tests up to about 45.7 tons per square inch can be obtained with 22 per cent. elongation on rolled rods, zinc will be looked upon with disfavour in many cases.

The destruction of galvanised iron is brought about by the zinc being dissolved by moisture. This action is more easily accomplished on commercial zinc than on pure zinc. When an electrolyte such as rain water is present electrolysis is set up, the zinc destroyed, and the underlying metal attacked.

Protection of Outside Structures.—Speaking generally, paint should be totally inhibitive as well as protective, and should possess thorough insulating and moist-proof properties. The coating should have the same coefficient of expansion as the metal, so that it will not be affected by changes of temperature. It should also possess acid-resisting as well as alkali-resisting qualities.

Certain inaccessible parts of steel structures under special conditions should be painted with an elastic medium which at all times retains its elasticity.

Graphite is still largely used for coating steelwork, and is fairly satisfactory, especially when lead is added to the pigment to give it a better hold on the metal.

Linseed oil is the principal vehicle used in all paints, but different pigments produce different results. Linseed oil absorbs oxygen from the air, and thereby its volume is increased and also its weight, a substance known as linoxygen being formed, which on continued oxidation evolves carbon dioxide and water. This electrolyte furnishes a medium for electrolysis to be set up between the metal and the pigment, the former being the anode and the latter the cathode. Expansion caused by rust exposes the metal surfaces underneath, and in the presence of water vapour further corrosion takes place.

Special paints are now on the market which have been subjected to a curing process by heat treatment in the absence of air. All volatile substances are thereby eliminated, so that when the coating is applied it oxidises and does not evaporate, thus producing a film impervious to moisture, and the permeability of linoxyn is thereby reduced. All moisture, resin, sulphur, and any other element that would excite corrosion should be eliminated. Certain paints containing dryers, benzine, or neutral oils, have a tendency when dry to dissociate and break the bond between the pigment and the vehicle, and thereby become pervious to moisture. Good results depend on proper mixing before immediate application. Red-lead paint chemically combined so as to prevent the red lead from separating and settling to the bottom forms a good material, especially for shop coatings.

The colour of the pigment also affects the results, and dark colours are recommended for the protection of iron or steel.

It is most important that steel and iron surfaces should be thoroughly dry and cleaned from mill scale, rust, grease, and dirt, before applying the first coat of paint, which should consist of finely-ground pigment.

Multiple thin coats of paint are recommended in preference to thick single coats for general protective purposes.

The most onerous conditions for preservative compounds are where the metal is alternately wet and dry. Tar and various bitumastic paints and solutions are found to give good results, have low permeability to oxygen and water vapour, and will withstand fairly high temperatures.

In reinforced concrete the cement should be absolutely waterproof, and the steel will then remain in a passive condition, due largely to the alkaline compounds. If concrete is not waterproof, electrolytic action will be started, with the inevitable result that there will be stresses in the concrete due to the products of corrosion, and the bond will be destroyed between the reinforcing metal and the concrete.

With suitable concrete 1½ inches in thickness surrounding the reinforcements for ordinary atmospheric conditions, and 2 inches for salt-water conditions, no injury can take place.

French Colonial Wireless Stations.—An article in the *Revue Générale de l'Electricité* abstracted from the *Economiste Français*, states that outside of the Mother Country there are 35 French radio-telegraphic stations in service, 25 in course of construction and 20 others projected. These include installations in Algeria, Madagascar, the Congo, Timbuctoo, Indo-China and the other Colonies. The author holds that the still unexecuted project of encircling the globe by a chain of wireless posts in French territory, reaching from the South of France and Tunis to the Marquezas Islands, thence under the Pacific to Central America and Martinique, is quite feasible. The Eiffel Tower sometimes receives signals from Panama, San Francisco and Honolulu, and it makes itself heard in New Zealand.

PLANNING A WORKS RESEARCH ORGANISATION.

At Bristol, on March 31st, Mr. A. P. M. Fleming, O.B.E., delivered his lecture (an abstract of which appeared in our issue of January 31st, 1919), which was followed by a discussion, before the Western Centre of the Institution of Electrical Engineers.

Mr. H. I. Rogers said that it was undoubtedly a fact that conditions had altered most materially since the conclusion of the war. That assuredly meant scientific organisation and research work, which, although carried out quietly in this country, must be very greatly extended if they were to play their part in foreign competition. Prior to the war it was possible to compete with Germany and America, but he did not think that was possible to-day, so high were wages and consequently materials. The coal inquiry might be taken in conjunction with the present paper. Now that shorter hours were in vogue it was essential that scientific management should be brought into play in the colliery, and it was to the engineer they must look for operation at reduced costs together with increased output. Industrially they had passed through a bloodless revolution, but he thought they need have no fear regarding the future.

Mr. W. A. Chamen expressed his appreciation of the paper and the information which the author had given. One talked of research in the first instance as making new discoveries and finding out principles or facts in science, but Mr. Fleming had shown that research covered a very great deal more than that, and it was necessary in more ordinary matters in saving actual waste. He was sure all, whether power engineers or manufacturers, must welcome all efforts to increase research for that reason alone.

Mr. A. Ellis said there was no industry so capable of development by research work as the electrical. They should keep their end up now that they had come satisfactorily through the war as competition was going to be very severe. It occurred to him that if they were going to compete successfully, that research work was worthy of Government assistance financially in order that all classes could have a sporting chance of taking part in this world's work. He did not think there was a lack of men who were capable of being technically trained. He was glad the author agreed that the sandwich system was satisfactory. An interesting feature was the provision of service ducts in buildings. If these had only been generally adopted, how many troubles experienced to-day would have been got rid of. Large ducts in the principal streets for gas, telephone, and traction mains—instead of having to take up streets. In Cardiff they had built a technical college, a portion of which it was intended to set aside for research work. Thousands of pounds had been spent in fitting it up, and the necessity of spending possibly thousands more in the creation of a fund from which highly competent men could be paid an adequate salary was equally necessary.

Mr. A. L. Stanton thought it unfortunate that the author felt it necessary to go out of this country in order to furnish planning details, as he (the speaker) held that needs must be governed by the demands of the particular works with which they might be associated. Conditions in America differed greatly, both materially and psychologically, from those which prevailed here, and it was deemed a matter of regret that no information regarding existing conditions in this country had been given and no reference made, to the valuable work carried out, for example, by the National Physical Laboratory, and Messrs. Hadfields, Ltd., respectively representative, he believed, of high grade, State-controlled, and privately-owned research work developments. A far wider meaning was attached to the word "research" than was usually associated with it. Referring, for example, to the enumerated functions of a research organisation, it was not easy to accept the idea, that such an organisation should be vested with the control of matters grouped under headings numbered: (3), (4), (5), (9), (10), and (11), and he thought such inclusion embraced elements entirely outside the scope of "research" as commonly interpreted. Works managers, engineers, production superintendents, view-room chiefs, and other similar executive officials, directly or indirectly responsible for production, could not be placed, as the author's grouping would seem to infer, subordinate to a research department, without impairing the efficiency of production operations. Education of the right kind was needed, and systems of technical training which neglected the commercial aspect of industries were faulty. If the true value of team work and co-operation between research and production departments was to be realised it could only come about by educational methods which demonstrated its utility, along lines free from departmental antagonisms, mistrust, and prejudice. The cost figures quoted by the author, for originating and running a research department were prohibitive, unless either associated with large industrial enterprises or combines, which permitted of an advantageous centralisation of facilities desired; or equipped as State-controlled research centres, situated in localities where their utility was justified.

Prof. D. Robertson said, in connection with the lack of trained men, that he did not think, unless they did something to attract the men, they would get quite as many as they wanted. If they wanted the best brains they must make the prospects as good on the average as they were in any other profession. He did not think research workers would work 48 or 44 hours per week, because that particular type of worker had to do different work. About the universities, they would be only too glad if local manufacturers would tell them their problems. If they did not tell them they had to imagine the problems or invent problems for them, and discovered at the end that they were no problems at all. He thought as a general rule universities should co-operate with manufacturers.

Mr. A. C. Macwhirter said that co-operation in research was a vital matter. The lack of trained men, as Prof. Robertson had said, was due to the miserable remuneration offered for this class of work. Without giving financial inducements one could not expect to get highly trained men. British workers from the scientific point of view were second to none, but in the past the commercial element had not taken advantage of their inventions.

Mr. W. Nairn said that at Bristol they had a large number of comparatively small firms and very few large ones. The large ones, of course, could provide for themselves, but considering the size of the laboratory which had been outlined, the annual cost of maintenance was a figure quite beyond small firms, and, in fact, quite beyond a combination of firms. One of the principal objects of scientific research was the conservation of the nation's resources of raw materials, therefore it ought to be compulsory for small works to have their plant inspected and checked for efficiency once a year. If compulsory inspection were adopted, a very great saving would be effected, and would mean a great saving to the works at a small annual charge. It would also bring in a steady source of revenue to the laboratory. There was nothing very startling about compulsory inspection, steam raisers had been used to it for a considerable time.

Mr. A. Nichols Moore said that not much had been said on national laboratories or national research. The introduction of State-controlled laboratories would more materially benefit the smaller industries than if research works were privately owned. They would all be most optimistic if private firms were going to be patriotic when the war was over and disclose the results of their research. Private research would mean that the purchaser was not going to reap that benefit which he otherwise might look for. The control of industry was drifting into the hands of gigantic financial combinations, possibly to freeze out the smaller manufacturer, who was one of the great supports of the country. He would like to see the development of laboratories on a national scale, so that all could derive the benefit of research work. Competing firms pursuing the same object were wasting brains instead of pursuing the same problem in one State-controlled laboratory.

Mr. A. P. M. Fleming, in reply, agreed that the great need for research work in the electrical industry, especially when one considered the almost unlimited bounds, would have to have more attention if the industry was to be developed on the right lines. There were some twenty research laboratories in this country, but it was extremely difficult to give details of these. People were very conservative in this country. In the United States it was totally different, there was no secrecy whatever, and that was one of the things they had to learn. When they were all making shells they assisted each other by giving "tips," &c., and he believed that spirit would persist after the war. In time they would get the centralised laboratory; in the meantime, however, there was much they could do in the way of assisting laboratories which would tend to stimulate research in industrial works. With regard to the intelligence department, he felt there was a good deal to be done in the way of national indexing. It was a very difficult and troublesome problem to avoid overlapping, and they hoped to avoid some overlapping when research associations were able to deal with the work of their particular industries. At Bristol, where the industries were so varied, he suggested that each industry might subscribe to a research organisation for its own particular industry. Another way would be to make the fullest use of their technical institutions, and aid in that way their proper equipment. Quite a lot of work could be done there. Sir Robert Hadfield's laboratory gave him all the information possible. Messrs. Brown-Firth's laboratory in a general sense was not so modern, and the adapted buildings were not so useful for the purpose he had in mind. The National Physical Laboratory was not what one would expect if one were starting to lay out the laboratory to-day. Industrial research depended on little things; one required different organisations for different industries, and he thought there was room for several points of view. One should remove from the shops as far as possible investigational work, so as to utilise manufacturing departments for the purposes for which they were designed, and not subject them to hampering conditions of experimental work. He fully agreed that the teaching staffs of colleges should have had works experience.

Cable Standardisation in Germany.—New rules have been published by the German Standardising Committee relating to the construction and installation of electric cables. These are given in detail in *E.T.Z.* of January 23rd, but are not of a nature permitting short abstraction.

THE WIRELESS COMPASS.

Through the stimulation of necessity, the wireless compass or direction-finder, an instrument whereby the bearing of a ship on a shore station may be ascertained with speed and accuracy, has overcome the dangers and difficulties of fog and storm to mariners approaching port. Its value has been proved by service, it having been in constant operation on naval shore stations during the war.

It is not generally known that wireless operators were constantly on watch at various naval shore stations in the vicinity of New York, nor that, during the war, operators timed the length of, as well as the interval between, dots and dashes whose characteristics aroused suspicion, and manipulated the wireless compass to obtain a direction on the sending station. This work proved to be of valuable assistance in locating enemy stations. An interesting article contributed to the *Scientific American* by Mr. J. Lachenbruch, wireless electrician, U.S.N.R.F., deals with this subject.

In construction, the wireless compass differs from the usual receiving set mainly in the type of antennæ used. In place of the stationary aerial is a rotating five-foot frame with a few turns of stranded copper-bronze wire wound about it. The frame (fig. 1) is mounted on a vertical steel shaft which projects downward through the roof of the building into the room where the operator is on watch. In many stations, a cupola is built about the frame to afford protection against the elements and conceal its presence. At the base of the shaft, and within easy reach of the operator, the wheel which controls the turning of the frame is attached. The compass dial, a circular aluminium band, with the 360 degrees of the compass engraved on its surface, is fastened to the shaft near the roof of the shack; but the indicator is placed in a permanent north and south direction. Two leads from the frame form the electrical path between the antenna and the receiving set.

In conjunction with the receiver, an oscillating audion and an amplifier are usually employed, thereby magnifying the strength of incoming signals to about eight times their normal degree of audibility.

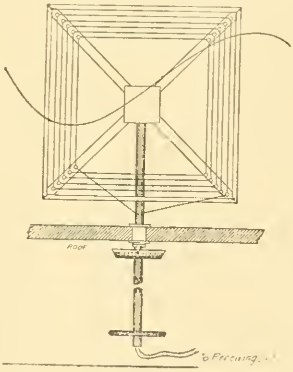

Fig. 1.—Wireless Compass Turned Parallel to an Oncoming Wave.

In the accompanying diagram, fig. 1, the plane of the wireless compass is shown parallel to the oncoming wave which strikes both sides of the wired frame at different phases and at different amplitudes. Two currents are induced in the antenna, one when the magnetic wave comes in contact with the nearer side of the aerial, the other when it reaches the farther side. These induced currents will be in the same direction, and consequently will tend to counteract each other. But, due to the differences in amplitude and in phase of the magnetic wave at the two points of contact, the induced currents will be of different strengths, and, although the one tends to obliterate the other, the difference in strength between them is conserved and heard in the telephones. However, if an incoming electromagnetic wave strikes the plane of the antenna perpendicularly, the currents induced in both sides of the compass will be equal in strength, of the same phase and amplitude, and will neutralise each other. No sound is then heard in the telephones. By means of the rotating antenna, the angle at which a wave acts on it can be controlled by the operator. Thus when the plane of the antenna is parallel to the direction of the oncoming wave, the sound heard in the 'phones will represent the maximum strength of the oncoming wave and, consequently, the position of the ship or shore station sending it will be disclosed. To be more accurate, two positions are usually made known, 180 deg. apart.

To obtain the best results in guiding vessels into the port of New York, five wireless-compass stations have been established at points on the coast. Each station is connected by a land-line telegraph instrument with a central controlling wireless station. When a ship approaches the coast line, the operator aboard calls New York and asks for his bearing. The ship does not get into direct communication with the various compass stations, as they are equipped only with receiving sets. The central controlling station, in answering the ship's call, transmits a signal to the ship to send its call letters for 30 seconds, and at the same time notifies the various compass stations, by means of a three-letter signal sent simultaneously, to obtain a bearing on the ship sending her call letters.

The control station, when all compass stations have been heard from, transmits by wireless the bearing, in degrees, to the ship on different shore stations.

The accuracy of the bearing reported by each compass station is determined at the control station by consulting a map of the coast spread out on a table, and covered with glass. Holes are punctured through the glass at the centre of large circles drawn about the various compass stations as centres. The circumferences of the circles are divided into degrees. Threads are then led through the holes and laid out on the map. When a compass station sends a bearing to the control station, the operator there draws out a thread to mark the line of direction between the ship and the compass station. As the other bearings are reported, similar marks are laid down; and the point where all the threads intersect is the exact position of the vessel desiring to know its position.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

8,670. "Accumulators for electric pocket lamps, &c." W. Robinson. April 7th.

8,688. "Generation of electricity." H. A. Farwig. April 7th.

8,694. "Electrically-controlled typewriters, &c." J. Greenwood. April 7th.

8,733. "Means for preventing sparking in appliances for making and breaking electric circuits." H. H. Hill. April 7th.

8,751. "Telephone systems." L. C. Bygrave, T. M. Inman, and Relay Automatic Telephone Co. April 7th.

8,759. "Winding of induction coils." F. Weatherill. April 7th.

8,783. "Make-and-break devices for magnetos, &c. E. Harrison. April 7th.

8,794. "Magneto couplings." T. R. Heyworth. April 7th.

8,795. "Electric furnaces." R. Steiger. April 7th. (Switzerland, April 8th, 1918.)

8,798. "Electrical device for heating liquids." W. B. Smits. April 7th. (Holland, April 5th 1918.)

8,823. "Combined pulley-wheel and extension for trolley pole of tramcars." J. M. Hodges. April 8th.

8,827. "Electric vehicles." W. Rogers. April 8th.

8,837. "Starting-switches for electric motors." J. S. Macintosh. April 8th.

8,852/3. "Lamp-holders and shade fittings for incandescent electric lamps." G. F. Joseph and A. A. Simes. April 8th.

8,855. "Controllers for electric motors." T. B. Lewis. April 8th.

8,863. "Rheostats." F. C. Curtis. April 8th.

8,864. "Electrical fittings." D. Anderson. April 8th.

8,877. "Electric signalling-apparatus for cars on electric, &c., railways." C. Kunzli and H. Schaub. April 8th. (Switzerland, April 23rd, 1918.)

8,889. "Apparatus for signalling and interlocking on railways, &c." G. B. Fielding. April 8th.

8,894. "Dynamo regulating systems." Electric & Ordnance Accessories Co. and J. Etchells. April 8th.

8,901. "Regulators for electric generators." British Thomson-Houston Co. (General Electric Co.). April 8th.

8,909. "Radio-telegraphic transmission systems." W. J. Mellersh-Jackson (A. Taylor). April 8th.

8,911. "Electric relays." Electric & Ordnance Accessories Co. and J. Etchells. April 8th.

8,914. "Electric selective switching apparatus." E. R. Baldock and International Electric Co. April 8th.

8,921. "Electric regulating systems." Electric & Ordnance Accessories Co. and J. Etchells. April 8th.

8,924. "Electric switches." C. A. Damey and R. K. Damey. April 8th.

8,927. "Collector for electrical machines." E. Bolton. April 9th.

8,928. "Self-electrical generator." G. E. Metcalfe. April 9th.

8,943. "Motor-cycle, &c., electric lighting sets." F. E. Cutler, Efandem Co. and W. Owen. April 9th.

8,944. "Dynamo-electric generators and electric motors." F. E. Cutler, Efandem Co., and W. Owen. April 9th.

8,969. "Papers for use as dielectric for electrical condensers, &c." F. Haigh. April 9th.

8,989. "Dynamos." M.-L. Magneto Syndicate and E. A. Watson. April 9th.

9,013. "Telephone and telegraph cables." Johnson & Phillips and G. C. Pearson. April 9th.

9,053. "Electric arc lamps." F. Proctor. April 9th.

9,054. "Directive aerials for emission of electric waves in definite planes." P. P. Eckersley. April 10th.

9,055. "Electro-magnetic wave-transmission systems." P. P. Eckersley. April 10th.

9,074. "Electrically propelled vehicles." J. Scott. April 10th.

9,095. "Systems for supplying electric power for lighting from low-frequency power circuits." J. R. Beard and Electrical Improvements, Ltd. April 10th.

9,096. "Visual and audible electric indicators." J. G. Rose. April 10th.

9,157. "Miners' safety, &c., electric lamps." G. Oldham and J. Oldham. April 10th.

9,168. "Wireless receiving and transmitting apparatus." J. Erskine-Murray and J. Robinson. April 10th.

9,175. "Storage batteries." J. L. Lotsch. April 10th.

9,176. "Apparatus for electrically igniting miners' safety lamps." V. E. Joyce and Park Royal Engineering Works. April 10th.

9,178. "Electric motors." G. Fryer & Portable Electric Motors, Ltd. April 10th.

9,179. "Commutators for dynamo-electric machines." G. Fryer and Portable Electric Motors, Ltd. April 10th.

9,186. "Apparatus for forming electric battery elements, &c." H. Wade (National Carbon Co.). April 10th.

9,187. "Apparatus for producing continuous electrically conducting liquid jet." J. F. G. P. Hartmann. April 10th. (Denmark, May 11th, 1918.)

9,188. "Apparatus for closing or interrupting electrical connection between two conductors." J. F. G. P. Hartmann. April 10th. (Denmark, May 16th, 1918.)

9,189. "Rectifiers for alternating electric currents. J. F. G. P. Hartmann. April 10th. (Denmark, November 14th, 1918.)

9,205. "Electric fuses." H. J. Abbott. April 11th.

9,206. "Brush-holders for dynamo-electric machines, &c." Electric Construction Co. and P. J. Stikrup. April 11th.

9,211. "Sparking-plugs for internal-combustion engines." F. W. Baker. April 11th.

9,235. "Electrical ignition systems of internal-combustion engines." A. Edwards. April 11th.

9,276. "Electric batteries." J. H. Goodman. April 11th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1915.

16,008. Detection and transmission of earth vibrations. Mellersh-Jackson (Submarine Signal Co., U.S.A.). November 12th, 1915.

17,868. Submarine sound signalling. Gardner. December 22nd, 1915. (Cognate application 10,058/16.)

18,212. Signalling. Colley. December 31st, 1915.

1917.

18,917. Vibration transferring means. H. Smith. August 23rd, 1916 (112,444.)

1918.

4,064. Dynamo-electric machines. Lancashire Dynamo & Motor Co. and H. B. Whitmore. March 8th, 1918. (124,249.)

4,074. Double-plug ignition means for internal-combustion engines. R. W. Standfield. March 8th, 1918. (124,250.)

4,750. Electric contact making and breaking apparatus. British Thomson-Houston Co. & H. K. Trechmann. March 18th, 1918. (124,258.)

4,760. Spark-plug and method of manufacturing same. F. M. Fbrber. March 17th, 1917. (115,813.)

4,840. Controlling-mechanism for electrically driven air compressors, pumps, or the like. British Thomson-Houston Co. & J. J. Ash. March 19th, 1918. (124,263.)

4,870. Bearings of magneto-electric machines. R. B. North & A. M. Allen. March 19th, 1918. (124,267.)

7,450. Electric vacuum cleaners. British Thomson-Houston Co. (General Electric Co., U.S.A.). May 3rd, 1918. (124,317.)

7,597. Method of forming connections to and between metal sheets or strips. Marconi's Wireless Telegraph Co. & F. Woods. May 6th, 1918. (124,320.)

8,082. Magneto-electric ignition apparatus. D. Y. Wheatley. May 14th, 1918. (124,325.)

9,735. Electric switches. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 13th, 1918. (124,338.)

10,120. Electric motor control systems. British Thomson-Houston Co. (General Electric Co., U.S.A.). June 19th, 1918. (124,341.)

11,459. Instrument whereby short ends of carbon may be held securely whilst being used in electric arc lights. W. A. Gitsham. July 12th, 1918. (124,357.)

11,583. Electric fuse cabinets. W. T. Tallent-Bateman & British Westinghouse Electric & Manufacturing Co. July 15th, 1918. (124,358.)

11,595. Electric testing devices. R. C. Bierbower. July 15th, 1918. (124,359.)

14,530. Electric accumulators. W. G. Pearson & General Electric Co. September 6th, 1918. (124,378.)

15,450. Electric drive for ships' screw propellers. Akt.-Ges. Brown, Boveri et Cie. July 3rd, 1918. (124,380.)

15,541. Spark-plugs. E. J. Taylor. September 24th, 1918. (124,382.)

18,088. Electrical signalling systems for use on motor-road vehicles. Naillik Motor Signal Co. & J. P. Ogden. November 5th, 1918. (124,394.)

20,621. Electric induction motor meters. A. G. Landis & Gyr. December 11th, 1917. (121,482.)

20,793. Electrical phase converting systems. British Westinghouse Electric & Manufacturing Co. December 13th, 1917. (121,486.)

21,769. Apparatus for the conversion of direct electric currents to alternating currents. R. van Cauwenberghe. September 24th, 1917. (124,407.)

1919.

1,558. Means for securing the pole shoes of a magneto-electric machine. British Lighting & Ignition Co. & A. E. Bennett. January 21st, 1919. (124,411.)

Output of U.S.A. and Canadian Generating Systems.—Data of the outputs of all generating companies in the U.S. and Canada having yearly outputs in excess of 100 million KW.-hours are given in the *Electrical World* of March 26th, and statistics for 1917 and 1916 are included. The combined output of the 46 companies listed is more than 25,000 million KW.-hours, of which 4,500 million KW.-hours represents the output of companies in Canada. The increase in output for 1918 approximates 4,000 million KW.-hours. Although there was a serious dearth of water both in the Far Western States and in the South-eastern States, so that the ratio of output from water power to that from steam power is not so great as it was last year, still more than half of the energy produced was generated by hydroelectric plant. Owing to the consolidation the present Niagara Falls Power Co. tops the list with an output of more than 2,000 million KW.-hours. A most remarkable condition existed on the Niagara frontier, where during the year every bit of hydraulic and steam equipment was pressed into service because of the great demands for energy both in Canada and in the Niagara and Buffalo districts.

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. MAY 2, 1919. No. 2,162.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: AGEEKAY, CENT., LONDON." Code. A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

WIRELESS PROGRESS IN WARTIME.

WHILST engineering entered into each and every phase of military activity, there were certain branches of engineering, notably wireless telegraphy and telephony, which were vastly developed by the war. The imperative necessity for maintaining communication at the front at all times, and under all conditions, resulted in astonishing progress being made in wireless practice. It has been said that these branches of engineering were further advanced during four years of war, than they might have been under normal conditions in, perhaps, 30 years. The *Electrical World* recently printed a series of articles, some of which have been abstracted in the REVIEW, on the development of wireless work and methods of signalling in the U.S. Signal Corps, during America's participation in the war.

A very notable factor in wireless development has been the vacuum valve. These valves, which are most versatile in their adaptability, have become an important element in this branch of engineering, and the device has been perfected and standardised to a wonderful degree. The capabilities of this apparatus have made it possible to accomplish what was formerly impracticable in wireless engineering. At the outbreak of war the three-electrode vacuum valve was a laboratory device rather than an army instrument, and it must be admitted that incredible wonders have been achieved in transforming the delicate valve into a standardised military apparatus, so that it could be manufactured, shipped, and utilised in large numbers under war conditions, and without much dependence upon highly specialised skill.

The remarkable service that wireless direction-finding apparatus has rendered during the war was made possible by the substitution for the vertical-mast antenna of a simple loop or set of loops capable of being rotated about a vertical central axis. By this means it becomes theoretically possible to orient any particular set of incoming electromagnetic waves to which the loop is attuned. It may surprise some readers to learn that a simple vertical frame about 2·7 sq. m. in area, and containing in, say, 25 turns, an aggregate of 67·5 sq. m., will enable an operator, when equipped with suitable receiving apparatus, to hear on the eastern coast of America the high-powered wireless stations of Europe. Within certain limits of precision the true bearings of these stations may also be determined by means of such a frame.

Two valuable applications of the loop direction-finder are to the establishment of the map position in bad weather of both air- and sea-craft. The simple loop is merely a direction finder, but, by the use of a pancake loop, the dissymmetry of structure with respect to the inner and outer ends may be utilised in such a way that the apparatus becomes a wireless compass. It should ultimately become almost impossible for a navigator to lose his map position, either in the air or on the sea, if equipped with suitable wireless direction-finding apparatus, and with beacon land stations at work.

As illustrative of the unusual and difficult problems that presented themselves for solution, mention may be made of the designing of a two-way wireless set for use in tanks. This important branch of the service was entirely dependent upon wireless for reliable communication, a number of other systems having been tried without success. A tank is a very near approach to Faraday's shield, or completely electromagnetic wave-proof, metallically-enclosed receptacle. The continuous-wave sets designed to meet the exigencies of the situation are very interesting, and involve the use of the vacuum valve, both in transmitting and in receiving. Transmission may be carried on during the progress of the tank over the roughest ground, but, on account of the tremendous noise of the mechanism, reception is extremely difficult, except when the tank is stationary.

In conclusion, it should be pointed out that the success of the work of development of wireless engineering and apparatus is largely attributable to the whole-hearted co-operation of various electrical firms and engineers. Nor must the officers and men of the Army Signal Corps, who won widespread approval, and deserve unstinted praise for the way in which their work was done, be forgotten. They were called upon to plan and install, under many hardships, large telegraph and telephone systems, and they maintained communication often under conditions that would be regarded as hopelessly impossible from peace-time standpoints.

Watch the Meters.

It is, perhaps, not sufficiently realised, especially by the smaller electricity supply undertakings, that the question of metering the energy supplied to consumers is one of the most crucial factors in the whole business. Every unit not properly metered is a dead loss in money to the undertaking. An all-round lack of accuracy on the meters would thus seriously affect the revenue. Further, it has to be recognised that this is not a case where inaccuracy in one direction can be set off against inaccuracy in another. Assuming that a meter is correct to start with, the tendency is for the meter to go slow, seeing that this is a natural result of increase in friction. The tendency to develop over-registration is rarely met with, and is, in fact, practically impossible on many types of meters.

It may be taken, therefore, that the faults developing on meters are all on the side of the consumer, and against the undertaking. One very general fault is for a meter to get into the condition of not starting on a low load. With the low-wattage lamps now in use, a corresponding demand is made on the meter for efficiency in this direction. It is a most common fault for meters not to start with one lamp, and this with thousands of consumers would become, in the course of a year, quite a serious matter. Further, by the nature of the case, this fault operates on high-priced units, namely, the lighting supply. As a case in point, some years ago a large London undertaking found that, although it was developing rapidly, there was not a proportionate advance in the revenue, and it was decided to inaugurate a thorough-going meter department. Within the next year or so following the overhauling and accurate adjustment of the meters, they brought in an extra revenue far and away outstripping the expenses incurred. One of the new steps taken in this case was that the meters were changed about every three years, instead of being left out on circuit almost indefinitely. In some small undertakings, even at the present day, meters are installed and left without attention for years. There has, in fact, been a case in which the meters in an undertaking were allowed to go wrong so far as to attract attention through a noticeable and wholesale falling off in the revenue. Of course, if the station meters are kept in order, and the total of the consumers' meters checked thereby, after making allowances for distribution and other losses, a check is readily obtained. The item of "units unaccounted for" reflects the efficiency of the meters, and in some cases one may guess from this where there is a top-hole meter department. Perhaps the fact of the meters being looked upon as merely part of the mechanical apparatus coming under the control of the engineer, has caused their direct relation to the revenue to be overlooked by the management. Now the whole question is one of crucial importance to supply undertakings. Curiously, in Mr. Seabrook's otherwise excellent book on the "Management of Public Electric Supply Undertakings," there is a lack of stress in emphasising this point. The subject of testing and repairing meters is dismissed with the statement that "the Meter Department will require well-equipped testing and repair rooms." Whatever may be conveyed *implicitly* by this, to drive in *some* truths requires a sledge hammer.

Lighting Efficiency.

In our "Correspondence" columns to-day, Mr. F. W. Willcox raises some interesting points relating to illumination. With regard to the first—the necessity of photometric tests—it is, of course, admitted that to judge of the technical efficiency of an illuminating system by the eye alone is apt to be most misleading: in this respect, owing to its extraordinary adaptability, the eye as a measuring instrument is altogether out of court. On the other hand, it should never be forgotten that the illumination is provided solely for the *use* of the eye, and therefore the eye is entitled to express an opinion—a very decided and weighty opinion—on the utility of the illumination. This fact was emphasised by Mr. A. P. Trotter in his presidential address to the Illuminating Engineering Society, over a year ago, when he went so far as to say: "The eye only is the judge" of the final result. Hence, though in the case of Mr. H. G. Solomon's installation at Pusey House Chapel we should certainly have preferred to include photometric tests in our article, had they been available, we are not prepared to go so far as Mr. Willcox, and say that the power expended per square foot, in order to produce results satisfactory to the eye, is a valueless item of information. As our illustrations showed, the result was satisfactory to the camera; but whilst a photograph will indicate approximately the degree of uniformity of illumination obtained, it is admittedly useless as a criterion of the optical utility of the result. We relied, therefore, upon the fact that the illumination proved satisfactory to all concerned, and that glare, of course, could not possibly occur under the conditions described (facing east).

We seize this opportunity to lament the fact that many instances of lighting in public halls, and churches, could be cited where the methods of illumination adopted—whether by gas or electricity—are literally atrocious. Bare, unshielded mantles or m.f. lamps project their dazzling rays into the eyes of the audience, and there is no escape from them. Even in the large lecture theatre of a well-known college in London this is the case. Nothing, apparently, can be done except to urge our readers, when they meet with such atrocities, to take steps to bring the matter to the notice of the guilty parties.

Mr. Willcox endorses our judgment on the lighting of the theatre at the Institution of Civil Engineers, and suggests a remedy; a simple and, we believe, an effective plan, wholly in keeping with the design of the handsome ceiling, would be to suspend a powerful semi-indirect fitting in the centre of the dome, somewhat below the level of the plane ceiling, so as to illuminate the latter as well as the seating space. Then one would no longer feel as though immured in a pit, with a sort of Mahomet's coffin floating over one's head, surrounded by a luminous gap. The monotonous absence of "light and shade," and the lack of contrast, at the living level, produce a feeling of depression.

Municipalisation in Berlin.

The question of municipalisation in Berlin has now taken a new course in the light of the proposals referred to in the Electrical Review for April 18th. Since the taking over in 1913 of the Berlin supply works of the Berlin Electricity Works Co., the municipalisation of the works is declared to have so far yielded the city no "fiscal advantages," whilst the citizens and the industrial consumers have been faced with the disadvantage of having to pay an extraordinary increase in the charges for energy. Undeterred by these unsatisfactory results, the authorities now have under consideration the question of municipalising the transport undertakings in Berlin, under the auspices of the Berlin Public Utilities Union—a combination of the local authorities of Greater Berlin. The first to be taken in hand is the Grand Berlin Tramways Co., whose undertaking was to have been purchased as a going concern at the price of 150 per cent.—according to an agreement entered into a few years ago. It is now suggested, however, that the agreement should be repudiated, or that the new revision of fares, which are subject to approval or disapproval by the local authorities, should be so arranged that instead of the increases devolving upon the passengers, the company should be compelled to bear the additional working expenses, for which recoupment is desired by way of the proposed higher fares, so that the directors might be induced voluntarily to abandon the undertaking! Truly, nationalisation and municipalisation in Germany are proceeding, on paper, at all events, from bad to worse. Scrap-iron terms seem to be the principle aimed at, and only a short step separates this stage from that of complete confiscation.

S.A. ASSOCIATION OF MUNICIPAL ELECTRICAL ENGINEERS.

The third annual Convention of the Association of Municipal Electrical Engineers of the Union of South Africa was held at Port Elizabeth from February 10th to 15th, 1919, and was well supported by the various municipal electrical undertakings of the Union.

The Convention was opened by the Mayor of Port Elizabeth according the Association a hearty welcome to the City, after which the annual general meeting took place.

Mr. B. Sankey (City Electrical Engineer of Port Elizabeth) was elected President of the Association. and Mr. T. C. Wolley-Dod (City Electrical Engineer, Pretoria) was elected Vice-President, with Col. Dobson, D.S.O. (General Manager Electrical Departments, Johannesburg), and Mr. John Roberts (Borough Electrical Engineer, Durban), as Past-Presidents.

visits were paid to the power station, and the boot works of Edworks, Ltd.

On the following day, discussion was invited on the Presidential Address, which, dealing as it did with many matters of interest, was warmly applauded, and elicited some very useful points from the many speakers.

A report on "Proposed Wiring Rules" was then submitted by a Committee, consisting of Messrs. Sankey, Stewart and Wolley-Dod, but as they had not completed their investigations, it was decided to re-elect them, so that a final draft might be submitted at an early date.

In the afternoon a motion of Mr. John Roberts (Durban) was read on the inclusion of other municipal officials in the Association, which was left for members to consider and express their opinion on at the next Convention.

W. A. Hodge, Winburg. A. E. Val Davies, Capetown. T. Jagger, Ladysmith. Councillor Fairclough, Ladysmith. R. D. Coulthard, Oudtshoorn. G. Mercier, Betbel.

Councillor Thomson, His Worship the Mayor, Bloemfontein. P. H. Newcombe, Aliwal North. H. Brittle, Cradock. F. W. Mills, S.A. Railways. J. Mordy Lambe, East London. J. Vowles, Kingwilliams-town. Councillor De Jager, Oudtshoorn. J. Younger, Krugersdorp.

Councillor Crawford, Bloemfontein. A. S. Munro, Pietermaritzburg, (Member of Council). G. A. Stewart, Bloemfontein, (Member of Council). B. Sankey, Port Elizabeth, (President). E. Poole, Durban, (Hon Sec. and Treas.). W. Bellad-Ellis, Queenstown, (Member of Council). Councillor Doull, Pietermaritzburg.

C. J. Everett, Johannesburg. T. Millar, Harrismith.

Members and Delegates at the Port Elizabeth Convention.—February 10th—15th. 1919.

The elections for Members of the Council from the arious Provinces were as follows :—

Messrs. W. Bellad-Ellis (Queenstown), G. A. Stewart loemfontein), A. S. Munro (Pietermaritzburg), and E. T. rice (Johannesburg).

Mr. E. Poole (Durban) was again elected as hon. secretary d treasurer.

The valedictory address by the retiring President, Mr. hn Roberts (Durban), was next read, after which the wly elected President, Mr. B. Sankey (Port Elizabeth), ok the chair, and delivered his Presidential Address.

After the meeting, the Association was entertained to nch by his Worship the Mayor, and in the afternoon

A special report was then presented by the Hon. Secretary and Treasurer, Mr. E. Poole (Durban), on Municipal Statistical Returns, in which an appeal was made for all returns to be on a similar basis; owing to the lengthy nature of the report, a Committee, consisting of Messrs. Roberts, Munro, Lambe, Davies, and Poole, was constituted to go into the matter, and draw up suitable forms for submission at a later date.

On the Wednesday a visit was paid to the Bulk River Waterworks of the municipality, the party numbering about 40.

On Thursday the party journeyed to Uitenhage, where they were officially received by the Mayor, after which a paper by Mr. G. H. Swingler (Cape Town) was read on

"The Registration of Electrical Contractors," and a warm discussion took place, in which the principle was approved of, and a Committee, consisting of Messrs. Swingler, Stewart, Dobson, Jagger, and the President (*ex-officio*) was appointed further to consider it and report. An adjournment was then made for lunch, by kind invitation of the Mayor, after which a visit was paid to the power station and railway workshops. The party then returned to Port Elizabeth, and in the evening the annual dinner of the Association took place.

On Friday a very interesting paper was read by Mr. C. J. Everett (Johannesburg) and discussed, on "Local Manufacture from S.A. Products," after which visits were paid to other local works.

The next Convention will take place at Pretoria.

BALANCING THE SUSPENDED COIL OF A MARINE GALVANOMETER.

By J. RYMER-JONES.

In the case of a sensitive moving-coil galvanometer, not only must the means provided on the coil itself for equilibrating the weight on both sides of the taut-wire suspension, and also for equalising the weight of the back and front of the coil, be capable of very fine adjustment, but, in order to test the degree of equilibrium attained during the process of balancing, the galvanometer is generally mounted on a platform which can be so manipulated as to subject the instrument to movements sufficiently resembling, for the purpose required, the pitching and rolling of a ship at sea. Furthermore, to expedite the process of balancing, there must be some method which can show the amount and direction of the adjustment necessary to compensate for any observed displacement of the spot from the instrument's zero, under a pitch or roll of a definite angle as indicated by a clinometer mounted on the platform.

The method hitherto employed consists in securing the galvanometer at one end, and a lamp, with its lens and graduated scale, at the other end of a stout board provided with a roller, in the form of a segment of a circle, secured to the underside of the board near the scale end; and, if desired, another also near the galvanometer end. Sometimes two handles project from the galvanometer end of the board for raising that end in order to represent a pitching movement of the ship; and the rollers beneath the board are to facilitate turning it over to one side or the other, through a considerable angle, and so produce on the suspended coil the effect of a ship's rolling motion.

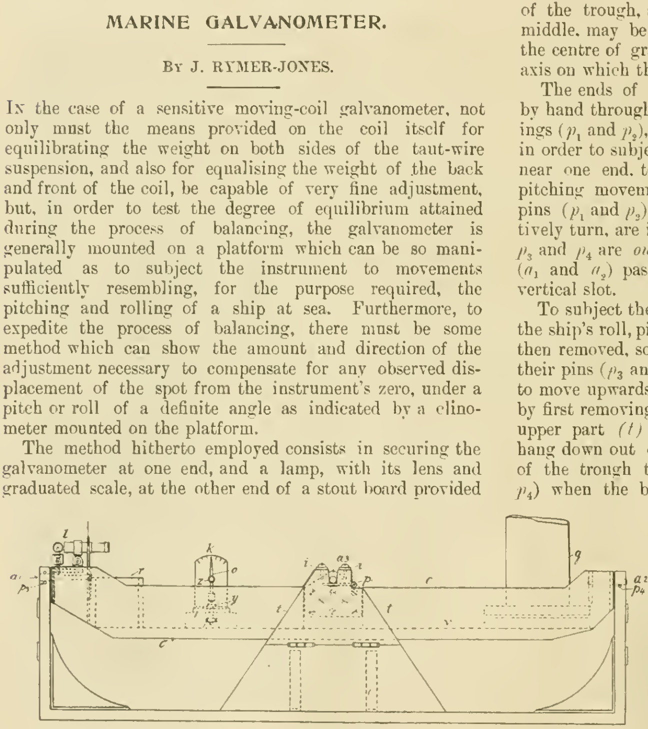

Fig. 1.—Rymer-Jones Balancing Cradle.

In both these movements the adjustment required (if any) for improving the balance is roughly indicated by the displacement of the spot of light, reflected on to the scale from the mirror, to one or the other side of the instrumen zero position, according as the one side or the other, or the back or front of the coil, is the heavier; but the inexpe find it difficult to obtain a perfect balance quickly with th uncertain indications furnished by the above-mention board, and with the means of adjustment hitherto provid on the coil.

The improved platform here described for measuring a want of equilibrium in the galvanometer coil, with a vie to perfecting its balance, is serviceable for any suspend coil, but it has been designed more especially to facilita balancing a coil fitted with the balancing wires describ in Patent Specification No. 108,649/1917 (Rymer-Jones entitled "Improvements in or Relating to Galvanometers."

It consists of a shallow trough (c) fig. 1, whose bottom formed by a thick board (v) made additionally strong b stout sides and end boards. These end boards, and also th middle portion of the two sides, rise several inches abo the board, in order that the axle rods (a_1 and a_2) at the en of the trough, and also the axle rods (a_3 and a_4) at th middle, may be sufficiently high above the plank to ke the centre of gravity of the moving portion well below th axis on which the trough (c) turns, for the sake of stabilit

The ends of the trough can be easily moved up or dow by hand through any desired angle, up to 20°, on pin bea ings (p_1 and p_2), placed midway along the trough's lengt in order to subject the galvanometer (g), which is mount near one end, to the disturbing effect brought about by pitching movement of the ship. In this case these sto pins (p_1 and p_2), on which the axle ends a_3 and a_4 respe tively turn, are inserted, as shown in fig. 1, while the pi p_3 and p_4 are *out*, to permit of the longitudinal axle en (a_1 and a_2) passing freely upwards or downwards in vertical slot.

To subject the galvanometer to a movement representi the ship's roll, pins p_3 and p_4 are first inserted, and p_1 and then removed, so that the axle ends (a_1 and a_2) can turn their pins (p_3 and p_4), while the axle ends a_3 and a_4 are fr to move upwards or downwards. This is rendered possib by first removing the four metal straps (i), and letting th upper part (t) of the side support, which is hinge hang down out of the way and thus allow the *nearer* si of the trough to turn outwards on its bearings (p_3 a p_4) when the bottom of the trough is moved outwar with the hand, to represent a rolli motion. The upper part of the back su port can be similarly hinged, but it not necessary that the trough be movab in both directions, because any want balance, as shown by the ship's rollin is equally evident in one direction as the other; in fact, it is desirable, in ord to avoid confusion when interpreting th meaning of the displacement of the sp of light, to move the hanging part of th trough in only one and the same directi *always*. This applies also when testi the balance under a pitching moveme as will be explained later on.

The scale, with its electric light (l) a battery (r), serves as a convenient counte poise to the weight at the galvanomet end, which is intentionally made rath the heavier, so that the platform w automatically return to its normal ho zontal position of rest when free to do It, consequently, only requires a gen pressure of the hand to tilt the trou and instrument through the desired angle.

The trough is fitted with a clinometer (k), capable being turned round on its pivot (y), so as to be serviceat in two positions, at right angles to each other, and havi a scale graduated up to (say) 20°, and its index-hand a sleeve (o) is movable, by friction, on the circular axle z which the pendulum is attached, so as to be adjusta to the scale's zero whenever the platform is not qui horizontal when in a position of rest.

The displacement of the spot of light from zero on t galvanometer scale indicates the amount of correction to pplied by the balancing wires carried by the galvanometer oil frame in order to perfect the equilibrium—see Specifi-ation No. 108,649/1917, already referred to.

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* See The Electrical Review, December 6th, 1918, p. 535

To obtain the data for readjusting the galvanometer's il balance:—

If when the screw-threaded wire (b_2) provided for pro-ucing equilibrium between the back and front of the coil s turned through one complete circle a roll of 20° dis-laces the spot of light, say, 40 scale divisions to the *right* f zero, this will furnish a datum for future rebalancing etween the back and front—*e.g.*, a quarter turn of b_2 in the *everse* direction will in this case exactly compensate for an rror indicated by a displacement from zero of 10 divisions o the right, provided that the platform is always turned hrough the same angle 20°.

Similarly, if when the other screw-threaded wire (b_1) rovided for producing equilibrium between the two *sides* f the coil, is turned through one complete circle a pitching novement of 20° displaces the spot of light, say, 24 divi-ions to the right of zero; this will afford a datum for uture rebalancing between the two sides—*e.g.*, a quarter urn of l_1 in the *reverse* direction will compensate for an rror of six divisions to the same side of zero, provided hat the platform be always moved through the same ngle (20°).

As one end of each of the adjusting wires is filed flat, it is uite easy to judge when the wire has been turned through right angle, or even a quarter of that angle.

What very greatly facilitates rebalancing is the important ct that since in the Rymer-Jones pattern of galvanometer, ith which we are dealing, the adjusting wires b_1 and b_2 oth pass *through the central line of suspension*, as well as t right angles to each other, they are quite independent of ach other in respect of their effect on the coil's balance. onsequently, any want of equilibrium, be it under a itching or a rolling movement of the ship, can be quickly orrected, the one immediately after the other, at one peration, with the assistance of the two tables constructed n the basis of the above data.

The balancing process is greatly simplified if the alancing board be always turned in the same direction (say), *utwards*, to represent a *roll*, and the galvanometer end be *aised* to represent a pitching movement, and invariably hrough 20°, as was done when constructing the two ables.

Moreover, it prevents confusion if the operator always otes which is (say) the *heavier*. Thus:—"Back 10, Right 4," would mean that the *back* of the coil is too heavy s indicated by 10 divisions, and the right *side* 4 divisions oo heavy. Referring these values 10 and 4 to their espective Tables, it will be seen what adjustments are ecessary to compensate for both of these inequalities n weight. For example:—In this case the back end f wire b_2 is to be turned through $\frac{10}{40}$th of a complete ircle in the direction of the hands of a watch to make he *front* heavier by that amount, and also the right-and end of the wire (b_1) is to be turned through $\frac{4}{24}$th, r $\frac{1}{6}$th, of a complete circle, *i.e.*, 60°, in the direction f the hand of a watch to make the left-side heavier by hat amount.

The trough and stand are made in two separate parts, and re, therefore, easily portable; but, if so desired, the whole radle, with its galvanometer and fittings—as shown in g. 1—can be permanently installed on the testing-room able, and the testing-keys and other apparatus arranged round it, so that the sliding frame, in which the alvanometer coil is suspended, has simply to be withdrawn o make any alteration in the two wire adjustments required rom time to time, and then replaced in the galvanometer.

The facts that these two wires (b_1 and b_2) have uite independent effects on the coil's balance, and hat both adjustments can be quickly effected, the ne immediately after the other, render what has itherto been a very risky, difficult and confusing pro-ess—not lightly undertaken even by those who can justly onsider themselves experts—a simple, expeditious and eliable operation by the method above described.

The galvanometer scale and the electric-light fittings re provided with special adjustments to ensure a good spot f light.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

The Supplementary Estimates provided by the Provincial Legislature of Ontario for the Hydro-Electric Power Commission, for capital expenditure during the present fiscal year provides for amounts, allotted as follows:—

Niagara system	$1,000,000
Severn system	100,000
Eugenia Falls system	50,000
Muskoka system	200,000
Port Arthur and Thunder Bay system ...	2,500,000
Woodell's Falls system	1,000
St. Lawrence system	150,000
Ridean system	500,000
Miscellaneous	75,000
Central Ontario system	1,000,000
Nipissing system	175,000
Queenston — Chippewa development at Niagara Falls	6,000,000
Expenditure on account of Province ...	195,000
Total...	$11,946,000

This Commission recently gained a victory at the polls in the City of Hamilton, where a by-law was submitted to the people regarding a proposed "hydro-radial" electric railway, which is to run from Toronto through Hamilton to St. Catherines. In 1916 this by-law was voted on by all the municipalities, through which it is intended the railway shall pass, but although at that time Toronto, and practically all the other places, voted strongly in favour of such a line being constructed and operated by the Commission, Hamilton, which has a population of about 100,000, together with one or two very small places, voted against it, and the whole question was postponed till the cessation of hostilities.

Sir Adam Beck has stated that the line will now be built as soon as possible.

It will be noted in the foregoing table that a sum of $2,500,000 is appropriated for capital expenditure during the year on the Port Arthur and Thunder Bay district. This is for the development of water power to serve the "twin cities" Port Arthur and Fort William; the power house will be about 75 miles from these towns, and about 50,000 H.P. will be developed and transmitted at 110,000 volts, on a wooden pole line. This part of Ontario is rich in minerals, particularly iron and copper, while the two cities named are the ports at the western end of Lake Superior, where all the great shipments of grain which are sent east by way of the Great Lakes are loaded on to the vessels.

There is much discussion going on in this country at present on the question of making engineering a closed profession; the Engineering Institute of Canada, formerly the Canadian Society of Civil Engineers, is asking various questions of its members in regard to this matter.

The electrical engineers, particularly in Toronto (most of whom, owing largely to the fact that no branch of the I.E.E. exists in Canada, are members of the local sections of the American Institute of Electrical Engineers) are desirous of forming a purely Canadian Electrical Institute, and this matter was discussed at a meeting held recently in Toronto; the question is also coming up whether there should not be some purely Canadian Institute or Society which would embrace all engineers—civil, mechanical, electrical, &c.

A general description of the great electric-steel plant at Ashbridge's Bay, Toronto, which went by the name of British Forgings, Ltd., has recently been published in the *Canadian Engineer*, permission for the publication of the details having just been accorded by the chairman of the Imperial Munitions Board.

The site of these works, which is all reclaimed land, has an area of 127·65 acres; there are 5,000 ft. of dockage facilities along the ship channel—a body of water 400 ft. wide and 7,000 ft. long ending in a turning basin 1,000 ft. sq., having a depth of 24 ft. at mean low water.

There are also about 7 miles of railway sidings. Before reclamation the ground was waste marsh land; it has been filled by hydraulic dredging to a depth of about 10 ft.

Owing to the unstable nature of the ground, all building column piers and foundations for heavy plant are supported on piles spaced 3 ft. apart and driven to a depth of about 30 ft.

The melting house where the electric furnaces are is 608 ft. long × 75 ft. clear span in 27 bays of steel frame construction.

There are ten 6-ton three-phase Héroult furnaces; each furnace has its own 1,500-K.V.A., 13,000/100-volt, three-phase, 25-cycle, water-cooled, oil-insulated transformer; the electrodes are controlled by Thury automatic regulators, although hand regulation is provided for as well.

During the war this plant melted steel scrap—borings and turnings from munition factories—into steel billets for making shells, and the plant of the British Forgings, Ltd., includes also a large forging shop equipped with six 500-ton hydraulic presses.

Altogether this entire works took about 20,000 H.P. to operate it, power being obtained from the Toronto Hydro-Electric system, which purchases in bulk from the Hydro-Electric Power Commission of Ontario; at present the works are for sale, and are being largely advertised in Canadian and American journals.

THE FIELD OF THE ELECTRICAL CONTRACTOR.

By DONALD SMEATON MUNRO.

In these days of the settlement of frontiers, it should not be impossible to define a just boundary between the spheres of the electrical contractor and of the manufacturer with his selling agencies and factors.

This is an old grievance, for it is a long time since the contracting frontier was violated by the wholesale men. At times a better feeling prevailed, but there are ominous signs of a renewal of hostilities.

If the contractor be merely an injurious middleman, there is no more to be said. Contractors, however, may claim that they did great service not only when the foundations of the electrical industry were being laid, but in building up its structure. Most of them are men of experience, and many have had excellent technical training. This great body constitutes an ideal selling agency, in local and daily touch with the needs and fancies of the purchasing public. Yet if some of the wholesale people had their way, the contractor's domain would be reduced slice by slice until its occupants became a group of petty wiremen struggling for a livelihood with the inferior class of plumbers, ironmongers *et hoc genus omne*. Were this policy to continue, the final result would be an unexpected disaster to the wholesale trade. It is a poor invasion which cannot find some justification for its high-handed proceedings, and it may not be irrelevant to consider a few of the pleas advanced.

1. Messrs. Manu. Factors, Ltd. (symbol here adopted to economise space) find that their accounts are more surely and quickly met by certain large consumers than by the average contractor.

The reply to this is, that the financial struggle of the contractor is mainly due to the very invasion which this article seeks to stem. You cannot annex the richest fields without impoverishing those who lose them. To a certain extent, however, contractors finance Manu. Factors, Ltd., because many consumers do not pay for their installations until very long after the contractor has paid for the goods.

2. Messrs. Manu. Factors, Ltd., think to save all, or part, of the contractors' profit margin. It would be easy to show that this hope is a fallacy. It is, however, unfair to contractors, who hold stocks, employ skilled labour, and do good work for their discounts, and their extinction in any branch would result in a vast increase of selling cost and much less selling efficiency. No one is likely to work so hard as the man whose capital is at stake.

3. Some contractors are supposed to favour cheap foreign goods. If this were so in the old days, it will not be so in future because of the healthy change in public feeling about home manufactures—unless the contractors are driven to buy goods made abroad for the purpose of repelling the trespasses of Manu. Factors, Ltd. The contractor has to live by his local reputation, and his selection of articles to sell is a protection to the consumer against the plausible tongue of the casual commercial traveller. It was the foreign manufacturer and his local agents, however, who began the invasion complained of.

4. Messrs. Manu. Factors, Ltd., go to the expense of sending out commercial travellers—ostensibly to the trade. If any one contractor does not buy the goods of Messrs. Manu. Factors, Ltd., why should not the wholesale traveller sell direct to the important customers of that contractor? The traveller thirsts for immediate results.

This is a case of heads M.F. wins; tails contractor loses. No contractor can buy everybody's goods all the time. Neither can a manu. factor expect to receive orders from all the contractors of a district, but should reasonably be content with his share of business gradually acquired. If this principle of item (4) were to prevail, then in a town or district of ten contractors on whom ten manu. factors were calling, each contractor might have nine hostile "wholesale" travellers competing with him.

The only way to meet this is for all the contractors to combine against a manu. factor who pursues this policy. If Messrs. Manu. Factors, Ltd., desire to cultivate the retail trade no one can hinder them; but it would be unreasonable for them to expect any assistance from contractors.

In many cases there would be no harvest for the more grasping manu. factor to reap if contractors had not prepared the soil and sown the seed.

5. Messrs. Manu. Factors, Ltd., find it useful to establish local agencies. They may expend much money on these, on handsome showrooms, extensive stocks, and shop window show. Why should they not sell to the public so long as they charge retail prices? Against this it may be urged that they would not so readily find it profitable to do so if they were not subsidised by the orders from contractors. This gives them the additional advantage that, in the course of the legitimate wholesale business, they become acquainted with the names and needs of the retail customers of their proper clients.

6. Messrs. Manu. Factors, Ltd., have graciously agreed to sell only to people who have an electrical staff. Even if this arrangement were rigidly adhered to by the local agencies, its value is reduced to the vanishing point by the adopted definition of the phrase "an electrical staff." There are now few works or warehouses or clubs or hotels, &c., which do not have at least an elevator attendant or fuse-replacing porter who (when suitably pressed) will call himself an electrician. Manu. Factors, who do not wish to play the game, consider this quite sufficient for their purpose. Thus whenever contractors develop a town sufficiently they may have to carry on their trade against the competition of hosts of wholesale (?) travellers. First their profits are cut down, then all their good customers are lost, then Manu. Factors, Ltd., are very angry because a contractor does not send them good orders and pay promptly. When the weaker contractors are reduced to a helpless condition they may be financed by Manu. Factors, Ltd., and become really a cover for the more shady transactions, permitting the wholesale practically to carry on an extensive retail trade.

These latter points apply specially to the agencies for foreign goods.

To meet the questions raised by No. 6 the contractors should press unitedly for a fairer definition of an electrical staff. What is really wanted is to exclude the consumer from traffic with Messrs.

Manu. Factors, Ltd. This is done in nearly all other respectable trades; why not in the electrical industry? And a large consumer should not be bribed to become a nominal contractor merely to secure trade terms for his own requirements.

7. Not only every plumber, but every ironmonger, optician, store, and fancy goods shop, is sedulously cultivated by the electrical travellers of Messrs. Manu. Factors, Ltd., lest there should yet remain a small field for the business of the retail electrican.

In view of the modern growth of the multiple department business it is not so easy to suggest a remedy for this. A remedy can be found, however, if a sense of fair dealing prevail.

It would not be difficult to name further points of conflict, but those given may suffice. The electrical contractors, maintaining useful local businesses with their own capital, skill, and personal effort, are like the infantry in the line. They are essential to the successful advance of the electrical industry. There is little wisdom in turning all the heavy ordnance, tanks, and aeroplanes of the electrical army into instruments for the decimation of their own infantry.

The desire of the author of this article is to see a united industry with all sections working together, each in its own sphere, for the triumphant progress of applied electricity.

WIRELESS ARTILLERY-FIRE CONTROL.

The most important and extensive use of wireless apparatus by the Army during the war was for directing artillery fire from airplanes. Capt. G. F. Gray and Lieut. J. W. Reed, of the U.S.A. Signal Corps, contribute an interesting article on this subject to the *Electrical World*.

When the U.S. entered the war the type of transmitting set chosen for the major part of the work for this service used an alternator mounted on the wing of the airplane and driven by an air fan, the wireless apparatus being of the synchronous gap type. This fan maintained fairly constant speed independent of the velocity of the airplane. The receiving apparatus used a double tuned circuit and a crystal detector. The communication provided was entirely one-way, the airplane carrying a transmitting set only and the battery station having only a receiving set. The circuit used is of the synchronous spark type, and is shown in detail in fig. 1.

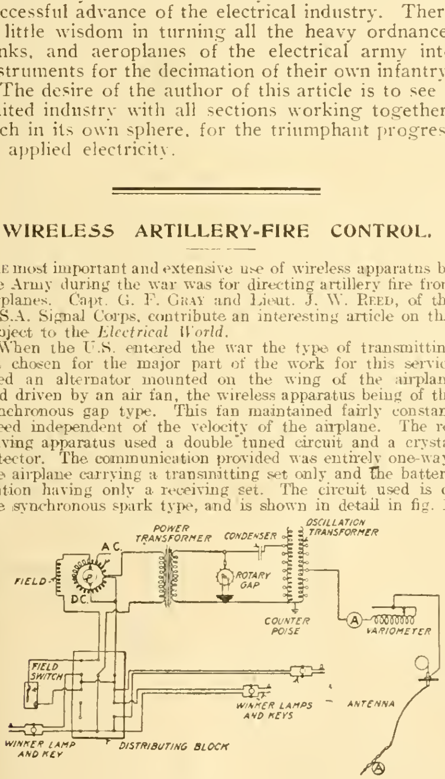


Fig. 1.—Circuit Diagram of Transmitting Set.

The generator is an inductor alternator, self-excited. The Westinghouse design has the following characteristics: Diameter, 6¼ in. (15.9 cm.); length of frame, 5⅜ in. (13.6 cm.); weight, 11 lb. (4.9 kg.); output, 335 volt-amp. at 94 volts, 900 cycles, and 60 per cent. power factor; excitation, 0.4 amp. at 45 volts; speed, 4,500 r.p.m.

A particular requirement in designing this generator was that it should always build up when the field switch was closed. It was found that occasionally in shutting down the set the condenser discharged back and destroyed the residual magnetisation of the machine. The comparatively low field voltage also led to occasional failures to build up due to brush resistance. The use of higher field voltage, a damper winding around the field poles, and a change from the simple a.c. winding shown in fig. 2 (left) to the split winding shown in detail in fig. 2 (right), which prevents the demagnetisation of the field mentioned above, entirely eliminated the failure to build up.

The wireless apparatus, with the exception of the antenna variometer, is mounted in the stream-line casing of the generator. The detail development work and the production of this material were handled principally by the International Radio Telegraph Co., and the resulting extremely simple and ingenious design is due in great measure to its chief engineer, Mr. F. H. Kroger.

The construction provides for a number of spark wheels, giving the following spark frequencies: 1,800, 1,275, 900, 600, and 450. Nine wave lengths are provided for, and by varying the coupling it is possible to reduce the output current in several steps to a minimum of approximately one-fourth of the maximum. Under normal conditions the current in the antenna is approximately 2 amp.

The stream-line casing, which encloses the wireless apparatus and provides the necessary stream-line shape for the generator mounted in the air stream, is particularly notable as an example of the possibilities of "duck micarta." It is 16 in. (40.6 cm.) long, 6¼ in. (15.9 cm.) in diameter at its open end, has walls 1/16-in. (1.5 mm.) thick, and is not only an insulator, but is stronger and lighter than an equivalent aluminium casing. The surfaces are given two coats of baking varnish to prevent absorption of moisture or surface leakage.

The antenna variometer is used for tuning the antenna to the proper wave length (the antenna ammeter is mounted in the same case), and is a simple helix of copper wire wound on a bakelite tube and provided with a suitable trolley for short-circuiting more or less of the inductance. This device and the keys, antenna reel and field switch are the only parts of the apparatus that must be mounted within reach of the operator.

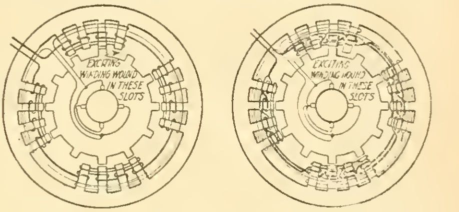

EXCITING WINDING WOUND IN THESE SLOTS
EXCITING WINDING WOUND IN THESE SLOTS

Fig. 2.—Wiring of Inductop Alternator as originally made (left); Method of Preventing Demagnetisation of Field (right).

The air fan which supplies the power for driving the generator has been considerably developed. The speed of an airplane is variable, and a fixed-blade air fan varies its speed almost in direct proportion. Since the frequency of the alternator determines the note of the spark, and as this note is depended on to enable the receiving operator to read the signals through very serious interference, there was extreme need for a constant-speed air fan. In the more successful types of regulating air fans the principle of operation is to vary the pitch of the blades by means of the movement of weighted arms, which tend to move in response to centrifugal force, and are restrained by springs, the resultant of the two opposing forces determining the angle of the fan blades with the line of flight, and consequently the ratio of air speed to speed of rotation. The weight of this set is 28 lb. (12.7 kg.).

The antenna system on an airplane generally consists of a trailing wire having a maximum length of about 300 ft. (90 m.), the "earth" connection being furnished by the metal parts of the machine, which are all bonded together.

The antenna reel has a simple centrifugal governor which limits the speed at which the antenna pays out and prevents the loss of the antenna due to carelessness. It also is provided with a removable bobbin, so that a spare antenna may be carried on an extra bobbin and installed if needed.

The floor insulator through which the antenna wire passes, and at which the high-voltage connection to the wireless apparatus is made, is either made entirely of moulded material or of micarta tubing having a suitable flange moulded in place. The importance of careful design in this insulator will be appreciated when it is understood that the high-frequency potential in this set may reach 30,000 volts.

The weight used at the end of the antenna wire consists of a number of lead "beads" ½ in. (1.27 cm.) in diameter, in order to permit of a new antenna being installed with the airplane in flight, the new weight being dropped through the opening in the fairlead.

The antenna wire itself is a braided cable made up of 16 strands No. 30 B. & S. copper, and having an average breaking strength of 60 lb. (27 kg.).

There are three keys for each set, of flame-proof construction and having very heavy knobs and levers with fairly stiff springs, since they must be used by men wearing heavy gloves, and include a small incandescent lamp connected in parallel with the contacts. If the set is in working order, this lamp glows when the key is not depressed. In addition, the lamp serves to indicate to the pilot when the observer is transmitting and *vice versa*, since all lamps wink when any key is closed. The various circuits are wired through a moulded compound distributing box, and a toggle-joint switch is used for the field circuit.

The receiving set is generally installed in the neighbourhood of its artillery battery, with which it is connected by wire telephone. In this exposed position it would often be undesirable to supply charged storage batteries (hence the use of vacuum-tube detectors and amplifiers was impracticable), and the set was designed to use crystal detectors, galena or silicon being generally specified. The circuit used is shown in fig. 3. The buzzer is so connected as to excite the antenna circuit. This reacts on the calibrated secondary, so that the operator can adjust his set to listen for a signal of predetermined wave length without the use of a separate wave meter at each receiving station.

The antenna must be light, inconspicuous, easily erected in a short time, and adaptable to a variety of surroundings and local conditions. In general the design used is a 60-deg. "V" composed of two wires 100 ft. (30 m.) long, and mounted approximately 20 ft. (6 m.) from the ground. When trees or buildings are not available masts are required. These are made of spruce or pine wood, and the sections are joined by a socket joint, slightly conical, the two parts being made of dissimilar metal to prevent rusting together. Simple strain insulators of bakelite material and light guy ropes are also provided.

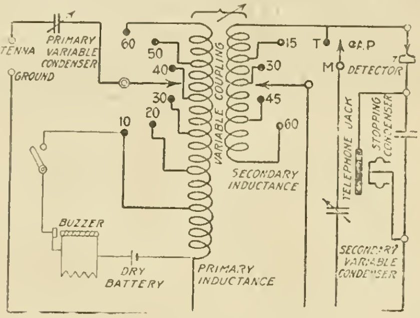


Fig. 3.—Circuit Diagram of Receiving Set.

The earth connection is generally a woven copper mat in direct contact with the earth. In other cases an insulated counterpoise wire stretched along the ground or ground stakes are employed.

Normal service for this combination requires a range of communication of at least 5 miles (8 km.). In field tests the sets here described have operated over 30 miles (48 km.), while with a vacuum-tube detector at the receiving station signals have been received from this transmitting set at 90 miles (145 km.) distance.

A ROTARY-CONVERTER INSTALLATION AT ILFORD.

An interesting installation of converting plant, involving the use of an inverted rotary converter with step-up transformer at the power house and a rotary converter supplying direct current at the sub-station, has recently been carried out by the General Electric Co., Ltd., for the Ilford Urban District Council.

The supply at Ilford is a direct-current one, and before the recent extensions was provided by a 1,000-kw. "Witton" set, shown in the background in fig. 1, and by other "Witton" generators installed in the adjacent engine room.

The district extended to such a degree that it was found impracticable to lay down more copper for feeders, and it was, therefore, necessary to consider some other means of supplying the outlying districts. This question became acute when a large Government factory in the neighbourhood of Chadwell Heath demanded a supply from the Ilford mains, and it was then decided to install a rotary converter at the power house to supply the sub-station at 6,600 volts, three-phase, 50 cycles. At the sub-station the high-pressure supply is converted back to direct current for the use of this particular firm, as well as for the district in general.

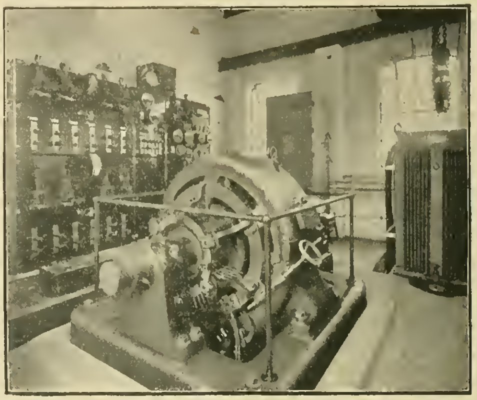


Fig. 2.—"Witton" Rotary Converter and D.C. Switchgear in the Sub-Station.

A contract was placed with the General Electric Co., Ltd., for one 280-kw. rotary converter complete with booster, exciter, and step-up transformer, together with the necessary switchgear at the power house, and for the rotary converter, transformer, and switchgear at the sub-station.

The rotary converter at the power house is of the "Witton" standard type for inverted running, and starts up from the D.C. side; when working off a 480/520-volt D.C. circuit, it gives an output at the terminals of the transformer of 250 kw.

The high-pressure switchgear consists of a G.E.C. standard boiler-plate cubicle equipped with the usual G.E.C. instruments, as will be seen on reference to fig. 1. The D.C. panel is of standard type.

At the sub-station the three-phase current is brought in by means of a three-core paper-insulated cable direct to a H.T. switch cubicle similar to that at the power house, and thence through a step-down transformer to the rotary converter. This machine is similar to that at the power house, with the exception that it has no exciter, as it is not arranged for inverted running; but it is fitted with a starting motor for starting up from the A.C. side on the self-synchronising method devised by the General Electric Co., Ltd. The converter, which is shown in fig. 2, supplies direct current at 480/520 volts to the network through the switchgear seen in the same view. This switchgear is a typical example of a plug board, and was constructed specially to the instructions of Mr. A. H. Shaw, M.I.E.E., M.I.Mech.E., engineer to the Council, who kindly gave permission for the photographs to be taken and for this description to be published.

In addition to the foregoing, the General Electric Co., Ltd., has received a contract for further extensions at the Ilford Urban District Council power house, including a 2,000-kw. Fraser and Chalmers turbo-alternator, 1,000-kw. "Witton" rotary converter, transformers, five-panel truck-type H.T. switchboard, and the necessary L.T. switchgear.

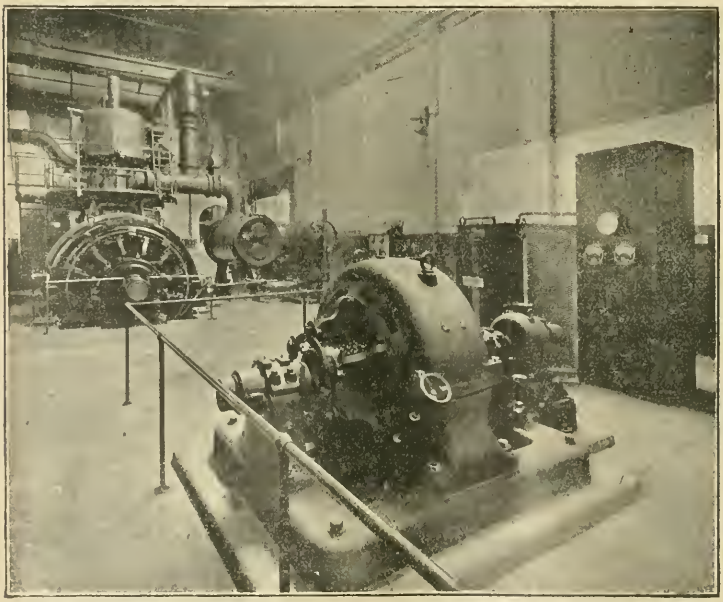


Fig. 1.—280-kw. "Witton" Rotary Converter and H.T. Switch Cubicle in the Power House, Ilford U.D.C.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Meters for Small Currents.

I have only just noticed in your issue of November 29th last a letter written by Mr. R. H. Barbour, in which it is contended that the commutator type of ampere-hour meter is the meter "par excellence" for small currents. While I do not wish to enter into any controversy between Mr. Barbour and Mr. Stubbings regarding the relative merits of the mercury and commutator types of motor ampere-hour meters, I strongly join issue with anyone who contends that the ampere-hour motor meter, whether it be mercury or commutator type, is the meter most suitable for small currents.

The reason is to me obvious, inasmuch as the makers, in their effort to reduce the losses in the meter, do so only at the sacrifice of low starting current. When it is considered that a five-ampere meter having a full-load drop of one volt is frequently called upon to register the amount of current used by a 25-watt lamp, it can hardly be wondered at that the meter after having been in service for some time refuses to start, the drop across its commutator being only 0.02 volt on a 230-volt system.

I refer especially to conditions such as obtain in Australian country towns, where public supply undertakings are installed in townships of 200 and 300 inhabitants, and where meters cannot receive the expert and constant attention which would be accorded them in a larger concern.

I have had very considerable experience with these meters, and have come to the conclusion that the type is not suitable for small consumers, an electrolytic meter being the only type permissible.

Gerald B. Lincolne,

Melbourne, *March 13th*, 1919.

Fault Localising.

On looking over the article on fault localising in the REVIEW of April 18th, I note that in the remarks on the Murray loop test, the contributor points out the complications introduced into the test by the use of connecting leads to the slide wire, and states that if the galvanometer is connected across the cable ends of these leads, then if the leads are of equal resistance they can be ignored, as they do not affect the balance point. A little reflection will show that this is not the case; it is possible, however, to allow for the leads in the construction of the bridge, where the bridge consists of a wire stretched along a scale; then if this same scale is used, the wire is shortened at each end by an amount, which will leave the resistance of the slide wire and connecting leads the same as that of the slide wire alone before making the alteration. In using the bridge, assume the wire to be of the original length, and the balance point is read off on the scale. I find the best method of finding the length of slide wire which has the same resistance as the connecting lead is by passing a current through the lead and slide wire, then taking the drop across the lead; now find the position on the slide wire where the drop from the junction of lead and wire is the same as that of the lead. The lead is now attached to the slide wire at this point, and the other end is treated in a similar manner. The only limitation to the use of this set now is that in the event of a fault being near the testing station it may not be possible to get a balance on the wire; this point can be found by pricking through the insulation of the lead at various points, then measure carefully the length of lead to this point, and calculate the divisions of slide wire that this length is equal to; it is well worth while to divide up the length of the lead into as many divisions as were cut off the slide wire, bare the wire at those points, and tape up.

J. F. F. Dalston.

[illegible]h, *April 22nd*, 1919.

I should like to draw attention to the fact that a portion of the article on "Fault Localising: A Few Hints," by H. Bujama, appears to be rather misleading.

There is no doubt that the resistances of leads and connections introduce considerable errors if they are included in the unknown arms of the bridge, and it becomes necessary to use a formula for correction, especially for low-resistance cables.

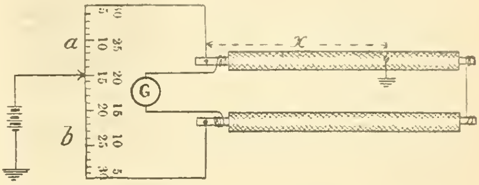
To eliminate this trouble, the writer suggests including the resistance of the leads in the ratio arms, and claims that, provided the leads are of equal resistance, the point of balance is unaffected.

In the first place, it is not good practice to include temporary leads and connections in the ratio arms, especially if the latter are of low resistance.

There is only one possible position of the slider in which the resistance of the leads will have no effect on the point of balance, and that is when it is exactly midway between the two ends of the slide wire, thus giving a one-to-one ratio. If, however, the ratio arms a, b are unequal, say $a/b = 2$, and calling the resistance of the leads d, then, according to the writer $(a + d)/(b + d) = 2$ also.

It is obvious that this equation only holds good when a and b are equal, and, furthermore, the greater the difference between a and b, the greater will be the error.

This difficulty can be overcome by making the leads to some known convenient resistance, and commence marking at one end of the slide wire from this value instead of from zero; then the ratio may be read directly in terms of a and b.



In the figure the resistance of the leads is represented by five scale divisions of the slide wire, and the numbering of the divisions is so arranged that a and b may be read directly. This method has the disadvantage of placing metals having different temperature coefficients in the ratio arms.

A. E. Underdown.

London, S.E., *April 23rd*, 1919.

Trouble with Magnetos.

I should deem it a great favour if you could let me have, *viâ* your "Correspondence" Columns, the opinions and experiences of any of your readers in any case where the "make" of magneto on an internal-combustion engine had any relation to the expended H.P. Of course, when I say "make" of the magneto I mean its construction, and I presume that each manufacturer's article must give a different quality of spark.

On the M.T. Co., where I at present am, I have had a deal of trouble with one make of "bus" particularly; the trouble started thus: The lorry was originally fitted with a Bosch magneto; this, however, one day broke down, and, being unable to get spares immediately, I had to put on another make of magneto, it being, however, a dual system, and one very well known (though not Bosch). After a day or two on the road the drivers complained that they could not get up hills without switching over on to the battery. The magneto was taken off and inspected, and was found to be perfect, and was, indeed, put on another lorry, where it has been for six months. Three or four makes of magnetos were tried on the offending "bus," but all to no avail; the complaint was still the same—"She won't pull." One day, however, along comes a Bosch magneto, and I put that on, and lo and behold! "She's as good as ever."

The particular engine has a very high compression, and the plugs are on the sides of the cylinders. The point on the stroke when the spark occurs is the same for every magneto fitted, the engine itself running with fixed ignition, which, if I remember rightly, is 7 deg. before dead centre.

I have had this experience with one or two other makes of lorries, but it was never so pronounced as in the case I mention. I should very much like to know if any of your readers have experienced the same difficulty, and if any can offer an explanation.

Sparx.

B.E.F., France, *April 21st*, 1919.

Searchlight Equipment and Operation.

I have read with interest the article in this week's ELECTRICAL REVIEW by Mr. H. M. Goody on the above subject. There is one point, however, which is either incorrectly stated, or stated in such a way as to be misleading. Mr. Goody states that a number of rays reflected from the mirror are divergent, that they strike the side of the barrel, and are reflected thence through the front screen, making a widely divergent cone of light apart from the main beam, and that concentric rings are fitted to stop all but the parallel rays of light. Now the rays from the mirror are unavoidably divergent, the divergence depending on the diameter of the crater and the focal length, this, however, within the limits of 2½ deg. to 3 deg. is an advantage, as a perfectly parallel beam would be only the diameter of the mirror, and consequently too small to find a target with, or illuminate sufficient of it to be of use should it happen to strike one. It will be seen, therefore, that the concentric rings are not to stop the divergent rays from the mirror, which are necessary to efficient working, but to stop the widely divergent cone mentioned by Mr. Goody. This cone, however, is not from the mirror at all, but is caused by direct rays from the negative carbon, which diverge in the form of a cone, the outside edge of which is a line drawn from the negative carbon tip to the edge of the front window.

J. A. Chapman.

Finchley, *April 25th*, 1919.

"Rules" for Electricity Supply.

Your welcome notes in this week's Review come at a time when supply authorities are going still further with their rules, regulations, and charges, to the detriment of progress; we give a few instances:—

The Hendon Supply Co. for some years have insisted on heating plugs being purchased from them. The company are contractors in the full sense of the word; whilst they test and pass their competitors' work, they have the privilege of passing their own.

The company, together with St Pancras (who demand "Z" fuses only), Marylebone, Willesden, and Hampstead, that we are aware of, although the restrictions on service mains were raised on January 10th last, have up to the present time made and do now make unauthorised charges for the regulation length of service main. Willesden have during the last week advised us that they will not make any charge in future.

We would refer you to a letter on this subject written by Mr. Tweedy Smith, the solicitor to the Electrical Contractors' Association, in last month's edition of the *Electrical Contractor.*

These charges range from £5 to £20, and the consumer pays or gets no supply.

Watson Marsh & Co. (Hampstead), Ltd.

London, N.W., *April 26th*, 1919.

The Southampton Appointment.

When one's disgust has somewhat subsided after reading the Mayor of Southampton's explanation in connection with the suggested appointment of Mr. H. S. Ellis, of South Shields, one begins to seriously consider how much this mode of procedure is in vogue, and how many similar appointments have been made, and afterwards advertised in the "usual manner," with the usual warning, "Any canvassing of the Committee will be deemed a disqualification"! One can almost discern a smirk of conscious rectitude on the advertiser's lips as he delivers himself of this final adjuration. Seriously, Sir, if electrical engineers are to uphold the high prestige which their profession enjoys, I suggest that the only course for the I.E.E. to follow is to immediately declare a boycott on Southampton, until such time as those responsible for "creating this precedent" are replaced by men of integrity and honour.

No Influence.

April 28th, 1919.

The Lighting of Pusey House Chapel, Oxford, and of the Institution of Civil Engineers' Lecture Room.

I note with interest articles and letters in your April 11th issue on the above. On page 401 of the April 11th issue, the lighting of Pusey House Chapel, Oxford, is described. This article contains a statement of the efficiency of the lighting installation which calls for comment. Tables are given showing the lighting efficiency as expressed in watts per sq. ft. It should be clear to anyone that such values mean nothing, given as they are, without any statement of the illumination intensity. An expression of the efficiency of lighting must state the foot-candle intensity per watt per sq. ft., or in simpler form the lumens per watt. In brief, any data purporting to give the efficiency of a lighting installation must take into consideration something more than energy expended per sq. ft. One might give any figures one liked for the watts expended per sq. ft., as long as the degree of lighting intensity was not stated. This point appears to be totally disregarded in the article in question, and is a serious omission, invalidating as it does the data given, and the conclusions or claims put forth for the work.

I would also comment on the editorial note made to Mr. G. E. Moore's letter on page 405 of the April 11th issue. Mr. Moore's letter calls attention to the scientific lighting of the House of Commons by skylight effect from luminous panels in the ceiling of the room. Your editorial comments remark as to the possibility of being "too scientific," and you instance the disappointing results obtained in the lighting of the lecture room of the Institution of Civil Engineers. This is an unfortunate installation to put forward as a sample of illuminating engineering, as it is certainly not a good example. The trouble in this case is that too much has been attempted with too little. The lecture room in this institution is a very long and wide room, and an attempt has been made to light it with lamps placed behind the cornice around the room. The result fails because it is not possible to illuminate a room having the length and breadth of this lecture room by cornice lighting. Cornice lighting can only be successful where the width and length of a room does not exceed a given maximum.

The defects of the lighting of the Civil Engineers' lecture room could be corrected, and the indirect lighting made a perfect thing of its kind by the installation of a few indirect fittings, of suitable size and type, suspended from the ceiling, thereby supplementing the insufficient cornice lighting, in the main or central portion of the room.

It is unfortunate that the Institution of Civil Engineers has repeated the same unsuccessful form of installation as had been tried at the Institution of Electrical Engineers' lecture room. Such bad examples, which fail by their insufficiency, when allowed to continue uncorrected, tend to cause prejudice in many people's minds against indirect lighting—a form of lighting which, when properly designed, gives a most agreeable, effective, and satisfactory illuminating result.

F. W. Willcox.

London, E.C., *April 28th*, 1919.

[We refer to this matter in a leaderette.—Eds. Elec. Rev.]

The L.P.E.A. Award.

Mr. Connaught T. Smith's remarks on the above award in your issue of the 25th inst. caused me considerable surprise, and I sincerely hope that there are not many undertakings whose technical staffs have so far received "specious promises" only.

I recommend your correspondent to get into touch with Mr. Faraday Proctor, The Exchange, Bristol, who generally knows all that is worth knowing on this and other matters concerning the welfare of our industry, when no doubt he will find that the undertaking he is concerned with is in a very small and unenviable minority.

So far as this undertaking is concerned the committee carried out the terms of the award to the letter immediately the award was given.

R. Sidwell.

Bath Corporation Electricity Works, *April 28th*, 1919.

I am certain many engineers are being forcibly brought to the same conclusion as Mr. Connaught T. Smith when considering the attitude of the above association. It is with regret that one has to bring censure upon the union which has such excellent principles and intentions, but up to the present very little has been done to make these intentions bear fruit, and to place the members on a financial basis in accordance with their professional responsibilities.

Promises have been made from the time of its inauguration, but what are wanted are not promises, but definite action and results.

The basic-rate question has been on the agenda for months and still months pass without the faintest hope of a settlement, and when this time arrives, where are the mandatory powers to compel the councils and employers to pay the agreed rates? The same trouble will arise over this, as occurred over the belated 20 per cent. + £90 bonus, which apparently has not been settled in Mr. Smith's case.

When one considers these facts, one comes to the conclusion that there is obviously something wrong with the methods of an association which can only bring about a bonus, so many months after a bonus was justified. I do not know where many central station engineers would have been (financially), but for the action of the non-technical unions in the matter of bonuses, for in many cases staff engineers fortunately, participated in these.

There undoubtedly seems to be a want of system, ability to negotiate, or strength of mind when important matters, like the above, are being dealt with.

I think central-station engineers know what councils do with their employés (both technical and non-technical)—nothing, until pressure is applied.

It is absolutely no good attending a conference of councillors and chief engineers with kid gloves on, to discuss basic rates or bonuses; one has to go prepared to fight and to fight with a firm hand.

The feeling at the high court of justice (injustice?) is that the E.P.E.A. members are a very decent set of fellows, and would never think of doing anything drastic.

They will remain so if they are treated fairly, but I think my brother engineers will agree that patience can be tried too long.

Nil Desperandum.

London, N., *April 26th*, 1919.

A Demand Better than 100 per cent. Load Factor.

The hope of very general adoption of electrical heating and cooking apparatus will be difficult to realise unless we strive to popularise the application of thermal storage.

It is difficult to understand why the importance of cultivating the water heating load is not better appreciated by managers of supply undertakings with, perhaps, the solitary exception in this country of Mr. Bell, of Hammersmith, who essayed useful pioneer work with his thermal apparatus, which was handicapped by being manufactured on too complicated and expensive lines, and by claiming for it more than it was practicable to achieve.

If we consider the case of a small household of four persons, who are already in the habit of availing themselves of the public baths, then a daily supply of ten gallons of water at 150 deg. Fahr. will be amply sufficient for that household. If the tank, sink, and lavatory basin are so located as to minimise heat losses from pipes, then it is possible to get this hot water supply with a 180-watt heating element in the ten-gallon lagged tank, on the assumption that it is left in circuit for 22 hours per diem, and cut out by means of a time switch at the peak period. Cost: 1s. 2d. per week at 0.5d. per unit.

This would surely be a highly desirable load to cultivate, and when the industrial classes have learnt to appreciate the convenience and economy of a supply of electrically heated water, then the system will extend, and a very important change in the character of the load curve will result.

Water for tea and cooking would be drawn from the hot supply and boiled up on the electric stove, which latter and the oven may also involve the principle of thermal storage, but of this, more anon. In the meantime, I would like to learn the views of supply authorities as to the advisability of encouraging a demand that would be better than 100 per cent. load factor. I mean an off-peak demand.

C. Orme Bastian.

London, W., *April 28th*, 1919.

COAL CONSERVATION.

In his third Cantor lecture on this subject at the Royal Society of Arts on March 24th, Prof. W. A. Bone, F.R.S., dealt with the question of power supply in relation to schemes of reconstruction. He said that in the opinion of many competent judges, the question of increasing and reorganising the supply of power for industrial purposes was one of the most important problems which the country would have to undertake during the coming decade of reconstruction. It might be expected that those who were alive in 1930 would see in operation a comprehensive scheme of public power supply and distribution on co-operative lines, so organised and administered that every power user in the country would have the right to participate, according to the magnitude of his requirements, on the same terms and conditions as all others. Important industrial and social consequences would follow. There was installed throughout the United Kingdom between 10 and 15 million H.P. According to the 1907 Census of Production, of the total capacity of prime movers, 26 per cent. was associated with electrical plant, and about two-thirds of this was engaged in public utility services. In that year public utility services were practically all electric, whereby power was generated co-operatively, and the average load factor was only about 16 per cent. The individualistic basis upon which practically the whole of the mechanical power was generated in this country during the 19th century, was the outcome of the natural limitations under which the steam engine and the boiler laboured unless associated with the dynamo, which was invented much later than the steam engine. It was the invention and development of the dynamo and electric motor that made it possible, at the beginning of the twentieth century, to organise big public power schemes on the principle that the power required in a given industrial area should be generated where it could be most economically produced.

If it were agreed that power was most efficiently applied to industry through the medium of electricity, then undoubtedly there were great advantages to be gained in the way of cheap production by the co-operation of consumers with properly organised electric power schemes operating over large industrial areas. No other country in Europe was so well adapted as our own for such co-operative schemes, because of the compactness of our industrial areas, the densities of their population, and their proximity to the coalfields. If all the manufacturers in such areas were linked up with a few large and efficient power stations, instead of having their own independent and inefficient power plant, and supposing the electricity supply authority purchased the surplus gas, waste heat, and exhaust steam from its customers, and converted it into electricity, it was fairly obvious that greater economies would be achieved than would be possible under any purely individualistic scheme.

Everyone was agreed that our colossal war debt could only be paid off by vastly increasing the productivity of labour, and it was only by increasing the amount of power used per worker that the net output of the individual worker could be increased. By net output he meant the value added by the worker to the material he operated upon, *i.e.*, the selling value at the factory minus the cost of the material used. Clearly the worker could not be paid more in wages than a certain proportion of the value he added to the materials, and if he already received a fair proportion, he had no justifiable ground for demanding more unless or until he increased his net output. Hence it followed that if net output, and consequently wages, were both to be increased, more power per worker must be employed in industry.

There could be no doubt that before the war power was generated very inefficiently in this country. There were grounds for believing that the consumption of fuel was not less than 5 lb. per B.H.P., and that meant that on the average we were only utilising about 4 per cent. of the available energy in the coal burned, the other 96 per cent. being wasted. That alone ought to make us profoundly dissatisfied with the present system. He had always believed that in the long run the principle of co-operative power production in a densely populated industrial country like ours would become the accepted custom, and if that principle was accepted, there seemed to be no other really effective way of putting it into operation except through the medium of electricity. If he wanted heat, except for very special purposes, he would certainly use gas, but for power for industrial purposes he would certainly use electricity. For heating purposes electricity must be ruled out. He said this to show that he was not an advocate of electricity as a panacea for everything.

The production of power was becoming more and more a specialised process. When coal was being burned on a large scale, for special purposes, there was a science of combustion and of heat transmission, a very complicated science, and they must train up men who would make it their business to study the thing specially. Further, the most economical generation of power was only possible with larger units and a better and more economical load factor than most individual establishments could employ. In large power stations, equipped with the largest and most modern units, superintended by specially trained fuel and power engineers, it was possible to burn under the boilers with good average results, inferior grades of coal, whilst the recovery of by-products would be more feasible in connection with such stations than with small private plant. If by this means an efficiency of only 10 per cent. was got out of the fuel, that was better than leaving it at the pit never to be used at all. That was a point which the critics of the recommendations of the Coal Conservation Sub-Committee overlooked. They seemed to assume that the best steam coal was going to be used in these power stations. On the contrary, a fuel would be used which but for such a scheme would never be used at all, and in that way it would facilitate the export of the best coal, which was necessary having regard to our great foreign debt. The next point was that co-operative electrical power production would facilitate the development of rural industries, and greatly assist small manufacturers. Further, cheap electrical power throughout the country would mean that an electric motor would become part of the equipment of every house, a great boon to overworked housewives, and one which was bound to have important social consequences. He was not looking at this matter from the narrow point of view of the exponent of gas or the exponent of electricity, but from the broad point of view of public policy.

Having outlined the proposals of the Coal Conservation Sub-Committee, Prof. Bone discussed the choice of prime movers. During recent years such great advances had been made in the development of the steam turbine that it had for the time being out-distanced the gas engine as a power-station machine, except for small units of, say, 300 B.H.P. capacity. From the point of view of thermal efficiency, there was little to choose, the figure in both cases being about 20 per cent., when both were working under the best conditions, but from the point of view of the size of units, the turbine had shot far ahead of its rival. On the other hand, for comparatively small units, where the load factor was uniformly high and not subject to abrupt variations, the gas engine had certain advantages. The choice between the two types, however, would not turn on purely thermal considerations, but on other equally important factors.

The public seemed to have run away with the idea that it was proposed to put up generating stations near the collieries. That was not stated in the report, and it was not necessarily so. It all depended on the circumstances. It might be advisable to put the power station at the colliery, or in another place where there were better facilities for condensing water. If a low-grade class of coal was to be used which would not stand transportation, that would be a reason for going to the colliery, but the position of the power stations was a matter which must be decided according to local circumstances. An adequate supply of condensation water was most important, and a good many power stations had been crippled because that had not been taken into account.

He thought there had been some misunderstanding on this matter. Prof. Cobb, in an article in the *Edinburgh Review*, and Sir Dugald Clerk, in his paper at the Royal Society of Arts, the previous week, said that the best electric power station was working with an efficiency of only 13 per cent. Something better than that could be shown. One of the large power stations in this country working on an inferior grade of coal of 10,500 B.TH.U. per pound, had a coal consumption corresponding to 19,500 B.TH.U. per KW.-hour sent out from the station. That gave an efficiency of 17½ per cent. He was also informed that in a large super-station now in course of erection in the country, and which would probably be in operation by the end of the present year, no more than 16,000 B.TH.U. would be expended per KW.-hour sent out, which would give an efficiency of 20 per cent.

Some of the criticisms of the recommendations of the Coal Conservation Sub-Committee seemed to suggest that the members of the committee were mesmerised by some influence and fell down before electricity. In the criticisms which he had seen, the most important considerations had not been referred to. The considerations which determined the opinions of the sub-committee, and certainly his own, were purely scientific and economic. Those and those alone enabled him to make up his mind to become a signatory to the principles in the report. He hoped the country would take up this matter, and have it carried out on comprehensive lines.

THE LABORATORY AND THE WORKSHOP.

At the annual general meeting of the Institute of Metals, on March 26th, Dr. W. R. Barclay discussed the relationship between the laboratory and the workshop. He pointed out that since the laboratory was a "place where scientific experiments were carried out," and every branch of human industry fundamentally was "applied" science, the ultimate basis of both laboratory and workshop was the same. The keyword as to their relationship was therefore, "co-operation." Essentially they had the same principles of operation and the same objects of accomplishment. The scientist in the laboratory, the workman in the workshop, equally relied on the immutability of the laws of nature, chemical or physical. To the workman this was not always clear, but in point of fact he also, like the scientist, was something of a mathematician, a chemist, a physicist, and a geologist, though rarely realising the fact. And the objects of both laboratory and workshop were, or should be, the production of that which should be of service to the community. They were both links in the chain binding organised communities of men and women together, and making possible our modern civilisation. Only when all the implications of this were fully understood could both be efficient.

In industrial practice this should be the ideal. The works laboratory would then be continuously reinforcing the works foundries, shops, mills, and plant. The laboratory should examine not only all incoming and outgoing materials used or produced, but also the efficiency of works processes and methods, and should study the human factor in industry, seeking always to render workshop life less irksome. It should further act as the works intelligence department—ever on the alert for new discoveries, tapping all sources of experience and knowledge, and endeavouring to apply these to the particular industry in which it was concerned.

The laboratory staff should always include an engineer or a scientist with considerable engineering knowledge. Too often it was considered to be the domain of the chemist alone; yet every branch of applied science should be its concern. Above all, however, it should seek to establish the completest sympathy with the skilled workman. Often he was a severe critic of the laboratory, but let the spirit of helpful criticism on both sides be encouraged, and the scientist would often learn as much as he could teach.

Labour was going to take a much more prominent part in the management of industry than before the war. This would be a movement in the right direction, if this spirit of co-operation in respect of the scientific progress of industry was developed, and the scientific staff of the works could accomplish much by the exercise of tact and judgment. The secret of success in handling men was to get them to take an intelligent interest in their job.

The author believed that sooner or later we should develop on these lines—in spite of the dark outlook that sometimes appeared, as we read and heard of strikes and syndicalist movements, and general industrial unrest. After all the world would go on, and the continuance of life depended upon the continuance of production; wars or no wars, revolutions and counter-revolutions notwithstanding, we must hammer out some system for the carrying-on of industry.

The young technical man of to-day had a great life before him. It would mean work, hard work, but it would mean living and not rusting. And experience showed that the joy of life lay in the full use of it.

Dealing with "The Scope of the Works Laboratory," Mr. F. C. A. H. Lantsberry, M.Sc., said that the future industrial prosperity and commercial supremacy of our whole Empire depended to a very large extent upon the application of science to industry. Now there was a desire on the part of manufacturers to possess laboratories with an efficient staff, and there was the will to succeed on the part of the staff. So long as the two could adopt the right attitude towards each other, success was assured. Right from the outset the laboratory staff should recognise that the works was not a philanthropic institution. The success of a laboratory depended upon its being able to turn its activities and accumulated knowledge into money, and was not in any way proportional to the product of the number of chemical estimations and the number of mechanical tests it could do in a specified time. The manufacturer, on his part, must be imbued with the right scientific spirit, and must be prepared to take the laboratory into his fullest confidence. It must be recognised that the task set was a most complex and difficult one, and one which was not rendered simpler by the fact that its activities were bound to meet with a certain amount of opposition born of prejudice. The scientific worker must be given a status which was at least equal to that of the barrister, lawyer, or doctor. And, after all, why should it not be so, for was not his training as rigorous? The manufacturer must recognise that to the scientific worker a knowledge of chemistry, physics, the principles of engineering, mathematics, metallurgy, drawing, geology, and modern languages were absolutely essential. Was the man who had the intellect and patience to acquire a knowledge of these subjects to be treated lightly? The success of a laboratory depended on: (1) Possession of a proper equipment, which included an ample number of properly trained scientific workers; (2) mutual existence of the right attitude of mind between the works and the laboratory, and (3) complete confidence and sympathetic assistance of the management.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Hart Starter and Lighting Battery.

The Hart Accumulator Co., Ltd., Stratford, London, have introduced a starter and lighting battery, type "M.S.L.," which is interchangeable with the starter batteries fitted in most American motor-cars, and is specially designed to discharge at very high rates without injury, while the internal resistance is very low. A "ghost" view of one of these batteries is given in fig. 1, from which it will be seen that the outer wooden case is fitted with convenient handles; the cells are contained in strong ebonite boxes. These batteries are made in two sizes, giving 6 and 12 volts respectively.

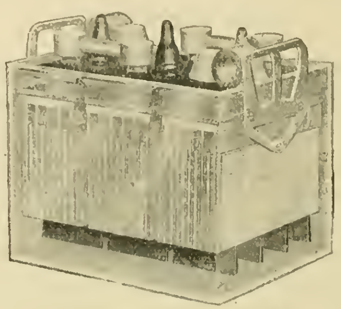


Fig. 1.—Hart "M.S.L." Type 6-volt Starter and Lighting Battery.

"Xcel" Heating Apparatus.

A large company which has been engaged on munition work during the war has turned its attention to the manufacture of electric heating and cooking apparatus, which will be of entirely British manufacture. It is its intention first to specialise in the popular table lines, previously imported from abroad, and the iron here illustrated is the first article put on the market. This iron is said to be of the highest finish, and to have many excellent points, amongst them being a replaceable element, special connector with insulated rod, taking up the slack in flexible, permanent stand at back, &c.

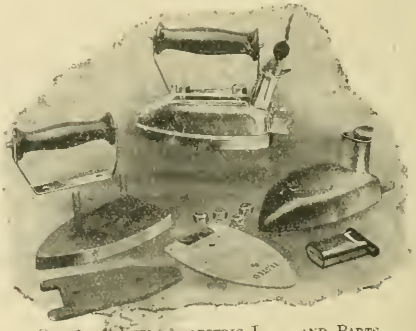


Fig. 2.—"Xcel" Electric Iron, and Parts.

The products of the company will be known under the trade name of "Xcel," and the whole of the output will be marketed by the following firms, to whom all inquiries should be addressed:—

Berry's Electric, Ltd., 86, Newman Street, W.
Downs & Davies, 1-3, Stanley Street, Liverpool.
Drake & Gorham, Ltd., 67, Long Acre, W.C.
Siemens Bros. Dynamo Works, Ltd., 39, Upper Thames Street, E.C.
Sun Electrical Co., Ltd., 118, Charing Cross Road, W.C.

Priority Closes Down.—The Priority Department of the Ministry of Munitions is being closed, and Lieut.-Col. A. H. Burgoyne, M.P., has relinquished the position of Controller of the department.

BUSINESS NOTES.

Export Licences.—It is officially announced that His Majesty's Customs have now been instructed that all export licences are to be considered as of unrestricted validity, even though a time limit for shipment may be stipulated therein.

Fire.—About £1,000 damage was caused by fire at the electric light power house at Tarvit, near Cupar, Fife. The plant was totally destroyed.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for April 25th and 29th.

British Transport Charges.—The Traders' Traffic Conference of Birmingham has addressed a letter to the Prime Minister, the President of the Board of Trade, the Home Secretary, Mr. Bonar Law, and Sir Eric Geddes, urging the seriousness of a statement made by Mr. Bonar Law, on March 23rd, from which it appeared that the Government contemplated a general increase in the rates charged by the railway companies for the conveyance of merchandise over their lines. Members of the Conference view with grave apprehension the possibility of any increase in the already high charges for transport which exist in this country. It is generally admitted that these charges are substantially higher than those operating in competing countries, and one of the urgent needs of to-day, if the commerce of this country is to be successful and unemployment is to be avoided, is not higher, but lower rates, and more efficient service. The letter says:—"If British manufacturers are to be enabled to exist, if unemployment is to be avoided, and the flow of exports, on which the solvency of this country must largely depend, is to be maintained, it is confidently submitted that much more sympathetic consideration in the matter of transport will be required. . . . It is felt that any increase in transport charges at the present time could only prove disastrous, not only to manufacturers by limiting output, and to the industrial population by creating unemployment, but also to the railways themselves by preventing, at least, any increase in traffic, from which source the railways might primarily look for increased revenue." The letter further asks for an assurance that if any increase of rates is contemplated, the traders shall have an opportunity of being heard as to the effect of such increases, before any decision is arrived at.

Business Representation in Russia.—A considerable number of merchants and business representatives who formerly lived in Russia are at the present time in the United Kingdom, owing to the actions of the Bolsheviks. As a considerable part of the former Russian Empire is now available for trade, it may be that firms in this country would be glad to take advantage of the present exceptional opportunity of obtaining the services of these men, who are especially well qualified to open up trade with Russia. The Department of Overseas Trade would be glad to hear from any firm that desires to be brought into touch with the persons referred to, either immediately or later on, when trading in a more general way can be conducted with Russia. Inquiries should be addressed to the Russian and Scandinavian Section, Sunderland House, Curzon Street, Mayfair, W. 1.—*Board of Trade Journal.*

Trade Openings in Italy.—The British Chamber of Commerce for Italy (Inc.) has issued from its headquarters at Genoa a new list of openings for British articles in Italian markets:—

No. 1,662.—Tortona merchant, handling iron, steel, metals and engineering articles, seeks connections with British manufacturers and shippers.

No. 1,668.—Ex-officer (Engineer), at Cornigliano (Genoa), seeks connections with British firms interested in the exportation of industrial machinery in general.

No. 1,673.—Genoa engineer requires agency for metals, electrical machinery, machine tools, &c.

No. 1,676.—Spezia depositary agents wish to represent manufacturers of iron, steel, metals, machine tools.

No. 1,679.—Genoa commission agent has openings for chemicals, steel, engineering articles, lubricants, paraffin, &c.

No. 1,680.—Engineer at Florence seeks agencies for electrical material and machinery.

No. 1,685.—Agent at Bari has openings for machine tools, metals, &c.

No. 1,690.—Commission at Genoa agent is interested in engineering articles in general, boiler valves and cocks, pumps, agricultural machinery.

No. 1,694.—Turin engineer seeks agency for electrical sundries.

No. 1,698.—Mechanical engineer at Cagliari (Sardinia) would accept agency for cast-iron and steel water-pipes, boiler tubes, galvanised water and gas pipes.

No. 1,704.—Old established firm at Genoa would handle, for their own a/c and on commission, electric and hydraulic material, engineering articles.

No. 1,717.—Party at Novi Ligure inquires for addresses of manufacturers of telephonic apparatus.

No. 1,720.—Party at Turin would handle, both on commission and for own a/c., electric materials, &c.

No. 1,730.—Merchant at Naples would import on commission, and for own a/c, electric articles.

Welfare Work.—The Phœnix Dynamo Manufacturing Co., Ltd., have taken a lease of Grange Farm Estate, which is close to their works on Bradford Moor, with a view to having it laid out as playing fields and recreation grounds, and the farm buildings are to be adapted for use as a social club. The estate is henceforth to be known as "Phœnix Park." An annual income of about £800 per year is assured, and the scheme is under the management of Miss Matthias, the works welfare superintendent.

Coventry Technical College Scheme.—It was stated at Coventry City Council that the new technical college would probably cost £150,000, and that local manufacturers were likely to contribute £50,000.—*The Times.*

Works Dinner.—The workmen of Messrs. Ferguson, Pailin, Ltd., recently arranged a dinner at the Wheatsheaf Hotel, Manchester, to which they invited the staff management. The gathering was highly successful in bringing employers and employés closer together, and making for a better understanding between them. The chair was occupied by Mr. W. J. Freeman (works), who in the course of an interesting speech appealed to both workmen and management for tolerance. Mr. S. Ferguson (managing director) replied, and pointed out that in the great majority of cases the interests of both employés and employers were identical, and signified the willingness of the management to have the full co-operation of the workmen in the discussion of all questions in which they were directly interested. The musical part of the programme terminated with the singing of "Auld Lang Syne."

Catalogues Wanted.—The Warrington Electrical Co., Ltd., of 82, Sankey Street, Warrington, ask us to repeat their invitation to manufacturers to send catalogues, as only three have been received.

Export Restrictions.—The *London Gazette* for April 25th contains particulars of relaxations in export restrictions.

British Trade-Mark Applications.—Below we give a summary of the recent applications for British trade-marks in respect of materials and productions connected with the electrical industries:—

Britmac. No. 385,678. Class 13. Electrical fittings and accessories. C. H. Parsons, Ltd., 151½, High Street, Bordesley, Birmingham. October 17th, 1918.

Glovrit. No. 387,907. Class 8. Electric cables. W. T. Glover and Co., Ltd., Trafford Park, Manchester. January 28th, 1919.

Orbit. No. 387,346. Class 8. Electric batteries (medical). The Orbit Electrical Co., Ltd., 2, Coleman Street, London, E.C. January 6th, 1919.

Namco. No. 387,115. Class 13. Sparking plugs. Isaac E. Walton, trading as the Northern Automatic Machine Co., Byre Lane, High West Street, Gateshead. December 23rd, 1918.

Sunco (lettering and design). No. 387,061. Class 8. Electrical fittings and accessories, but not including cables for electrical purposes, dry cells, or similar goods. The Sun Electrical Co., Ltd., Neal Street, Long Acre, London, W.C. December 20th, 1918.

C C C C (four C's in leaf design). No. 388,225. Class 8. Rubber-insulated electric cables. Callender's Cable and Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. February 11th, 1919.

Velikoid. No. 386,518. Class 50. Electrical insulating materials; insulators, and insulating electrical fittings. Mr. Charles W. C. Bate, Daw Bank Works, Wellington Road South, Stockport. December 4th, 1918.

New French Electrical Companies.—There has been formed at Lyons, the Ateliers de Constructions Electriques des Lyon et du Dauphiné with a capital of 6,000,000 fr. The company embodies the old-established firm of A. Grammont.

The Société Anonyme des Etablissements Galey Frères, is the style of a new company formed at Paris, with 2,000,000 fr. capital, with the object of carrying out electric installations.

Etablissements Dubray et Lucas is another new Parisian concern, with a capital of 600,000 fr., whose scope is the general application of electricity.

Imports into Holland.—It is stated that restrictions on the import into Holland of overseas goods are rescinded, so that the Netherlands Oversea Trust has received authority to grant licences for unlimited supplies of all goods except war material. Dutch firms which have hitherto been on the black list will enjoy the same facilities for the import of oversea goods as all other firms.

Belgian Industries.—Mr. Herbert Samuel has been appointed by the British Government as a Special Commissioner in connection with the reconstruction of Belgian industries. He has a staff which includes several technical experts, and he proceeded to Belgium last week. The address of the British Commission over there will be 30, Boulevard de Waterloo, Brussels, but in London correspondence should be addressed to the Belgian Section of the Department of Overseas Trade, India House, Kingsway, W.C. 2.

Lodge Fume and Dust Recovery Plant.—The Lodge Fume Deposit Co., Ltd., of Birmingham, is going through the form of liquidation, (Mr. C. B. Flint, of Temple Row, Birmingham, is liquidator) in order that the present business may be acquired by a new company which is in course of formation, to be called "The Lodge Fume Co., Ltd." The object of the formation of this new company is to meet the increasing demand for the fume and dust-recovery plants manufactured by the company, and to develop the business on a larger scale. The new company, which will be a private one with a capital of £100,000 in £1 shares, will take over all the assets and liabilities of the old company, and the management will be identically the same as at present.

G.E.C. Sports Club Resumes.—A fairly large percentage of the staff of the General Electric Co., Ltd., having been demobilised, it has been decided that the Sports Club shall now be revived. A ground has been secured at White Hart Lane, Tottenham. The club will be pleased to hear from any of their old friends who are desirous of fixing up games for cricket or football. Communications regarding cricket should be addressed to Mr. H. O. Joseph, and for football to Mr. H. P. Wella, at 67, Queen Victoria Street, London, E.C. 4.

The Swiss Electrical Machinery Industry.—A review of Swiss trade in 1917, by the United States Consul at Basel, gives some interesting items of news regarding electrical activities during that period. The demand for electrical machinery and equipment was heavy throughout the year. As the use of gas was cut to less than half of the normal needs, and wood and coal were scarce and dear, efforts were made in private homes and in industrial plants to replace heat and power with electricity. Raw materials especially electrolytic copper, could not be had in sufficient quantities to meet the demand, and prices rose to many times the normal. Large electrical machines could not be sold or delivered without Government permits. Electrical insulations, especially high-tension insulations, were in demand. These were manufactured and sold profitably in the district and also exported to France and Italy. A new industry for manufacturing electric heaters was established, and was able throughout the year to dispose of its product. This heating apparatus is constructed of composite stone, with inside wiring, and heats during the night at a low current rate. The industrialising of the small villages has created a heavy demand for small motors. In almost every village in this district there is some kind of factory which gives employment to the inhabitants between the crop seasons. Some of the machine factories in the Basel district built to fill war orders were compelled to close, as nearly all orders for ammunition were completed, and but few contracts were renewed. The high prices demanded by Germany for iron, beginning August 1st, 1917, curtailed the profits on machinery contracted for before that time. The advance over former prices for iron deliveries after August 1st was £3 10s. per short ton, and prices continued to rise until September, when an agreement was entered into stabilising them. From the beginning of the war to September, 1917, iron of all kinds advanced from 700 to 800 per cent. Heavy construction and the electrifying of railways were hindered by these advanced prices.

Technical Men for Canada's Future Development.—An appeal for co-operation in assisting returned technical men was made by Mr. Fraser Keith, secretary of the Engineering Institute of Canada, at the Montreal electrical luncheon on March 19th. During the next ten years, said Mr. Keith, Canada would witness the greatest industrial expansion in the history of the world. This would involve the development of her natural resources, and the connecting link between these resources and their conversion into national wealth was the technical man. Every advancement had been made by the solution of some technical problem. Besides her wonderful natural resources, one of the greatest assets that Canada possessed was the technical man, a fact which was not generally recognised. Technical men would be needed as never before. There was, however, a very serious danger confronting the country. The war had drained the universities and technical schools of some of the very best men, and the danger was in connection with the return of these men. If they were not assisted in the matter of finding suitable positions the technical knowledge gained before the war would be lost. The co-operation of the Federal Government and the various technical associations had been asked with a view to solving the problem. It was absolutely necessary that some scheme should be devised whereby the technical men should be established in civil life. Between 3,000 and 4,000 technical men had gone overseas, and the country owed these men everything that was possible in the way of assisting them to secure suitable positions. He asked the co-operation of those present to this end. It was agreed that the Committee of the luncheon should assist in the way suggested by Mr. Keith.—*Canadian Electrical News.*

Canadian Mission in London.—The Canadian Mission, which has recently been established in London at 1, Regent Street, S.W. 1, by the Dominion Government, was constituted by an order of the Canadian Privy Council in November, 1918, and Mr. Lloyd Harris was appointed chairman of the Mission. Mr. Harris is a Canadian business man who has a wide knowledge of the new industrial Canada, which is one of the products of the Great War. He rendered invaluable service to the Dominion and to the Allied cause as head of the Canadian War Mission in Washington, and it was at the personal request of Sir Robert Borden, the Canadian Premier, that he consented to undertake his present duties. The objects of the Mission are briefly :—

(*a*) The serious tonnage position arising out of the war, coupled with the numerous restrictions put in force, both in the United Kingdom and in Canada, on import and export trade, tended to sever numerous old connections which had existed for generations between the Mother Country and the Dominion. It is one of the duties of the Mission to study the question at first-hand, and to devise the means of re-establishing the traditional value.

(*b*) A great work of reconstruction and reorganisation must be undertaken in Europe during the next few years in order to repair the devastating effects of the war. Raw materials, &c., will be necessary for this work, and many articles required can be obtained from Canada. The Mission hopes by means of negotiations with the Governments of the countries concerned to make arrangements for the supply of such goods to the advantage of all interests involved. It is, further, considering how by a system of credits to assist the Governments in purchasing the materials.

(*c*) The Mission is convinced that the re-settlement of Europe is largely dependent on sufficient supplies of food being available and distribution being properly organised.

In addition to foodstuffs of every description, Canada has available for export: automobiles and other vehicles, gasoline launches, aluminium, calcium carbide, asbestos, iron and steel manufactures, copper, nickel, coal, and agricultural implements. Canada seeks, above all things, to develop a larger interchange of trade with the Mother Country, and, indeed, with all parts of the Empire. Canada has large markets to offer British manufacturers, for she is a large buyer. Canada, too, feels that she can supply to this country many of the materials and manufactures which formerly were bought by Britain from the Central Powers. The Mission personnel includes, besides Mr. Lloyd Harris, several other prominent Canadian business men who are well acquainted with the present industrial and economic position in Canada. They will at all times be willing to advise persons in the United Kingdom desirous of obtaining information with regard to Canadian trade.

Output of Iron and Steel.—The following statement as to production of iron and steel in the United Kingdom is issued by the Ministry of Munitions, being the weekly average in tons during March :—

Pig-Iron.	Tons.
Hematite : Output	61,000
Furnaces in blast	103
Basic : Output	51,000
Furnaces in blast	81
Foundry, forge, and other qualities :—	
Output	39,000
Furnaces in blast	99
Alloys : Output	5,000
Furnaces in blast	12
Total pig-iron : Output	156,000
Furnaces in blast	295

Steel ingots and castings: March weekly average, 174,000 tons.

The Black Lists Withdrawn.—The Allied and Associated Governments decided that as from midnight, April 28th-29th, all black lists published by them of firms and persons should be withdrawn, and that all disabilities attaching to trade and communication with firms or persons on such lists should cease to operate. The Governments referred to reserve the right to re-introduce all or any of such lists should such action become necessary.

It is stated that, in view of the suspension of restrictions on exports from the United Kingdom to firms appearing on the statutory list and to certain other firms in neutral countries against which warnings have been issued in the past, it will not be necessary until further notice for firms in this country to consult the War Trade Intelligence Department concerning firms abroad with which they wish to trade.

It is further reported in the Press that the announcement on the subject of trade with the left bank of the Rhine, issued by the Board of Trade on March 14th, is now cancelled. It will no longer be necessary for exporters to obtain licences from the Export Licence Department before shipping to the territories on the left bank of the Rhine, in the occupation of the Associated Governments, goods other than those included in Lists A and B of prohibited exports.

Unemployment: An Appeal to Employers.—We commend to the serious consideration of all firms who are in want of workers of any kind, the important appeal that has been issued by Sir Robert S. Horne, Minister of Labour. They are asked to notify their requirements of labour, skilled and unskilled, to the employment exchanges, and also, as far as possible, to advise the exchanges well in advance of intentions to discharge labour where any considerable numbers are involved. The exchanges, as the medium of payment of out-of-work donation, have knowledge of the classes and numbers of workpeople awaiting employment in the district in which they serve, and are able also to introduce labour from other districts when the necessity arises. It is of the utmost importance that the Government should be kept informed of the extent to which employment is increasing or decreasing in each area, in order that, with the assistance of the local Advisory Committees connected with each exchange, preparations may be made for the absorption of surplus labour.

Exports to China.—With reference to the lists of firms mentioned here periodically for some time past, it is now announced that exports to China and Siam may be consigned to any person or firm in China and Siam respectively.

Sweden and the Black Lists.—A Reuter dispatch from Sweden records the general satisfaction with which business men in Stockholm received the announcement of the abolition of all the Allied Black Lists.

Sterling Footballers.—The Sterling Telephone Electric Co., Ltd., Lady Footballers finished the season by a victory over Messrs. Hoffmann's Ladies at Chelmsford. For the second season they have not suffered a reverse, and have the following remarkable record :—

				Goals.	
Played.	Won.	Drawn.	Lost.	For.	Against.
36	34	2	0	201	14

This season they have only had four goals scored against them, and three of these were scored by the R.A.F., Hornchurch.

The Sterling Gents have also had a good season, and finished third in the East and South-East London Munition League. On Saturday last, in drawing with Hoffman's Gents (holders of the Chelmsford and District Charity Shield), they accomplished a very good performance.

Plant for Disposal.—The Ministry of Munitions is inviting offers, by May 15th, for a number of A.C. motors, 200 volts, 50-cycle, two-phase, with starters and accessories, lying at the Daimler Works, Coventry. Full particulars are given in our advertisement pages to-day.

Government Controls.—It is announced that most of the Government controls affecting the sale and distribution of commodities will come to an end on May 31st.

Trade Announcements.—Mr. S. J. Bradley, electrical engineer, has reopened his business at Caen Street, Braunton, Devon.

Mr. T. A. Griffin, ex-lieutenant R.G.A., formerly construction engineer in Scandinavia for the Sperry Gyroscope Co., of New York and London, has entered into partnership with Mr. G. Wallace, and they will carry on business as contracting electrical engineers, manufacturers, and vendors of electrical plant, &c., at 58, High Street, W.C. 2. Manufacturers and agents are invited to forward catalogues of every description of electrical apparatus.

Messrs. Bulpitt & Sons, Ltd., have acquired the business of Messrs. Clarke & Clarke, Hockley, Birmingham, including rights of the Clarke & Clarke diamond transformers, the sole manufacture of which they will undertake. All communications should be addressed to Messrs. Bulpitt at Swansea Works, Camden Street, Birmingham.

Mr. G. V. Twiss, M.I.E.E., who has for the past ten years been technical adviser to Messrs. Bullers, Ltd., and who founded the high-tension department of that firm, has now founded a new company—Twiss Engineering and Electric Transmission, Ltd.—whose head offices are at 62-63, Queen Street, London, E.C. 4. Mr. Twiss has been closely connected with the design and supply of material for many of the most important recent transmission lines up to 100,000 volts and the like, and much of this work was referred to in his paper "High-Tension Overhead Transmission Lines," which he read before the Institution of Electrical Engineers in 1917 (awarded the Ayrton Premium). The new company will specialise in high-voltage equipment, including lightning arrester gear, choking coils, and air-break switches; insulating and isolating gear for indoor and outdoor sub-stations, and all overhead transmission line requirements, including poles, insulators, and the like up to the highest voltages, with special regard to relative co-ordination of such material and the transmission scheme as a whole. The company has an affiliated works at Mildmay Park, N.

Messrs. Norrington and Landon, who for many years represented Messrs. Veritys, Ltd., in the North-Western area, have resigned their positions, and are forming a company, which is in process of registration, as Norrington & Landon, Ltd., with offices at 33, Brazennose Street, Manchester, and works at Dewsbury. They are specialising in engineering plants as affecting collieries, shipyards, mills, and the like.

A Canadian Trade Inquiry.—Our Canadian correspondent writes, under date April 8th:—"I have just received a letter from Messrs. Powley & Townsley, Excelsior Life Building, Toronto, stating that they would like to take up British agencies for storage battery and trolley type electric locomotives of from two to fifteen tons weight, in gauges from 18 in. up to standard railway gauge. They are also anxious to get into touch with makers of rotary converters in capacities from 2 to 25 kw., for operation on single and three-phase 25 to 60-cycle circuits for battery charging purposes. The letter referred to states that the writers would be very glad indeed to get into touch with any British manufacturers of such equipment, since they are specialising on industrial transportation. They add, that at the present time there is a very bright outlook for the sale of the foregoing equipment. The references offered by the firm are as follows:—The Bank of Ottawa, Toronto, and also the principals for whom the firm is at present acting in Canada, viz., the Edison Storage Battery Co., of Orange, New Jersey, and the Automatic Transportation Co., of Buffalo, New York. I shall be glad if you can give this matter some publicity in your columns."

Liquidations.—Blackwall Engineering and Welding Works, Ltd., Millwall, E.—At the first meeting of the creditors and shareholders, held on April 25th at the Board of Trade Offices, Lincoln's Inn, W.C., it was resolved to leave the liquidation in the hands of the Official Receiver. Particulars of the failure appeared in our last issue. Appended is a list of the principal creditors:—

Brown Bros., Ltd., London	£62	Poplar Boro' Council, London	£28
British Oxygen, Greenwich	140	Palmer, Sutton & Co., London	35
Buck & Hickman, Ltd., London	54	Siemens Bros., Ltd., London	63
Botwood, W. J., London	12	Shelley, Ltd., R. T., Birmingham	36
Clark & Sons (Hull), Ltd., G., Hull	25	Siemens Bros. & Co., Ltd., Woolwich	25
Crabtree, Ltd., S., Todmorden	157	Steel, G., London	14
Calman & Sons, J., London	32	Sugarman, J., London	10
Cook, W., London	20	Sugarman, P., London	10
Dixon & Head, Ltd., London	24	Fully secured creditors	104
Hadfields (Merton), Ltd., Mitcham	17	J. Summers & Sons, Ltd., London (security valued at £134)	265
Imperial Light Co., London	15	Preferential claims	34
Langston, Jones & Samuel Smith, Ltd., London	32		
Norman Hopper, Ltd., London	11		

Standard Cable Manufacturing Co., Ltd.—First and final dividend of 20s. in the £, payable on and after April 28th at Carey Street, W.C.

Catalogues and Lists.—British Westinghouse Electric and Manufacturing Co., Ltd., Trafford Park, Manchester.—Special publication No. 7,747, entitled "Electric Winders." This is a very fine production containing some 50 odd sheets of photographic illustrations showing some of the principal electrically-driven winding engines or equipments that have been or are being installed by the company. It is pointed out in the opening notes that electrically-driven winding engines are rapidly replacing steam winders in all countries, and work that the British Westinghouse Co. has executed in this direction in England and Wales, and South Africa, is well represented in the book. Diagrams of connections of the Westinghouse plants appear at the end, also performance curves of various designs of winders.

British Central Electrical Co., Ltd., 6 and 8, Rosebery Avenue, London, E.C.—Eight-page price list of metal-filament lanterns for shop window and other lighting, reflector fittings, electric glue pots, boiling plates, hand lamps, c.i. watertight switches, and other accessories.

Book Notices.—*The Engineer's Year-Book for* 1919. Compiled and edited by H. R. Kempe, M.Inst.C.E. London: Crosby Lockwood & Son. Price 25s net. Pp 2,202 + cvi; 2,000 figs.—The Year-Book is now in its twenty-sixth year; it is four times the size of the first issue, and appears to be approaching the extreme limit of corpulence, though the additional pages of text this year only number 100 odd. Yet there is a long list of sections which are new or have been re-written for the present issue, amongst which we note "Clays and Allied Products used by Engineers," by Mr. A. B. Searle (including ordinary and refractory bricks, electrical ware, &c.); "Cranes and Crane Appliances," by Mr. J. H. Huntley; "Fuels: Solid, Liquid, and Gaseous," by Mr. H. Moore; and "Pulverised Coal," by Mr. L. C. Harvey. Before the mass of information contained in these thousands of pages could be adequately reviewed the next edition would be due; but, fortunately, it is not necessary to review a work of such tried and proved merit—the appeal to past experience serves to guarantee the worth of its contents, which cover an extraordinarily wide range of subjects, and replace a whole shelf of text-books. In future, we presume, the Associate Editors (over 50 in number) will have to give special attention to excision, in order to make room for new matter—and the question what to leave out, where all is worthy of retention, will be a difficult problem indeed.

Decimal Coinage. London: The Decimal Association.—In this pamphlet the advantages of decimal coinage are set forth, with special reference to the pound-mil system; the impracticability of universal coinage is explained, and the pound-mil system is described, with illustrative examples of its use. Reasons are given for making the change immediately, and arguments are advanced against the adoption of the dollar system.

The British Dominions Year-Book, 1919 (edited by Messrs. E. Salmon and J. Worsfold; London: Eagle, Star, and British Dominions Insurance Co., Ltd., price 1s.), though prepared during the war, and therefore somewhat hampered by circumstances, contains a remarkably varied and interesting series of articles and a mass of general information. Lord Leverhulme writes on "Comradeship in Industry." Mr. Archibald Hurd, and other specialists, on "The Fourth Year of War." Mr. E. Oliver on "The Truth About Japan," and there are articles on finance, trade, coal, oil, &c. Mr. Charles Bright, F.R.S.E., deals with the "Development of Inter-Imperial Communication." Altogether the Year-Book is a very successful production, and remarkable value for the price.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII, No. 4. April, 1919. New York: The Institute Price $1.

"Electrical Phenomena in Parallel Conductors." Vol. I: Elements of Transmission. By F. E. Pernot. Pp xii + 332; 82 figs. 1918. London: Chapman & Hall, Ltd. Price 18s. 6d. net.

"Principles of Radiotelegraphy." By C. M. Jansky. Pp. ix + 242; 179 figs. London: Hill Publishing Co., Ltd. Price $2 net.

"*Proceedings* of the Electrical Association of Australia." Vol. III. 1916-1917. Melbourne: The Association.

"Glasses for Protecting the Eyes from Injurious Radiations." By W. W. Coblentz and W. B. Emerson. (Technological Paper of the Bureau of Standards.) Washington: Government Printing Office. Price 10 cents.

"Annales des Postes, Télégraphes et Téléphones." 1918. Paris: A. Dumas. Price 14 fr.

Bankruptcy Proceedings.—F. J. Earle, electrician, Truro.—First meeting May 6th: public examination May 13th, both at Truro.

Electric Lamp Manufacturers' Association.—We understand that the Electric Lamp Manufacturers' Association of Great Britain has been registered as a company, limited by guarantee. The initial number of members is not to exceed 20, each liable for £100 in the event of winding up. The objects are to promote and protect the interests of manufacturers of and dealers in electric lamps in the United Kingdom, to carry on research work for improving electric lamps, to enter into agreements with members and wholesale and retail dealers in electric lamps, relating to the manufacture, supply, and sale of such lamps, &c. The first members of the Council of Management are:—W. W. Blunt, sales director, British Westinghouse Electric and Manufacturing Co., Ltd.; H. W. Cole, secretary Stearn Electric Lamp Co., Ltd.; W. Crawford, director of "Z" Electric Lamp Manufacturing Co., Ltd.; M. V. Ely, managing director, Foster Engineering Co., Ltd.; J. Y. Fletcher, director, General Electric Co., Ltd.; H. C. Levis, chairman and managing director, British Thomson-Houston Co., Ltd.; E. A. Marx, sales manager, Pope's Electric Lamp Co., Ltd.; W. Rutherford, managing director, Dick, Kerr & Co., Ltd.; C. W. Sully, manager lamp department, Siemens Bros. Dynamos Works, Ltd. The registered office is at 46, Queen Victoria Street, E.C.

The Industrial Future.—Lieut.-General Sir Edward Bethune, K.C.B. (Chief Organiser), and Mr. T. Ernest Jackson (Trade Union and Labour Organiser), of the National Alliance of Employers and Employed, will address joint conferences of representatives of employers and delegates from Trade Unions at Newport (Mon.), on May 5th; at Grantham, on May 8th; at Oxford, on May 13th; at Dudley, on May 14th; at Lancaster, on May 19th; at Bedford, on May 20th; and at Salisbury, on May 30th. The subject of discussion in each case will be "The Industrial Future." The National Alliance is aiming at forming joint committees of Employers and Trade Unionists for the purpose of harmonising the relations between Capital and Labour. New Committees are being formed every month in the large industrial areas, and in several cases industrial disputes have been avoided or shortened by the activities of these local committees. Already 23 committees have been formed in the chief industrial centres.

LIGHTING AND POWER NOTES.

Aberdare.—Proposed Bulk Supply.—The U.D.C. has decided to approach the Powell Duffryn Co. as to the terms upon which it would supply electricity to Cwmbach and Cwmaman.

Aberystwyth.—Proposed Municipal Purchase.—The Corporation is considering the question of purchasing the electricity works, and it is proposed to utilise the water power of the River Rheidol to provide increased power.

Armagh.—E.L. Scheme.—The T.C. held a meeting on April 25th, at which Mr. J. J. Woods, electrical engineer, Clones, was present, to discuss the advisability of lighting the town with electricity. It was decided to put in an installation, and to offer a prize of £25 for the best scheme, the prize winner to be appointed consulting engineer. Mr. J. J. Woods was appointed to go into the details of the various schemes submitted.

Australia.—Queensland.—Water Power.—The State electrical engineer, Mr. W. Corin, has prepared a report on the possibilities of the hydro-electrical development of the Clarence River. The report states that 100,000 H.P. can easily be obtained, and delivered at 0·2d. per unit. A preliminary estimate of the cost of the scheme shows that the expenditure would be approximately £240,000 for 600 KW., or £40 per KW. of maximum demand, and a bulk supply cost of one-fifth penny per unit. By extending the dam, it is estimated that 100,000 H.P. could be obtained.—*Commonwealth Engineer.*

Ayr.—Proposed New Plant.—The electrical engineer has recommended the T.C. to install a rotary converter, at an estimated cost of £3,500.

Battle.—E.L. Scheme.—Messrs. Newbery Bros., Ltd., have informed the U.D.C. that if it does not soon act in reference to the E.L. scheme they will be obliged to install their own plant.

Blackpool.—Year's Working.—There was a loss of £2,721 on the working of the Corporation electricity undertaking during the past year, compared with a surplus of £8,083 in the preceding year. The receipts were £58,171, against £59,647, of which interest and debt redemption absorbed £19,991.

Price Increase.—The Electricity Committee has decided to advance the charges for electricity from 15 per cent. to 33⅓ per cent. on pre-war charges.

Bray.—L.G.B. Inquiry.—Mr. A. D. Price held an inquiry, on the 24th ult., into the application of the U.D.C. for sanction to borrow £5,000 for extensions to the electricity undertaking. The town clerk stated that the Council had had to refuse many applications for power. The engineer, Mr. W. J. Sowter, advised the installation of an additional 135-KW. Diesel-alternator set, four transforming centres, and supplementary cables.

Brighton.—Proposed Price Increase.—The T.C. has decided to apply for permission to increase the maximum charge for electricity from 7d. to 8d. per unit. It is also proposed to advance the price of energy supplied to the tramway department from 1·75d. to 1·9d. per unit.

Bury.—L.G.B. Inquiry.—An L.G.B. inquiry was held last week into the T.C.'s application for sanction to borrow £94,000 for the purposes of the electricity undertaking. The town clerk asked that the sum be amended to £97,126, the additional amount having been incurred in respect of buildings. In 1914 extensions were contemplated and provisional sanction was obtained, but the work was suspended. Colonel T. C. Ekin, who conducted the inquiry, said the L.G.B. fully recognised the difficulties, and had adopted the policy that if it was satisfied as to the necessity of the work, it gave a general approval, and deferred definite sanction until tenders had been accepted. The borough treasurer suggested that it would be a good thing if the L.G.B. would consolidate the different periods of repayment.

Canada.—Water Power.—On April 25th, the Minister of Railways stated that the Government was preparing plans for the development of the water-power of the St. Lawrence River. It is expected that 2 million H.P. could be developed, which it is proposed to use for the electrification of the railways. Negotiations are to be opened in Washington on the subject.—*The Times.*

Carnarvon.—County Hall Lighting.—The Carnarvonshire Joint Police Committee has adopted a scheme for the installation of electric lighting, &c., at the County Hall.

Continental.—Italy.—Water Power.—There are great expectations in Italy of saving in the national consumption of coal, particularly in railway traction and industry, by the use of untapped sources of water power. The President of the Higher Council of the Water Commission recently stated that projects, involving the production of some three million nominal H.P., have been examined by the Commission; and the question arises as to how far it is the duty of the State to co-operate in the promotion and the profits of such work. Almost all the water-courses which could be easily employed have already been adapted, and the only favourable openings are the rivers in the neighbourhood of a close network of railways which has hitherto hindered water-power development; most of the new projects would require very large capital expenditure for reservoirs, and the profits would in many cases be doubtful. It would be difficult to sell large supplies of power in the most fertile areas, since, with the exception of Southern Italy and the islands, not much remains to be done in the way of the application of power for electric lighting and small motor use, only the application for big electrochemical plant remaining available. Some of the plant suggested in which electrical energy is only applied for the production of heat, would, in his view, be so costly that the same heat could be obtained more economically by the use of coal at 300 lire per ton. As to electrochemical applications, electricity for such purposes could not be produced sufficiently cheaply, except where part could be sold at satisfactory prices for lighting or small motor power.

Electric traction remains to be considered, as being the only application in which electricity can replace coal; and here it is not the want of electrical power which hinders electrification, but the financial difficulty of applying the change to more than 2,000 kilometres of the railway system. Even if this use of power were doubled or trebled not more than 4 or 5 per cent. of the energy proposed to be generated would be absorbed for several years.

His general conclusion would appear to be that, while there are cases where the public advantage demands the extension of water-power schemes, even if unlikely for the present to be remunerative, the State will have to assume a share of the capital expenditure and the profit or loss. But nothing suggests that, if coal can be obtained at a reasonable cost, there will not be a sufficient demand in spite of all the electrical developments of a good number of years to come.—*Board of Trade Journal.*

The Government has announced its intention to grant subsidies to undertakings which are in a position to install electricity undertakings to supply agricultural industries and machinery in the Agro Laziale, or between the Lake of Burano and the Lake of Fondi. The schemes are to be ready within one year of the signing of Peace. The subsidies to be granted will amount to 60 per cent. of the cost of H.T. transmission lines and 50 per cent. of the cost of the distribution stations. The outlay is limited to one million lire.

Spain.—Concessions have been granted for the installation of plant to utilise the water power of the River Muga at Figueras, the River Ason at Ruerga (Province of Santander), and the River Carrll at Terraso (Zamora) for the generation of electricity.

Germany.—The Berlin Electric Light and Power Co., which has a capital of 30,000,000 marks, closed the year 1917-18 with a loss of 78,833 marks. The net profits for the previous year were 1,644,611 marks, at about which figure they have remained during the war, although for the year 1912-13 the profit made was 2,593,475 marks. Last year 1,800,000 marks had to be written off on foreign holdings, principally Russian, the Russian Government having appropriated the company's concerns in that country. Full reports relating to the works in overseas countries had not come to hand. The Compania Pevillana de Electricidad is constructing an additional hydro-electric power station at Guardioro, the share capital being increased from 4,000,000 pesetas to 20,000,000 pesetas for this purpose. The Societa Elettrica Riviera di Ponente has also increased its capital to 110,000,000 l. in order to extend its area and acquire the majority of the shares in the Officine Elettriche Genovesi, which supplies Genoa and its environs with electrical energy. In addition to its share capital, the Berlin Electric Light and Power Co. has debentures issued for 36,140,000 marks.

Holland.—A company, to be called the Provincial and District Electrical Co., is to be formed to generate and distribute electricity over the whole of North Holland. Only public bodies can become shareholders in the concern—in this case the province of North Holland and the towns of Amsterdam and Haarlem—and these bodies will be supplied with energy at cost price, to be distributed by the separate bodies. The capital of the concern is to be 30,000 gulden.—*Board of Trade Journal.*

Sweden.—Among the new companies formed for the utilisation of water power in the generation and distribution of electricity is the Backs Kraft Aktiebolag, organised at Sunne, with a maximum capital of £16,700.

Croydon.—Proposed Extensions.—A report of the Electricity Committee states that its plant is insufficient to meet the demand in the near future, and that, owing to the age and diversity of the plant, it is uneconomical in working. The present plant consists of 12 sets of varying capacity. The Committee has been advised that, unless a bulk supply can be economically purchased, it should at once install two 5,000-KW. generators. The B. of T. has advised the Committee to apply to the L.G.B. for a loan for the new plant, as a satisfactory supply in bulk is not available. The estimated total cost of the extensions is £122,000 including two 5,000-kw. turbo-alternators and pumps, £70,000; three 1,000-kw. rotaries and transformers, £13,500; nine 500-kw. rotaries and transformers, £5,500; switchgear for rotaries, £8,000; static transformers, £3,000; piping, £7,500: and cooling tower, £2,000. It is estimated that, after meeting the increased capital charges, an annual saving of £8,458 will be effected, and the capacity of the plant will be doubled. It was agreed to apply for a loan.

Crowle (near Doncaster).—E.L. Scheme.—Notice has been given that at the next meeting of the U.D.C. the question of the adoption of an electric lighting scheme will be brought up.

Devon.—Water Power.—The scheme for utilising the water powers of Devon for an electricity supply includes the laying of mains to connect up the following principal towns with the plant, says the *Engineer*:—Brixham, Buckfastleigh, Bovey Tracey, Chagford, Crediton, Dawlish, Dartmouth, Exeter, Exmouth, Horrabridge, Ivybridge, Moretonhampstead, Newton Abbot, Okehampton, Plymouth, Tavistock, Torquay, Totnes, Teignmouth, and Topsham. The system of mains is to be such that in practically all cases alternative lines are provided to safeguard the supply against temporary breakdowns.

Dewsbury.—Price Increase.—The Electricity Committee has increased the price of electricity for lighting purposes from 25 to 35 per cent. over pre-war rates; to rateable-value consumers from 30 to 40 per cent., and for power and heating purposes from 50 to 60 per cent.

Dundee.—Proposed Loan.—The Convener has ruled that the application of the Electricity Committee for sanction to borrow £250,000 in connection with the proposed new generating station at Carolina Port is not in order until the scheme has been approved by the T.C.

Formosa.—Water Power.—The British Consul at Tamsui states that the hydro-electric works at Dakusui-Kei are estimated to cost nearly five million pounds sterling, and are expected to produce 130,000 h.p. (maximum 80,000 kw., average 56,000 kw.), with an easy extension of 55,000 h.p. at a further station, giving if necessary 185,000 h.p. (maximum 114,500 kw., average 80,000 kw.). The scheme is to swell the waters of Jitsu-getsu-tan (Lake Candidius) by turning into it water from the upper course of the Daku-sui-kei (River) from the vicinity of Shimai-gahara, a distance of about 15½ miles.

The average depth of the lake is 12 ft.; the average capacity of water is 660,000,000 cb. ft. Dams will be required at four places. The extra depth of water in the lake to be attained by the scheme is 75 ft., producing with the increased area of the lake an extra capacity of about 5,000,000,000 cb. ft. of water. The lake when raised will be able to give out 900 cb. ft. of water a second (maximum 1,300 cb. ft.), which will feed a large power station by the Suiri-kei (River). With an effective fall of 1,085 ft. it is estimated that 130,000 h.p. will be obtained. If necessary a further fall of 465 ft. can be arranged to the base of Mt. Taihei, which will yield an extra 55,000 h.p. In the course of this construction 65·9 miles of light railways will be worked, together with 9 miles of wire rope transportation. A subsidiary power station (2,500—3,000 h.p.) for constructional purposes is planned at the Nanko-kei River.—*Board of Trade Journal.*

Highley (Bridgnorth).—E.L. Scheme.—At a meeting of the Parish Council a scheme was brought forward for the lighting of the village with electricity at a cost of £5,000. The matter is to be discussed at a later meeting.

Hull.—Proposed Extensions.—In a report on the extensions necessary in connection with the Corporation electricity undertaking, the acting engineer, Mr. J. F. Magoris, stated that on March 31st, 1914, 17,000 kw. were connected, whereas on March 31st, 1919, the load had risen to 37,000 kw. During the three months immediately preceding the war, applications for new services averaged 16 per month, whereas during the past three months the average was 66·3. The new bulk supply scheme, which includes a supply to the tramways, is estimated to result in an increased output equal to the total output of the undertaking in 1914. It is, states the report, desirable to replace the old and economical plant, and to proceed with extensions at an early date. The installation of a 10,000-kw. turbo-generator, and a large water-tube boiler, is recommended, and two other boilers are suggested. The cost of the turbine plant is estimated at £67,286, the boiler-house plant at £31,615, and the pumps and pipe work at £4,200, a total of £103,101, to which must be added 20 per cent. for contingencies, making £123,721. The proposals are to be considered at the next meeting of the Corporation.

Bulk Supplies.—The Electricity Committee has decided to supply electricity in bulk to the Swan Flour Mill, the Hull Ice Co., and Messrs. Priestman Bros.

India.—Water Power.—A new hydro-electric power plant has recently been set to work at the Kambank Mine, 60 miles from Tavay, Burma.

Keighley.—Proposed Loan.—The Electricity Committee has recommended application to the L.G.B. for power to borrow £72,733, for expenditure already incurred and estimated to be required during the next two years in the electricity department.

Larkhall.—Colliery Electrification.—A new power station has been installed at Dykehead Colliery. It is three-phase 500 volts, and there are two mixed-pressure turbo-alternators of the Curtis reaction type. Each machine has an output of 400 kw., and is provided with a Westinghouse spray condenser. The air-circulating pumps are driven by a 60-h.p. motor, d.c. being supplied by a Bruce Peebles-La Cour converter, with an output of 75 kw. The Keith, Blackman fan, with a capacity of 90,000 cb. ft. of air per hour, is belt-driven by a 100-h.p. slip-ring induction motor. There are three electrically-driven pumps underground; and in No. 2 pit endless-rope haulage is all electrically operated.

Leintwardine.—E.L. Scheme.—At a parish meeting, a Committee was appointed to consider, among other projects, an electric lighting scheme.

London.—Poplar.—The Electricity Committee has reported that the arrangement with the Stepney B.C. for alternately closing down the electricity works during light-load periods, has resulted in a saving of 4½ per cent., estimated to be equivalent to £2,160 per annum.

N.-E. London Joint Scheme.—A preliminary report by the consulting engineer appointed by the West Ham and Poplar B.C.'s. to inquire into a joint scheme for the supply of electricity to the N.-E. London area, has been submitted to the Poplar B.C. A Sub-Committee has been appointed to consider the report, with representatives of the other Councils concerned.

Maidstone.—Proposed Price Increase.—The T.C. has applied for powers to increase the maximum price of electricity from 7d. to 10d. per unit, and to extend the supply to parishes outside the borough.

Manchester. — Year's Working. — The Electricity Committee has announced that there was a loss of £37,890 on the past year's working of the undertaking. The whole of the reserve fund of £23,636 has been placed to the revenue account, reducing the debit to £14,254.

North Wales.—Water Power.—The owners of the Nantlle quarries are considering the introduction of electric power. A Manchester newspaper states that the North Wales Power Co. has offered to supply electricity at 1¼d. to 1½d. per unit. Surveys have been made of the district near the quarries, and it is estimated that 1,500 h.p. could be obtained.

Nottingham. — Loan Sanction. — The L.G.B. has sanctioned the application of the T.C. for permission to borrow £75,800 for extensions at the St. Ann's Well Road generating station.

Southport.—L.G.B. Inquiry.—Col. T. C. Ekin held an inquiry, on April 23rd, into the application of the T.C. for permission to borrow £132,000 for electricity purposes. The Town Clerk stated that a good deal of the plant was out-of-date, and it was at present over-loaded. The application was made on the understanding that the borrowing powers were only desired provided the expenditure would not be rendered unnecessary by the Government's scheme, and the Council was willing, instead of installing new plant, to take a bulk supply if it could be supplied more economically. Mr. A. S. Black, the borough electrical engineer, stated that it was proposed to discard the existing 2,000-volt single-phase system of generation, and to install a three-phase system, at 6,600 volts, 50 cycles. The Electricity Committee had visited the Brush Co.'s works, and inspected the Brush-Ljungstrom turbine sets, and Mr. Black was satisfied that these machines were in every way reliable. The cost was estimated as follows:—Two 3,000-kw. turbo-alternators, with accessories, £52,000; switchboard, piping, &c., £8,000; 6,000-kw. transformers, £12,000; mains, £30,000; boilers, seatings, and fittings, £5 000; sub-station and switchgear, £2,000; capital expended in anticipation of borrowing powers, £23,000; total, £132,000. He estimated that the saving in fuel would be 50 per cent., or about 6,000 per annum under present conditions. The inquiry was closed.

Thurles (Co. Tipperary).—E.L. Scheme.—The U.D.C. has instructed its solicitor to take the necessary steps in connection with the installation of an E.L. scheme in the town.

Templemore (Co. Tipperary).—E.L. Scheme.—The U.D.C. has decided to proceed with the lighting of the streets with 40 50-c.p. electric lamps; the supply will be extended to private consumers, if desired.

Unsworth.—E.L. Scheme.—Particulars have been submitted to the P.C. by the Lancashire E.P. Co. *re* the proposed electric lighting of the village, and estimates of the cost are to be prepared for the next meeting.

TRAMWAY AND RAILWAY NOTES.

Aberdeen. — Tramway Track Arbitration. — The award of Sir Alex. Kennedy, in connection with the arbitration between the T.C. and the Tramway Co., with regard to the condition of the track to be taken over by the T.C. at the conclusion of the lease, directs that parts of the track be relaid with new rails, and parts with partly-used rails.

Blackpool. — Year's Working. — During the year ended March 31st, 1919, the receipts of the Corporation tramway department amounted to £140,929, an increase of £21,590 on the previous year. The expenditure was £90,033. Interest and loan repayments totalled £20,844, leaving a net balance of £30,052 against £31,518. Passengers carried numbered 23,279 202, an increase of over three millions, and 1,242,108 car-miles were run, a decrease of 10,770.

Canada.—Railway Electrification.—Three hundred representatives of Ontario municipalities have requested the Government to turn over to the Hydro-Electric Commission for electrification branch lines of the Grand Trunk Railway and the Canadian Northern Railway in the province, and to co-operate with the Commission so that municipalities may acquire branch lines as necessary.—*The Times.*

Continental.—Spain.—The Sociedad de Tranvias Electricos de Granade has applied for a concession for the construction and working of narrow-gauge electric railways between Granada and La Zubia, and between Arnulla and Alhendin, in the Province of Granada.

Exeter.—Conductresses.—The Corporation has decided to replace all women tramcar conductresses by youths.

Huddersfield.—Wages.—The Tramways Committee has agreed to pay its employés double time for Sunday labour.

Hull.—Fare Revision.—The Tramways Committee has decided to abolish the ½d. morning fares.

Keighley.—Year's Working.—The receipts of the tramway department for the year ended March 31st, 1919, amounted to £15,229, an increase of £2,642 on the previous year. The receipts from the railless section were £3,298, a decrease of £1,310.

Liverpool.—Collision Inquiry.—Reporting to the Board of Trade on an accident which took place on the Liverpool Overhead Railway on January 13th last, Lieut.-Col. Pringle suggests various modifications in the system of automatic signalling which is employed, with a view to ensuring greater safety.

London.—Breakdown.—Due to the breakdown of a cart on the tramway track near Blackfriars Bridge on Thursday, last week, traffic was blocked in both directions for about an hour.

Fire.—There was a serious outbreak of fire on Friday night, last week, at the Metropolitan Tramways Depôt, Finsbury Park, involving an extensive building used as a storehouse.

Snowstorm.—Following the snowstorm last Sunday evening, snow ploughs had to be used to clear the tramway tracks at Wood Green and Finchley.

The North London electric trains had great difficulty in climbing the steep gradient between Richmond and Broad Street owing to the accumulation of snow. Trains were run at intervals through the night to keep the rails free, and ensure the service on Monday morning.

Manchester.—Proposed Express Tramcars.—The Corporation's town planning scheme, which provides for three great roads into Cheshire, also makes provision for express tramcars into the city. The road devoted to this service would be protected, and railways and 'bus services would be arranged to cope with the new traffic from freshly developed districts. Specially constructed tramcars would be used for speed and comfort. In view of the present congestion of some city streets alternative routes may have to be found to deal with new traffic.

Sheffield.—Strike.—In connection with the interpretation of the agreement between the Municipal Tramways Association and the Transport Workers' Union, the tramway employés, on April 27th, refused to take out the cars, and called a mass meeting, to which the general manager was invited. The men refused to carry on until the Corporation met, and eventually the manager acceded to some of the demands. Work was then resumed, after a stoppage of three hours.

Spen Valley.—Fare Revision.—The Yorkshire (Woollen District) Electric Tramways Co. has decided that, from May 1st, all penny fares will be abolished in favour of 1½d. fares, except on the Moorend route at Cleckheaton.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—The Direct United States Cable Co. announces that, as only half the rental for the past six months has been received from the Western Union Telegraph Co., payment of a dividend for the quarter to March 31st last will not be made. The main cable was interrupted on September 22nd, 1917, and has not yet been repaired. Under the provisions of the lease the Western Union Co. was entitled, in the event of the main cable being interrupted for 12 months, to reduce the rent by one-half thereafter, and should the cable be interrupted for a further six months, the company had the option of ceasing to pay the rent until the cable was repaired, or of terminating the lease. The Western Union Co. has intimated that it intends to terminate the lease in consequence of the interruption. An unsuccessful expedition to repair the cable last year involved the company in an expenditure of over £70,000. The directors have taken steps to apply to the High Court for relief against forfeiture of the lease.—*The Times*

Continental Telegrams.—Private and commercial telegrams are now accepted, at 5½d. per word, for places in Latvia (Lettland) and Lithuania. Communication is uncertain, and telegrams are liable to heavy delay.

India.—The disturbances continue, and there have been reports of telegraph wire cutting in several instances. At Tanda near Hoshiarpur, the wires have been cut; near the district headquarters at Lahore the canal wire is cut, while in the Punjab telegraph wire cutting is constant.

New Telephone Lines and Stations.—In the London district during the 13 weeks ended January 21st, 1919, 1,390 exchange lines, 2,649 internal extensions, and 391 external extensions were provided. In the same period, 700 exchange lines, 850 internal extensions, and 145 external extensions were recovered, making net increases of 693 exchange lines, 1,799 internal extensions, and 246 external extensions.

For the three months ended January 31st, 1919, the net increase in telephone exchange wire mileage in the London Engineering District was 7,656 miles, the increase underground being 8,930 miles, whilst the open (bare wire) and aerial cable decreased by 488 miles and 786 miles respectively. Telephone trunk wire mileage increased by 181 miles, underground telegraphs increased by 101 miles, and aerial telegraphs by 41 miles. Pole line decreased by 3 miles. Pipe line increased by 22 miles. The aggregate mileages in the district at the end of January, 1919, were as follows:—Line mileage: Pole line, 2,567 miles; pipe line, 3,575 miles. Single-wire mileage: Telegraphs, 17,920 miles; telephone exchange, 1,012,845 miles; telephone trunks, 17,409 miles; spare wires, 18,235 miles; exclusive of wires on railways maintained by railway companies. The total length of underground cable is 7,166 miles.

The following statistics in connection with work carried out during the war for Government Departments have been extracted from official records:—Non-multiple-type P.B.X.'s: Number provided, 446; fitted capacity, 16,730; total working lines, 12,809. Multiple-type P.B.X.'s: Number provided, 38; number of sections, 323; fitted capacity, 20,910; total working lines, 16,130. During the progress of the work, numerous alterations in the grouping of the telephones were required to meet the ever-changing conditions, and in this respect great difficulty was experienced in getting the Departments concerned to specify their requirements to the Post Office early enough.—*P.O. Electrical Engineers' Journal.*

Snowstorms.—Reports of the damage by snow and gale during the week-end come from all parts of the country. Communication was everywhere interrupted. Out of 923 trunk telephone lines, 200 were brought down by the storm. Of London lines, over 11 000 are said to be affected. At noon on Monday there was no communication at all with the following places:—Bishops Stortford, Hertford, Southend, Halstead, Braintree, Hatch End, Epping, Radlett, Frinton, Witham, and Yarmouth. With the following places there was no direct communication, though they might be reached in a roundabout way: Bradford, Bournemouth, Bury St. Edmunds, Biggleswade, Cambridge, Clacton-on-Sea, Eastbourne, Harwich, Hastings, King's Lynn, Lincoln, Grimsby, Lewes, Malden, Middlesbrough, Newmarket, Newcastle, Norwich, Stevenage, Sandy, Seaford, and Uckfield. Out of 22 lines to Manchester, only 1 was working; to Leeds, 2 out of 12; to Ipswich, 1 out of 8; and to Hull, 4 out of 10. Curiously, all telephone lines to Glasgow were working. The rapid thaw did much to restore communication by removing short circuits. Considerable damage was also done to telegraph lines. On Tuesday only one line was working to Ireland, *via* Scotland, and only three from London to France.

The Post Office notifies that in consequence of interruptions caused by the snowstorm there is heavy delay of telegrams to and from the Continent.

Spain.—All telegraphists at Madrid who did not resume work by midnight on April 24th were to be dismissed and replaced forthwith by pupils of the School of Telegraphy and other applicants. The telephone service is again working normally.—*The Times.*

Only 40 telegraphists failed to respond to the demand of the Government to return to work. In consequence the appeal to people acquainted with telegraphy to offer their services during the strike was cancelled.

Underground Cables.—The Wimborne, Dorset, Urban District Council protests against the intention of the authorities to proceed with the laying of all the principal telegraph and telephone lines through the town in underground ducts.

Wireless Restrictions Removed.—With reference to our note last week, we are informed that the Marconi Co. has received notice from the Admiralty that from noon, on Thursday, May 1st, all restrictions on the use of wireless telegraphy on ships are removed except in the following waters:—North Sea; English Channel, east of a line joining Dungeness and Boulogne; Baltic; North Russian waters; Mediterranean; Black Sea: and the Sea of Marmora. On and after that date wireless telegrams intended for passengers on board ship may be filed at the offices of the company, or at any postal telegraph office in the U.K.

Wireless Telephony.—According to the daily Press, the s.s. *George Washington*, the ship on which President Wilson will travel back to the States, has been refitted with powerful wireless telephone apparatus, which, it is said, is capable of transmitting over a distance of 1,200 miles.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Brisbane.—June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.) from the offices of the company at Brisbane.—*Tenders.*

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

June 23rd.—Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.

Batley.—May 15th. Electrical engineer's work in erection of picture house for Regent Pictures, Ltd. Messrs. W. Hanstock and Son, architects, Branch Road, Batley.

Bedford.—May 3rd. Electricity Department. Meters for 12 months. (April 18th.)

London.—L.C.C.—May 12th. 5,000 driving-wheel tires, and 3,500 trailing-wheel tires for electric tramways. General Manager, L.C.C. Tramways, 23, Belvedere Road, Lambeth, S.E.

Manchester.—May 21st. Electricity Committee. Wet air filter for the Stuart Street station. (See this issue.)

Natal.—May 20th. Corporation. 12 miles steel girder rails (95 lb. per yd.) with fishplates, bolts and nuts. and 4,300 tie bars, and 1,000 copper rail bonds and 300 cross bonds. Webster, Steel & Co., Agents to the Durban Corporation, 5, East India Avenue, E.C.

Templemore (Co. Tipperary).—U.D.C. Electric lighting installation. Mr. Thos. Kielly, Clerk to U.D.C.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Glasgow.—The Tramways Committee recommends acceptance of the following :—

Stoneware ducts.—Albion Clay Co., Ltd.
Trolley wire. Fred Smith & Co., Ltd.
Micanite cloth.—Micanite & Insulators Co., Ltd.
Tread plates.—Jos. Billingham.
Truck frames.—J. G. Brill & Co.
Scrap for disposal.—R. M. Easdale & Co.; Philip & Bruce, Ltd
Enamelled plates.—W. Landell.

London.—The Charing Cross, West End & City Electric Supply Co., Ltd., has placed a repeat order for four more 12-retort Erith-Riley stokers, each being applied to a water tube boiler with 10,850 sq. ft. heating surface. Each 12-retort stoker is applied to an archless furnace 21 ft. wide and has a normal capacity of 3 tons of coal hourly, continuously discharging the incombustible ash.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 2nd. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Mechanical Properties of Steel, with some Consideration of the Question of Brittleness," by Mr. W. H. Hatfield.

Royal Institution of Great Britain—Saturday, May 3rd. At 3 p.m. At Albemarle Street, W. Lecture on "The Psychology of Industry: Essential Considerations in Business Organisation, and the Consequences of their Comparative Neglect in Modern Times," by Prof. H. S Foxwell.

Thursday, May 8th. At 3 p.m. Lecture on "Clutches," by Dr. H. S. Hele-Shaw, F.R.S.

Society of Engineers (Inc.).—Monday, May 5th. At 5 p.m. At Burlington House, W. Paper on "Heat Treatment of Steel," by Mr. C. O. Bannister.

Institution of Civil Engineers.—Tuesday, May 6th. At 5.30 p.m. At Gt. George Street, S.W. Further discussion on papers on "The Electrical and Mechanical Equipment of the All metal Cars of the Manchester-Bury Section L. & Y. Railway," and "All-metal Passenger Cars for British Railways."

Roentgen Society.—Tuesday, May 6th. At 8 p.m. At the Royal Society of Medicine, 1, Wimpole Street, W. Silvanus Thompson memorial lecture on "The Electrical Changes in Active Tissues," by Prof. W. M. Bayliss, F.R.S.

Industrial Reconstruction Council.—Tuesday, May 6th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Workmen as Directors," to be opened by Mr. G. H. Humphrey.

Royal Society of Arts.—Wednesday, May 7th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "The Supply of Electricity," by Mr. J. S. Highfield.

Institution of Electrical Engineers.—Thursday, May 8th. At 2.30 p.m. Joint meeting with the Iron and Steel Institute. At the Institution of Civil Engineers, Gt. George Street, S.W. Papers on "Electric Furnaces." See "Notes" to-day.

(South-Midland Centre).—Wednesday, May 7th. At 7 p.m. At the University, Birmingham. Ordinary meeting.

(Students' Section).—Friday, May 9th. At 7 p.m. At the City and Guilds Technical College, Leonard Street, E.C. Paper on "The Principles of Scientific Illumination," by Mr. C. E. Webb.

Society of Technical Engineers (South-Eastern District).—Thursday, May 8th. At 7.30 p.m. At Caxton Hall, Westminster. General meeting.

Junior Institution of Engineers.—Friday, May 2nd. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Engineering at the Front," by Capt. G. B. Paterson, A.I.F.

Friday, May 9th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Pneumatic Tires as Applied to Road Vehicles, and their Automatic Inflation," by Mr. R. Darnfather.

THE ELECTRICAL WHOLESALERS' FEDERATION, LTD.

On Wednesday morning members of this Federation assembled at the Trocadero Restaurant, London, for their annual general meeting. The morning and afternoon sessions were devoted to the consideration of many matters of interest to electrical factors, and, indeed, to the electrical trade as a whole. These proceedings were, no doubt quite necessarily, conducted in private, but the technical Press was admitted to the luncheon. Mr. R. Wilson Smith (Commercial Manager of Drake & Gorham, Ltd.), presided over a company which numbered over 40, including the Press. The speeches were brief and businesslike, and, as recorded here, will suffice to let electrical factoring firms of proved standing and unimpeachable integrity know what are the objects of the Federation, and that the membership books are open to receive additional names, if they desire to associate themselves with what may well become a movement of considerable importance and one of value to the electrical trade. We give below the list of members in the six districts as at April 3rd, 1919 :—

London.—*Berry's Electric, Ltd.; British Electric Equipment Co.; Dawson, E., & Co.; *Drake & Gorham, Ltd.; Electrical Supplies, Ltd.; Gillespie & Beales; Leach, S. G., & Co.; Marshall and Plumtree; *Pooley & Austin; Sloan Electric Co., Ltd.; *Sun Electrical Co., Ltd.; Vulcan Electrical and Mechanical Engineering Co.; Wholesale Electric Co.; Wholesale Fittings Co.

Lancashire (Liverpool, Manchester, &c.).—Atkinson, Lloyd and Co., Salford; Jackson, H. A., & Co., Salford; *Baxendale Bros., Liverpool; Dennis, E. P., & Co., Liverpool; *Downes & Davies, Liverpool; Sutton, C. A., & Co., Liverpool.

Yorkshire.—Albion Electric Stores, Leeds; Casperson Bros., Leeds; *Hallamshire Electric Co., Sheffield; Scattergood and Johnson, Leeds.

Northern District (Newcastle and Middlesbrough).—British Electric Manufacturing Co., Newcastle; *Electric and General Stores, Newcastle; Gledson, J., & Co., Newcastle; Grainger, T., and Co., Newcastle; Heckels, M. O., Newcastle; Miller, J. F., and Co., Newcastle; *North British Engineering and Equipment Co., Newcastle; Rawcliffe, F., & Co., Newcastle; Bell, J. T., & Co., Middlesbrough; Hanson, Brown & Co., Middlesbrough; Jarvis Bros. & Co., Middlesbrough; Mulcaster, J., & Co., Middlesbrough.

Midlands (Birmingham and District).—Berkeley, A., Birmingham; Bill & Berry, Birmingham; *Donovan & Co., Birmingham; Robinson & Hands, Birmingham; Electrical Stores, Nottingham.

Scotland.—Cartwright, J., Glasgow; Miller & Stewart, Glasgow; *Paterson & Service, Glasgow.

*Members of the Committee.

Secretary: Mr. A. G. Beaver.
Offices: 118-120, Charing Cross Road, London, W.C.

We may mention here that one of the standing rules with which all members of the E.W.F. have to comply before joining is that they must purchase and carry stocks on their own account for supplies to electrical contractors, &c., further, they must not cater for the retail trade, and must not have any contracting (wiring) interests.

Mr. Smith, in proposing "The Electrical Wholesalers' Federation," said that the Association germinated in 1914, and became an incorporated body in 1915. Everyone would agree in these days of powerful combines that it was necessary that they should have a representative Asssociation such as that, for pooling interests, and for their protection.

There was no need for him to dwell on the usefulness of a genuine factor who carried large and varied stocks, both to the manufacturer and to the contractor. As one American writer had put it :—"We are expected to give prompt and infallible service, interpret orders which would require a Sherlock Holmes to understand what is wanted, often take back goods which have been ordered in excess, and give the full credit demanded—in fact, act as warehouse, stockroom, shipper, and, in many cases, banker as well."

They did this, relieving the manufacturers of the necessity of carrying large stocks throughout the country, minimising their risk of bad debts, and, in fact, acting as general distributing agents at a percentage, in many cases, much less than their own selling charges.

The activities of the Federation had necessarily been affected during the period of the war, although the Committee had done a large amount of ground work, and on several occasions had been able to bring about a better understanding between the manufacturer and the factor. They felt that the time had now come when by means of Main and Local Committees, meeting at regular intervals, they should be able to achieve results which would be beneficial to the industry as a whole. Mr. Smith coupled with the toast the name of the indefatigable secretary, Mr. Beaver, who had done more work than anyone else in putting the Federation on its present footing.

Mr. Beaver, in responding, said that he had the work very much at heart. They started just before the war in a small way, but the outbreak of war considerably nullified their efforts, as it disorganised a good many businesses. Notwithstanding the difficulties, they continued to endeavour to make headway. He was more than gratified to see that out of a total membership of 44 they had at least 36 present. That was a very good percentage and a very good omen. Obviously the members of the Federation had its interests at heart. In these days of Trade Unions and combinations of all sorts it was very essential that an industry like the wholesale electrical industry should have its own Association. It had a large number of interests to look after, and it needed protection, which could only be secured by binding themselves together in some way. Some years ago they felt the need of some such organisation, because manufacturers appeared to have a tendency to eliminate the factor wherever they could. If the factor was in a large way, and could command good business, the manufacturer would come along and solicit his orders, and then he had a happy knack of going round to the nearest contractor, or trade user, perhaps, and selling on exactly the same terms as when he secured the factor's large order. It was to do away with that state of things that the E.W.F. was brought into being. The efforts that the main Committee had made had been the means of promoting a better understanding with manufacturers than ever they had before. When the members got together they found that they were not such bad fellows, after all. At one time they used to think their competitors were their natural enemies. Now that they were meeting one another and interchanging views, the industry as a whole was benefited. There was no use in the senseless price-cutting which went on, and by meeting together they could see how it could be prevented. It meant that they got the same business—there was room for everybody—and they could get it at a better price than before. Mr. Beaver concluded by issuing an invitation to other genuine wholesale factors to join their ranks.

NOTES.

Royal Arch Masonry.—On April 8th, Mr. P. Colville Smith, Grand Secretary and Scribe, consecrated the Kelvin Chapter, which will be attached to the Kelvin Lodge, No. 3,736, which is composed of electrical engineers. The ceremony took place at Mark Masons' Hall, W.C., and the other Grand Chapter officers assisting were Mr. Percy Still, P.P.G.Soj.; Canon C. W. Barnard, Grand Superintendent, Warwickshire; Mr. C. F. Quicke, P.A.G.Soj.; and Mr. A. Ransford Collett, D.G.D.C. Mr. V. Delebecque, Mr. E. J. Reid, and Mr. J. O. Pearston were installed as the first Principals, and Mr. H. Porter-Cox was appointed secretary.

The Incorporated Municipal Electrical Association.——Annual Convention.—The Convention will be held this year at Felixstowe on June 17th-19th, and we have received a copy of the programme, which indicates a return to pre-war amenities. Headquarters will be at the "Felix" Hotel, Felixstowe; the meetings will take place on June 17th at the Town Hall, Ipswich, and on the following days in the Spa Pavilion, Felixstowe. Papers and reports will be taken as read. On Tuesday, June 17th, the Mayor of Ipswich will receive the Association, and Mr. F. Ayton (engineer and manager, Ipswich Corporation electricity supply and tramways) will deliver his presidential address, after which Ald. W. Walker will read a paper on "The Whitley Report." In the afternoon there will be visits to various works, followed by afternoon tea with the Mayor, and in the evening, dinner at Felixstowe. After dinner a special meeting of "Committee" members of the Association will consider the question of the salaries of chief electrical engineers in the light of the scale formulated by the Associated Municipal Electrical Engineers. On Wednesday morning at Felixstowe Mr. S. L. Pearce will open a discussion on "Electric Transmission Considerations," and a paper on "The Rating of Electric Supply Undertakings" by Bailie W. B. Smith, of Glasgow, will be read and discussed. In the afternoon the seaplane station will be visited, and in the evening the annual dinner will be held. On Thursday morning the annual general meeting will take place, followed by a special general meeting with regard to the alteration of the articles of association. Communications should be addressed to the president of the Association, Corporation Electric Supply and Tramways Departments, Ipswich.

Dissension in the E.T.U.—According to the Manchester *Daily Dispatch*, serious internal trouble is threatened in the Electrical Trades Union in consequence of the action of the Executive Council in granting strike benefit to members in the Thames, Belfast, Clyde, and Forth areas, who came out on strike without official sanction, and against the advice of their union, during the Belfast and Clyde strikes.

The action of the Executive Council is to be put to the vote on the appeal of the Newcastle Central Branch, who consider the action of the executive on February 2nd a gross violation of the rules by which a ballot must be taken before a strike can receive sanction.

"We most emphatically deplore this dangerous precedent as unconstitutional, unjust, and certainly not democratic (they state). . . . If this dangerous and autocratic precedent is allowed to pass unchallenged it will deprive members of the only safeguard they have within the union whereby they may counteract irregular and irresponsible handling of funds. Should this precedent become an accomplished fact it will place members at the mercy of the extremist and the irresponsible and will end in bankruptcy and chaos."

Ballot papers have been circulated throughout the union, on which members will vote for or against the appeal.

Educational. — Aeronautical Engineering. — The Aeronautical Institute of Great Britain has inaugurated an intensive Course in Aeronautical Engineering at the Institute of Marine Engineers. A well-attended Course started on April 14th, and a new Course is being arranged to commence very shortly.

Eclipse of the Sun.—Observations will be made by special British and American expeditions in South America, the Atlantic, and Africa of the total eclipse of the sun, which occurs on May 19th. Magnetic and electrical observations will be made at Cape Palmas, Liberia. Special attention should be given by wireless operators to any peculiarities in the transmission of signals at the time of the eclipse. It is important to ascertain whether there are any effects on signal strength due to the passage of the moon's shadow over a station, such as accompany the daily passage of the earth's shadow at sunrise and sunset.

Fatalities.—While assisting to clean out a boiler at the Hill Crest Oil Works, Clayton, John Robertson (17), a labourer, received a fatal shock from an electric bulb. It was stated at the inquest, at Manchester, that Robertson was holding the bulb by the joint at the top. He had done so for about a quarter of an hour when the boilerman, whom he was assisting, spoke to him without receiving a reply, and found that he had died as if going to sleep, without making a sound. Medical evidence was that death was due to heart failure following an electric shock (240 volts A.C.). The inquiry was adjourned for H.M. Inspector of Factories to make an examination.

At the resumed inquest on Monday, Mr. Henry Topham, Electrical Inspector, said he had examined the scene of the accident. Deceased had been cleaning out a boiler flue, and using a portable electric lamp attached to a cable. He had carefully examined the lamp, and found that the locking-ring connecting the two parts of the lampholder was slack. On one side the stranding which prevented the spring contact from touching the metal sleeve of the lampholder was broken away. The result was that it was quite easy for the terminal to touch the metal work of the lampholder. The whole thing would then become charged at 240 volts. The deceased, while holding the lamp, made good contact with the damp earth, and he would receive such a shock that death would be instantaneous. The lamp looked as if it had been improperly wired by someone who did not understand it. A representative of the firm explained that candles were provided for the class of work that the deceased was engaged upon, and it was against instructions for anyone to use the portable electric lamp. A verdict of "Accidental death" was returned.

It is stated that Patrick Dillon (33), while working a coal-cutting machine in Easterhill Colliery, Tollcross, received a fatal electric shock.

Whilst fixing an electric cable in a house at Bethnal Green, Thos. Carter (36), in the employ of the Stepney B.C., was killed through touching the cable which was apparently alive. The inquest was adjourned.

On April 25th a Post Office telegraph lineman fell from a pole 80 ft. high in Boyle Street, London, and was killed.

Electric Vehicle Committee.—At the request of the Executive Committee of the Association of British Motor and Allied Manufacturers, Mr. F. Ayton, M.I.E.E., hon. secretary of the Electric Vehicle Committee of Great Britain, has consented to read a paper on Electric Vehicles at the Royal Automobile Club, at 8.15 p.m., on Wednesday, May 14th.

The primary purpose of this paper, and of the discussion which will follow it, is to encourage the manufacture, in this country, of electric vehicles, and of the various components, accessories, and apparatus, required in connection with the construction, use, or charging of electric vehicles. It is hoped that the meeting will be attended by all who are interested in this important subject.

Tickets may be obtained from:—The General Secretary, Association of British Motor and Allied Manufacturers, Ltd., 39, St. James's Street, S.W. 1; or from Mr. F. Ayton, Corporation Electrical Supply and Tramways Departments, Ipswich.

Appointments Vacant.—The Council of the British Scientific Instrument Research Association (26, Russell Square, W.C. 1) is about to appoint an Assistant Director of Research at £1,000 per annum. Applications must be received by the Secretary by May 21st.

Electrical engineer and manager (£800), for the West Ham Corporation Electricity Department; charge engineer (84s.), for the Bath Corporation Electricity Works; shift engineer (97s. 6d.), for the Ealing B.C. Electricity Supply Department. See our advertisement pages to-day.

Plant Life and Wireless.—Sir J. C. Bose, of the Presidency College at Calcutta, announces that plant life receives and responds to the long ether waves used in wireless signalling. This great Indian scientist announced four years ago that plants were intoxicated by alcohol, wearied by too much work, and stung by blows.

Workmen's Compensation Claim.—In the City of London Court, on April 28th, before his Honour Judge Atherley Jones, K.C., the case of Gamble *v.* National Steam-Car Co., Ltd., was mentioned under the Workmen's Compensation Act. Plaintiff, Herbert D. Gamble, electrical engineer, 3, Cornwall Terrace, Regent's Park, claimed against the defendants, 16, St. Helen's Place, E.C., compensation for very serious injuries which had occurred to him while working for them, his salary being £300 a year. Mr. Tristram Beresford, plaintiff's counsel, said that the accident happened on August 28th when Gamble was at Chelmsford carrying out certain tests with a coal calorimeter. There was a little test glass on it. That exploded and wounded the plaintiff very badly in the face, and destroyed his eyesight. Defendants did not pay any compensation straight away, but now they consented to pay him all he could claim, viz., 25s. a week from August 31st to the present time, and to continue during his total incapacity. The Court directed an award to issue in accordance with those terms.

The Society of Technical Engineers.—Although the existence of this new Society has for many months been a matter of common knowledge, the promoters have not courted publicity, preferring to complete their organisation before coming into the open. The first public appearance of the Society, in fact, was at the Industrial Conference on April 4th, when, as already reported, the general secretary applied for representation of the Society on Joint Industrial Councils, including the National Industrial Council.

The formation of the Society was first proposed towards the end of 1917, when a number of informal meetings of engineers were held to consider the position of engineers under the new conditions created by the war. The first formal meeting was held in February last year, when representatives of a large number of engineers attended, and a provisional National Executive Council was formed. The movement was taken up with enthusiasm in all parts of the country, as it was recognised that the managing class was the only class of industrial worker still without an organisation, the first essential to effective action on behalf of the members of that class. Thousands of men are eligible for membership, and there is no sign of opposition to the movement. It is not intended that the Society shall replace existing scientific institutions, though it will endeavour to further the technical as well as the material interests of its members.

The whole of the present organisation, though it has been elaborated and developed widely, is of a provisional nature; when the draft constitution and rules of the Society have been approved, it will proceed to the formal election of council and officers. In the meantime a salaried general secretary, Mr. Norman Wyld, has been appointed, with offices at 25, Victoria Street, S.W. Besides affording opportunities for intercourse and the exchange of ideas between the members, the Society will stimulate the diffusion of technical knowledge, promote education and training, and endeavour to secure for engineers a more adequate recognition of the services they render to the community, as well as a larger share in the control of their working conditions. The qualifications for membership have not yet been defined with precision, but will be designed to make membership a guarantee of professional qualification. Probably the Society will be registered as a trade union.

Institution and Lecture Notes.—The Institution of Electrical Engineers and the Iron and Steel Institute.—The following are the papers which are to come before the joint meeting of these two bodies at the Institution of Civil Engineers, Great George Street, Westminster, S.W., on Thursday, May 8th, at 2.30 p.m.:—

J. Bibby, "Developments in Iron and Steel Electric Furnaces."
W. K. Booth, "The Booth-Hall Electric Furnace."
H. A. Greaves, "Application of Electrical Energy to the Melting of Metals."
R. G. Mercer, "Electric Furnaces in the United Kingdom, 1918."
Axel Sahlin, "A New Type of Electric Furnace."
Victor Stobie, "Large Electric Steel-Melting Furnaces."

Will our readers kindly take special note of the time of this meeting?

Informal Meetings.—The next informal meeting will be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to 335, High Holborn, W.C., on Monday, May 12th, 1919, at 7.30 p.m., when Mr. W. E. Bradshaw will open a discussion on "Regulations Issued by Electricity Supply Undertakings."

Illuminating Engineering Society, U.S.A.—The 1919 Convention of the Society will be held in Chicago, Illinois, as early in October as possible. Further details will be issued as soon as definite plans are formulated.

Institute of Metals.—The spring and autumn meetings of the Institute will be held respectively in London on May 19th and in Sheffield on September 24th and 25th. At the former, Prof. F. Soddy, F.R.S., will deliver the ninth annual May lecture, on "Radio-Activity," for which cards of invitation may be obtained from Mr. G. Shaw Scott, M.Sc., 36, Victoria Street, S.W. 1, upon receipt of a stamped and addressed envelope. The Sheffield meeting will be the first provincial gathering of the Institute to be held since the outbreak of war. There will be visits to works and other functions besides the ordinary business. Those desirous of participating in the Sheffield meeting should communicate at once with Mr. Shaw Scott.

Electrical Association of Australia (Victorian Section).—At a meeting held at Melbourne, on March 27th, a discussion on "Automatically-controlled Sub-Stations and Power Stations" was opened by Mr. G. G. Cree.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Southampton T.C. has advanced the salary of the tramways engineer, Mr. W. T. Robson, by £200 a year.

Mr. J. R. Hanton has resigned his position as station superintendent at the Rawenstall electricity works, Hareholme, and Mr. Wm. Audley Weldon, of the Lancashire Electric Power Co., has been appointed in his place at £250 per annum.

Cleckheaton D.C. has increased the salary of Mr. A. Pickersgill, chief electrical engineer, by £62 10s. a year.

Major Herbert Bell, Hull City electrical engineer, has returned to his duties after four years with the Forces. The Electricity Committee has decided to recommend the City Council to approve of Major Bell visiting the United States in order to investigate and report on the latest electrical developments.

Mr. A. F. Kellett, of the Bradford Corporation surveyor's department, has been appointed the permanent way superintendent to the Sheffield Corporation tramways.

General.—We have pleasure in giving herewith a portrait of Mr. J. W. Beauchamp, the recently appointed Director of Electrical Development, whose functions will no doubt bring him into contact with very many of our central-station readers, as well as with other branches of the electrical industry. It is "up to" Mr. Beauchamp to develop "electrical development" in this country; he will not find time hang heavy on his hands in that capacity—he will have a hard task to overcome the dead-weight of inertia and gain the sympathies of his clients, but he can be depended upon to infuse life and energy into the movement of which he has become the motive force, and he has our best wishes for his success.

Mr. J. W. Beauchamp.

We are informed that Mr. J. E. Edgecombe and Mr. J. W. Elliott, representing the Tungsten Lamp Association, have been added to the Main Committee, and Mr. Edgecombe, Director of the T.L.A., to the Executive Committee, of the Electrical Development Association.

According to the *Times* Professor Frederick Soddy, M.A., F.R.S., Professor of Chemistry in the University of Aberdeen, was elected on Tuesday to the new-established second chair of chemistry at Oxford.

Mr. W. Elsdon Dew, chief mechanical and electrical engineer to the Central Mining—Rand Mines group, has accepted the local secretaryship of the Institution of Electrical Engineers.—*S.A. Mining Journal.*

Mr. S. Evans, A.M.I.E.E., electrical engineer, of Hoylake, has resigned his position of Chief Government Magneto Inspector at the British Westinghouse Electric & Manufacturing Co., Manchester, and started a business with Capt. G. B. Wheeler, as magneto and car lighting specialists in Argyle Street, Birkenhead.

Mr. W. Brand arrived at Simon's Town, Cape Province, during March to take up the position of electrical engineer to the Admiralty at the Naval Dock Yards.

Mr. T. J. Gibbons, third-grade clerk in the electrical department at Devonport Dockyard, has been appointed third-grade clerk in the constructive department at Simon's Town Dockyard, Cape Town, the base of the Cape and West African Squadron. Mr. S. W. Rickard, acting second-grade clerk in the electrical department, Bermuda Dockyard, the base of the West Atlantic Squadron, has been appointed to the electrical department at Devonport Dockyard.

Mr. J. J. Woods, engineer and manager of Clones, Co. Monaghan, Electric Light & Power Co., has been appointed to a similar position with the Irish Towns Electric Light and Power Co., Belfast.

At a farewell supper and dance organised by the employés, Mr. E. J. Walsh, A.M.I.E.E., who recently resigned his his position as engineer and manager of the Musselburgh Electric Light & Traction Co., Ltd., was presented with a gold watch and chain and Mrs. Walsh with a gold locket and chain. Bailie Anderson, the local director of the company, who presided over an attendance of about 80, expressed the directors' regret at Mr. Walsh's resignation. Mr. Small, station superintendent, Mr. Smalley, traffic superintendent, and Mr. H. C. Babb (Mr. Walsh's successor) also spoke. Mr. Walsh has joined the staff of Messrs. Andrews & Co., of Glasgow, agents in Scotland for the Enfield Cable Co., Brook Motors, Brotherton Tubes, &c.

It is announced that Mr. Arnold B. Gridley has resigned his position as Director of Electric Power Supply, but will act temporarily as electrical adviser to the Ministry of Munitions pending the liquidation of electrical contracts and the disposal of outstanding matters under negotiation.

Mr. W. J. John, D.I.C., A.M.I.E.E., has been appointed lecturer in electrical engineering at East London College (University of London). Mr. John was trained at the City and Guilds (Engineering) College, South Kensington, and has since been for 2½ years assistant designer to Messrs. J. H. Holmes & Co., Newcastle-on-Tyne, and afterwards as wireless engineer in the service of the British Admiralty. Latterly he has been experimental and research engineer with Messrs. Allen, West & Co., Ltd., Brighton.

The Honours List.—The New Year Honours List just published contains the following:—

The Hon. T. H. A. E. Cochrane, who is made a baron, is a director of the Direct U.S. Cable Co., Ltd., and chairman of Thermit, Ltd.

Mr. E. Jardine, M.P., who is a director of the English Electrical Co., Ltd., and of the Bridgwater & District Electric Supply Co., Ltd., is made a baronet.

Sir J. D. Rees, M.P., also made a baronet, is a director of the Kolar Mines Power Station, Ltd.

Mr. G. M. Chamberlin, upon whom the honour of knighthood is conferred, is a director of the Norwich Electric Tramways Co., Ltd.

Prof. Richard Arman Gregory, who also becomes a knight, is a member of the Council of the British Association and in other capacities serves the interests of educational science; he was organiser of the British Scientific Products Exhibition. As editor of *Nature* we tender him our congratulations upon this well-merited distinction.

Obituary.—Mr. H. Thomas.—The death occurred recently of Mr. H. Thomas, for many years chief engineer of Fleetwood & District Electric Light & Power Co.

Mr. Imre Kiralfy.—We regret to record the death which occurred at Brighton on Sunday night, of Mr. Imre Kiralfy, the world-renowned organiser of exhibitions. During the past 20 to 30 years he had played a prominent part in many international exhibitions held in London. The White City and Stadium, opened in 1908, was a scheme of his origination and execution. The Franco-British, Imperial, and the Japan-British exhibitions, held at Shepherd's Bush, were among the more recent of his important undertakings. There is no doubt that had he lived, his interest in such matters would have led him to undertake other exhibitions and festivals suited to after-the-war conditions.

Mr. A. D. Hunter.—We regret to record the death of Mr. Albert Daniel Hunter, which occurred on April 17th, after a short illness. Mr. Hunter entered the service of Siemens Bros. & Co., Ltd., in 1889. At the formation of Siemens Bros. Dynamo Works, Ltd., in 1906, Mr. Hunter was transferred to that company and occupied the position of chief assistant secretary. Upon the death of the then secretary in 1908, Mr. Hunter succeeded to the position. He was 50 years of age.

Will.—Lieut. Leonard Gustav Byng, who was killed on active service in France in August, 1918, left £166,608 gross. Lieut. Byng, who was a son of the late Mr. Gustav Byng, was a director of the General Electric Co., Ltd.

Mr. W. D. Butcher, an ex-president of the Röntgen Society, left £9,225.

NEW COMPANIES REGISTERED.

Armstrong Whitworth Development Co., Ltd. (154,548).—Registered April 17th. Capital, £2,000,000 in £1 shares. To acquire and hold shares, stocks, debentures, debenture stocks, bonds, obligations and securities, and to carry on the business of ironfounders, engineers, manufacturers of implements, tools, and machinery, brassfounders, metal workers, boilermakers, millwrights, machinists, iron and steel converters, smiths, metallurgists, electrical engineers, &c. The subscribers (each with one ord. share) are:—Rear-Admiral C. L. Ottley, 17, Queen's Gate Gardens, S.W. 7; J. H. B. Noble, Ardkinglas, Inverary, barrister; N. W. Smith-Carington, 12, Cheniston Gardens, W., barrister; H. T. McAuliffe, Runnymede, Manor Way, Blackheath, chartered accountant; S. W. A. Noble, Kent House, Knightsbridge, S.W., engineer; Sir Glynn. H. West, 47, Great Cumberland Place, W., engineer; J. P. Davison, 169, Burbage Road, Dulwich Village, S.E., secretary. First directors: J. H. B. Noble, S. W. A. Noble, and Sir Glynn H. West. Qualification, 1,000 shares. Remuneration, £250 each per annum (£100 extra for the chairman). Registered office: 9, Great George Street, Westminster.

Boothroyd Repairs, Ltd. (154,461).—Private company. Registered April 17th. Capital, £5,000 in £1 shares. To take over the business of the electrical contracting part of the business of H. T. Boothroyd at Akenside Street, Bootle. The subscribers (each with one share) are:—F. S. Milton, Gorsefield, Queen's Drive, Moseley Hill, Liverpool, pawnbroker; W. H. Thomson, 67, Worcester Road, Bootle, Liverpool, electrical engineer. First directors: F. S. Milton (chairman), H. T. Boothroyd, and W. H. Thomson. Registered office: 25-33, Chalbner Street, Liverpool.

Devon Hydro-Electric & Development Co., Ltd. (154,506).—Private company. Registered April 19th. Capital, £20,000 in £1 shares. To promote an Act for incorporating a statutory company for generating electricity by using water from rivers on Dartmoor or elsewhere in Devon, Somerset, and Cornwall, or otherwise, and supplying electrical current for all purposes, and also for supplying water, &c. The subscribers are:—F. B. Lacy, Claremont, Northwood, company director, 1,000 shares; W. S. Abell, 11, Wedderburn Road, N.W. 3, naval architect, 250 shares. First directors: Prof. W. S. Abell, F. B. Lacy, J. N. A. Houblon, P. B. Glanville, and Dr. J. A. Parves. Registered office: 52, Queen Street, Exeter.

J. A. Crabtree & Co., Ltd. (154,486).—Private company. Registered April 17th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electrical and mechanical machinery, dynamos, motors, cables, heaters, cookers, &c. First directors: J. A. Crabtree, 16, Clements Road, South Yardley, Birmingham; G. F. Harper, Branksome, Victoria Park, Colwyn Bay; J. A. Harper, 53, Douglas Road, Acocks Green, Birmingham. Solicitor: H. Cant, 33, Newhall Street, Birmingham.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Priestman Bros., Ltd.—Particulars of £5,000 debentures, created February 12th, 1917, and all issued March 28th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital, freehold and leasehold land, &c. These debentures rank *pari passu* with £5,000 like debentures issued in 1916, and next after a prior lien debenture for £10,000 issued in 1902, but in priority to £21,250 debenture stock secured by trust deed of 1913.

Thompson Bros. (Blackburn), Ltd.—Particulars of £1,500 debentures, created and all issued March 25th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Omega Lampworks, Ltd.—Issue on February 21st, 1919, of £600 debentures, part of a series already registered.

CITY NOTES.

W. T. Henley's Telegraph Works Co., Ltd.

At the annual meeting, on Friday last, Mr. G. Sutton, M.I.E.E., who presided, said that although the result of the trading for the year under review was not as good as that of the previous twelve months, he believed it would be regarded as very satisfactory by the shareholders. They had increased the share capital by the issue of 200,000 new ordinary shares. The reserve account was reduced by the £200,000 which had been capitalised by the new ordinary shares, but it still remained at the substantial amount of £105,000, which it was proposed to increase at the meeting to £130,000, and in addition they had provided £10,477 for repairs which could not be done during the war. They were still making war allowances to the dependents of men who still remained in the forces. So far they had spent about £16,000 on that account. On the other side of the balance sheet the amount to the credit of land, buildings, and machinery was reduced by the transfer to the new Tyre Co., and, on the other hand, it had been increased by the £19,000 of additions. There had not been much building during the war, but in the current year the amount which would be required for additions would be much larger, as they were proceeding with many building plans. Investments in Government securities were less by about £5,000, as they would be using the money in the development of the business now that restrictions on trading were removed. There was an increase of £140,000 in investments by reason of the partly-paid shares which they held in the new Tyre Co. The item of stock in trade was a little smaller than in the previous accounts. The profit and loss account showed a reduction of about £35,000 in the balance of trading account, but provision for depreciation was about £20,000 less owing to the fact that they had not had to put down as much special machinery for war purposes as in previous years, and consequently they had not had so much to scrap. The net profit amounted to £148,000, or about £14,000 less than last year, but notwithstanding that they were paying an increased dividend. They had considerably increased the salaries paid to the staff, and the wages of the workpeople; they had increased bonuses all round, had added to their reserve account, and increased the carry forward, and that being so, the directors thought that the reduction in the purchasing power of money and the high rate of income tax justified them in recommending an increase in the dividend. During the past 30 years the undivided profits of the business had been used in developments and extensions. The small factory which existed 30 years ago, employing some few score of people, had developed into the three factories now possessed by the company in which they employed some thousands of people. The use in that way of reserves so created was bound to lead to the enlargement of the profits. With regard to profit-sharing as usually understood, he thought it was absolutely impracticable in connection with such a business as the company carried on. He had given more than 20 years' consideration to the matter, and had endeavoured to find a method which the company could adopt, but without success. He could not find any system which would satisfy the labour side and at the same time would not endanger the existence of the business as a prosperous concern. Was it likely that labour under a profit-sharing scheme would be satisfied that profits should be used in extension of the business? That was only one of the many difficulties which arose in a business such as theirs in dealing with the problem. He was convinced that labour had to be satisfied with being properly paid and not by any division of profits. They were paying 15 per cent. on the ordinary capital, but that was not a proper way of looking at their dividend. The share capital was not the item to look at in considering the profits, but the actual capital which was employed in working the business, and the actual dividend paid on the capital employed in the business was less than 4½ per cent. They were doing a great deal more for their workpeople than merely paying them wages. They were doing all sorts of work in connection with their welfare departments, in respect of which a considerable charge appeared in the present accounts. As to the future, it was more difficult than usual this year to attempt any reliable forecast. They had quite a large number of peace orders on their books, but they had been hampered since the armistice by restrictions on exports, and to a more moderate extent by restrictions on imports of raw materials. He trusted that those restrictions would be removed in the course of a few weeks. At the present time, however, they were suffering under them, and the works were not as fully occupied with ordinary commercial work as they might otherwise be. The effect of the high wages which they were paying upon the future of the industry and upon their ability to meet competition was difficult to estimate. With his 40 years' experience of the business he might say that there was plenty of work at present for the whole of the electrical industry, and he thought that for the next two or three years the high rate of wages would not interfere with their obtaining business. Certainly as far as the home trade was concerned they would be in no worse position than any of their competitors, and he presumed that the authorities, who taxed them so heavily, would see that they were not unduly hampered in competitive trade in England by foreign competition in the form of dumping. For the next year or two at all events he did not think they would suffer as regarded the overseas trade, but high wages might eventually have a great effect on that trade, though he did not feel competent to make any forecast in that connection. It was impossible to state what the position of America and Japan might be in the next two or three years with regard to labour. The palliative for high wages was supposed to be a larger output, and so it was, but he was not inclined to think that the rearrangement of hours which they had recently made at their factories would give them an increased output to compensate for the increased cost of labour. He believed, however, that the higher rates of wages generally must inevitably lead to a greater demand for commodities which must result in higher prices or in the increase of production. Personally, he was not at all opposed to a high rate of wages. In conclusion, the chairman referred briefly to the tire business, which he said was a splendid enterprise. Its future, however, was endangered by the excess profits duty, because being a new business it had no pre-war standard of profits, and they were only allowed 6 per cent. on the original capital employed and 9 per cent. on the additional capital, which after providing for income tax and other charges, allowed nothing for the development of the business, and did not give a sufficient return to the capital employed, to enable new capital to be raised. Mr. Martin Roberts seconded the motion, and the report was adopted.

Bromley (Kent) Electric Light and Power Co., Ltd. Mr. F. E. Gripper presided recently at the annual meeting. He said that the adverse conditions had been increasingly felt at Bromley, where their revenue depended so largely upon lighting load. The Rationing Order decreased their lighting sales by 20 per cent., as compared with 1917, and by 40 per cent., as compared with pre-war. Sales for heating and power fell off by 20 per cent., as compared with 1917. Revenue decreased by £2,327, and costs of generation increased by 400. The combined effect of the lighting restrictions and summer-time had resulted in their having to run the works for six months last year at an actual loss, expenses exceeding the receipts during the six summer months, April to September. They not only had to increase the charge per unit, but had to put into force the minimum charge of 13s. 4d. per quarter provided for in their provisional order. The reason that the minimum charge of 13s. 4d. per quarter was provided for under the provisional orders was that capital expenditure had to be incurred by the company for every consumer connected to the company's supply, the cost of connecting a small consumer being very little less than the cost of connecting a large consumer. Unless a minimum of 20 units was taken and paid for each quarter there was not an adequate return upon the expenditure which had had to be incurred in order to make the supply available to the consumer. The consumers who used less than 20 units in any quarter had been supplied at a loss, as the company's standing charges incurred in order to make the supply available to the consumer had to be met whether the consumer was using a supply or not. Objections were taken to the charge on the ground that under the rationing order people were expected to economise, but it should be pointed out that people were not expected to economise below a certain point, and that the ration of electricity allowed for even the smallest house was never less than 20 units for each of the two summer quarters and 40 units for each of the two winter quarters. The company's object in enforcing the minimum charge was not that they wanted the consumer to pay for electricity which he had not used, but they wanted the consumer to use the minimum of 20 units, as it was the revenue which was of importance to the company. The year had been very difficult and trying, and of the future it was difficult to say how quickly to expect a return to normal conditions, but he hoped that the restrictions on lighting would shortly be removed, when a large part of the lighting load would be regained. During the last four years the connections to the mains had increased by nearly 20 per cent., and when in full use again he saw no reason why they should not regain former prosperity.

Dublin & Lucan Electric Railway Co. The report adopted at the annual meeting showed that after providing for debenture interest, there is a balance of £744, out of which the preference dividend for one half-year is to be paid, absorbing £475. The chairman, Mr. J. W. Hill, said the traffic receipts showed a net increase over 1916 of £3,284, and over 1917 of £2,345, and the receipts from electric light had increased from £362 in 1917 to £432 in 1918, or nearly 20 per cent. During 1918 the passengers carried were 441,171, compared with 452,137 in 1917—a reduction which was entirely due to the limited service, particularly on Sundays, when the service was cut down by 60 per cent. by order of the Government. All the principal expenditure figures showed increases. He hardly exaggerated in saying that the wages bill for 1919 would not be less than double that of any previous year, and the cost of fuel had risen by nearly £1,000, or practically 33 per cent. over 1917. The total increase in expenditure over 1917 might be taken at £3,000. In view of the arrangement with the Government, the present income did not depend on traffic receipts or working expenses. Unfortunately, they could never hope, as long as that arrangement held, to pay a full dividend on the preference shares. In the circumstances, the directors considered it their duty to ascertain the company's legal position with regard to the debenture liability, and counsel had advised that it was not necessary, under existing war legislation, to do anything beyond continuing to pay the interest for the time being. This advice, of course, they would follow.

Madras Electric Tramways (1904), Ltd.—Mr. A. M. Quill, presiding at the annual meeting on April 23rd, referred to the increased working costs and the cost of materials, also to the increase in fares to meet the situation. There was an increase of 9.9 per cent. in the number of passengers carried and of 11.2 per cent. in traffic receipts. It is intended, during the current year, to replace the 60-lb. rails in Wall Tax Road by 90-lb. rails, and this will practically complete the substitution of the old 60-lb. section. The route for a new double line for a certain length had been approved by the corporation, and the matter was before the Government for consideration. The estimated cost of widening of bridges in this connection was to be borne partly by the corporation and the company and partly by the Government. The board was about to proceed, in co-operation with the Madras Electric Supply Corporation, with the institution of a provident and pension fund for the employés.

Indian Electric Supply & Traction Co., Ltd.—The report for 1918 states that the surplus on the year's working in Cawnpore was £19,271 (against £17,767 in 1917), and including transfer fees and exchange adjustment in England the credit side of net revenue account shows a total of £20,674. London expenses £2,227; debenture interest, £3,900; reserve for depreciation and renewals, £6,000; debenture issue expenses written off, £1,000; brought forward, £685. After paying 8 per cent. for the year on the ordinary shares issued prior to December, 1918, and 5½ per cent. on those issued subsequently, £336 is paid as directors' commission on dividends, and £1,171 is to be carried forward.

North of Scotland Electric Light & Power Co., Ltd.—Gross profit for the year ended December 31st last £6,644. Interest on debentures and loans absorbed £2,629, leaving a balance, including £1,700 brought forward, of £5,714. A dividend of 3 per cent. is recommended; £2,000 to be placed to renewal reserve; £1,000 to general reserve, and £1,214 to be carried forward.

New Issue.—*The Manganese, Bronze & Brass Co., Ltd.*, have been issuing (through the British, Foreign & Colonial Corporation, Ltd.) £115,000 first mortgage six per cent. redeemable debentures to provide new capital for the erection of rolling mills at Ipswich, &c.

W. T. Glover & Co., Ltd.—Year 1918. Dividend on ordinary shares 5 per cent. and a bonus of 2½ per cent., both less tax. To reserve £20,000. Carried forward £9,891.

Montreal Light & Power Companies.—The Montreal Light, Heat, and Power Consolidated has declared a dividend of 1 per cent. on the paid-up capital stock (being at the rate of 4 per cent. per annum) for quarter ending April 30th. The Montreal Light, Heat & Power Consolidated, operating the above company, has declared a dividend of 2 per cent. on the paid-up capital stock (being at the rate of 8 per cent. per annum) for the same quarter.

Stock Exchange Notices.—The following are to be officially quoted :—

International Light & Power Co., Ltd.—£396,200 5 per cent. first mortgage debentures of £100 each (within Nos. 1 to 4,000).

Newcastle-upon-Tyne Electric Supply Co., Ltd.—500,000 additional ordinary shares of £1 each, fully paid (Nos. 797,682 to 1,297,681).

City Electric Light Co., Ltd. (Brisbane).—Year ended January 31st, 1919. Credit balance £33,559. Interim dividend paid in September £16,839. Further dividend paid in March, 1919, 3 per cent. on preference and 5 per cent. on the ordinary. Carried forward £415.

Dictograph Telephones, Ltd.—Annual meeting held April 14th. Very successful year reported; future prospects very satisfactory. Dividend 10 per cent., less tax.

River Plate Electricity Co., Ltd.—Half-yearly dividend of 3 per cent. on the 6 per cent. non-cumulative preferred shares.

Kaministiquia Power Co.—Dividend 2 per cent., less tax, for the quarter.

STOCKS AND SHARES.

Tuesday Evening.

The Stock Exchange is a-tiptoe with expectation over the Budget. As May 1st is a holiday, markets will not feel the force of the Chancellor's speech until the Friday in this week, but advance forecasts have been many. The income tax and the excess profits duty are the two main centres of interest. Relief in the one case may be balanced by further pressure in the other. Meanwhile the hopes of compromise between the "Big Four," the obvious breaking-up of Bolshevism in Russia, and the coming release of industry from Government control are hailed as bullish factors. Business is by no means bad, although last Sunday's blizzard played havoc with communications for a day or two. The oil boom continues an outstanding feature.

Oil is playing a prominent part in the amazing prosperity of the City Services Co. Gross earnings in 1911 were under a million dollars. In 1916 they were over 10 million dollars, and last year they came to 22 million dollars. Net profits were two million dollars in 1913, and 21¾ million dollars in 1918. The expansion occurred mainly through the company's utility business, but the report mentions a new branch of profit, present and potential, in the oil lands that are being developed. Two years ago, the gross earnings from oil operations were 4½ million dollars, whereas last year they rose to 18 million dollars. New capital to the tune of 34 million dollars was raised during 1918, and of this, 30 million dollars was in 7 per cent. convertible gold debentures. The common shares stand at 425, the fractions at 350, and the preferred at 84.

Home electricity issues are disposed to be dull, although the pre-ordinary issues remain firmly held. Charing Cross ordinary are ⅛ lower, and shares in the other London undertakings lean to the lower side. Edison Swan have gone back to par on the forthcoming issue of 200,000 ordinary shares at £1 each, the money being wanted for development of the business. General Electric ordinary rose 12s. 6d. to 18½ on the hope of an early scheme for splitting the shares. Electric Constructions are 1/16 easier at 23s. 9d. The new preference shares of the Midland Power Distribution are hard at 5s. premium.

Mexican Utilities have weakened on the disquieting news of further revolution and bloodshed. Mexico Tramways 6 per cent. bonds fell 3 to 49, and business was recorded at 47, while the 5 per cent. first mortgage changed hands as low as 59. British Columbia Electric Railway 4½ per cent. debenture recovered to 62, but the preferred is 2½ lower at 37½. Brazilian Tractions are 1½ up to 57¼, other Brazilian issues also being in favour.

Marconis remain quiet, notwithstanding the fact that the whole of the business is to be freed from restrictions. Mr. Godfrey Isaacs has been speaking optimistically of the capacity for wireless extension, more particularly in connection with the development of aeroplane services in the sphere of commerce. Marconis are steady at 4 13/16, Marines being better at 4 11/16. Americans fell sharply to 28s. on a slight pressure to sell. Canadians remain at 15s. 9d.

Direct United States Cable shares are flat at 4½, a fall of 15s., on a circular issued by the company recording a chapter of remarkable war accidents. The company's main cable was interrupted as far back as September, 1917, and one drawback after another conspired to prevent the necessary repairs being made. Admiralty requirements, submarine dangers, gales, engine trouble, were amongst the checks encountered. The company spent £70,000 upon fruitless expeditions. On top of all, the Western Union Telegraph Co. decided to enforce the clauses under which it is entitled in certain conditions, first, to reduce the rent, and, secondly, to terminate the lease. The Direct United States Board have taken steps to apply to the High Court for relief against forfeiture of the lease. Arrangements have been made for the immediate dispatch of the c.s. *Faraday* to repair the main cable. There the matter stands for the moment, but a more unhappy concatenation of adverse circumstances can hardly have befallen any cable company as a result of the war.

Anglo-American Telegraphs, meanwhile, are better. Cuba Submarines have risen another 5s. on the dividend, and Eastern Telegraph stock is half a point higher. Telegraph Constructions are 10s. up. Henley's maintain their advance. India-Rubber shares keep dull, although it is held by some that the continued shrinkage in the price of the raw material should be a good thing for such companies. Rubber shares are undecided; the market looks for benefit from the substitution of any form of taxation in place of excess profits duty. The engineering shares keep fairly hard, but Babcocks are ⅛ down. Armaments are a good market, on the close alliances being formed for peace purposes with electrical industries. The air is charged with rumours of arrangements, absorptions and amalgamations.

Home Rails are heavy, though Metropolitans rose superior to the prevailing weakness and advanced to 27. The London Electric Railway is applying for Parliamentary powers to raise more capital, in the shape of debenture stock. Recent activity in East Londons has given way to the more usual condition of complete quietude. There is a thousand or two 5 per cent. 1914 preference stock of the Metropolitan Railway in the market. It is offered at 77, at which the yield is the exceptionally high return, for a Trustee security, of 6½ per cent. on the money.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price April 29, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies.					
Brompton Ordinary..	10	8	6¾	—	£5 8 16
Charing Cross Ordinary	4	4	8⅝	−⅛	5 18 4
do. do. do. 4½ Pref...	4½	4½	8¼	—	6 18 4
Chelsea..	6	6	3⅝	—	4 1 1
City of London	8	8	11¾	—	6 16 2
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 3
do. do. 6 per cent. Pref.	6	8	9¾	—	6 3 1
Kensington Ordinary	7	6	5⅞	—	5 2 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref...	6	8	3⅞	—	7 14 10
Metropolitan	4	5	8⅛	—	8 0 0
do. 4½ per cent. Pref. ..	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
Sonth London	5	5	2¾	—	7 5 6
Sonth Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6½	—	6 8 1
Telegraphs and Telephones.					
Anglo-Am. T l. Pref.	6	6	98½xd	+1	6 1 10
do. Def.	1½	83/6	22⅛	+⅛	7 9 0
Chile Telephone	8	8	7¾	—	6 8 6
Cnba Sub. Ord.	7	7	11½	+¼	*6 7 4
Eastern Extension	8	8	16	—	*5 0 0
Eastern Tel. Ord.	8	8	162½	+½	*4 18 6
Globe Tel. and T. Ord.	7	7	14½	—	*4 16 7
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	22	22	81	—	7 2 0
Indo-European	13	13	57½	—	6 18 0
Marconi	20	20	4 13/16	—	4 3 0
Oriental Telephone Ord.	10	15	2 7/16	—	6 8 0
United R. Plate Tel.	8	8	7¾	—	*6 1 7
West India and Panama	1/3	1/3	1½	—	*4 8 4
Western Telegraph	8	8	16¾	—	*4 15 10
Home Rails.					
Central London Ord. Assented ..	4	4	63½	—	6 6 0
Metropolitan	1	1¼	27	+½	4 12 7
do. District	Nil	Nil	23½	—	Nil
Underground Electric Ordinary..	Nil	Nil	8¼	—	Nil
do. do. "A" ..	Nil	Nil	9/3	—	Nil
do. do. Income ..	4	5	96	—	*6 4 2
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	8 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	8¼	—	—
do. do. 2nd Pref. ..	—	—	3⅝	−⅛	—
do. do. 6 Deb... ..	5	5	68½	—	7 8 5
Brazil Tractions	—	—	67½	+1½	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	6	6	59	—	8 10 0
do. do. Preferred	Nil	Nil	37½	−2½	Nil
do. do. Deferred	Nil	Nil	37½	—	Nil
do. do. Deb. ..	4¼	4¼	62	+1	6 17 4
Mexico Trams 6 per cent. Bonds..	Nil	Nil	61	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	49	−3	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	68	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	9⅝	−⅛	4 2 9
British Aluminium Ord.	10	10	1 11/32	—	6 0 10
British Insulated Ord.	25	12½	2 1/16	—	6 1 1
British Westinghouse Pref. ..	7½	7½	2½	—	6 8 0
Callenders	25	25	10	—	6 6 0
do. 6½ Pref.	5	6½	5¼	—	6 9 10
Castner-Kellner	25	20	8¼	—	6 8 1
Edison-Swan, "A"	—	—	1	−1/32	7 10 0
do. do. 6 per cent. Deb. ..	4	5	75½	—	6 12 8
Electric Construction	10	10	1 3/16	−1/16	8 8 6
Gen. Elec. Pref.	6	6½	10⅜	—	6 5 4
do. Ord.	10	10	18½	+⅝	*5 8 0
Henley	25	25	2 7/16	—	5 2 6
do. 4½ Pref..	4½	4½	4	—	5 12 6
India-Rnbber..	10	10	16⅜	—	*6 0 4
Siemens Ord...	—	10	6⅝	—	*7 11 0
Telegraph Con.	20	20	24½	+½	4 16 2

Dividends paid free of Income Tax.

THE LITERATURE OF SCIENTIFIC MANAGEMENT.

By FRANK J. MAURICE.

Before the war, in the United Kingdom, there were probably not more than a hundred manufacturing employers who had heard of scientific management, nor a dozen who knew what it meant; only one had adopted it.

To-day there is a rush for information about it, and a growing realisation that competition will be impossible against American, French, Belgian, Italian, and German industries which produce three articles per workman against our one.

The situation is not an old one that we have survived in the past, but an almost entirely new one, owing to the extension of scientific management, in the countries mentioned, during the war.

The books on the subject are beginning to multiply, and at the request of the editor, the writer proposes to give an outline of the scope of those books which have come under his notice, for the assistance of intending students.

1. *The Principles of Scientific Management.* (By Frederick Winslow Taylor, M.E., Sc.D. Publishers: Harper & Bros., New York.)—In this book—which is essentially the first to read—Dr. Taylor deals with the fundamentals and principles of the subject. The whole philosophy of scientific management is to be found here, together with a number of illuminating examples showing the results the author obtained in leading engineering works in the United States.

The work is a short one—70 pages—the style and subject matter fascinating, and it has for one of its principal objects—to quote the author—to answer the questions: "(1) Wherein do the principles of scientific management differ essentially from those of ordinary management? (2) Why are better results attained under scientific management than under the other types? (3) Is not the most important problem that of getting the right man at the head of the company? And if you have the right man cannot the choice of the type of management be safely left to him?"

2. *Shop Management.* (By F. W. Taylor, M.E., Sc.D. Publishers: Harper & Bros., New York, 1912.)—This book should certainly be next read by a student of the subject. It deals fully with the practical application of the principles of scientific management, but without too much detail, and contains nothing too technical for, shall we say, the non-scientifically trained directors of an engineering concern.

Dr. Taylor does much straight talking to both employer and workman, and while "soldiering"—or ca' canny—is not spared, the still too prevalent notion that low wages mean a low labour cost is equally exploded; and both parties are cautioned at the outset "that no system or scheme of management should be considered which does not in the long run give satisfaction to both employer and employé, which does not make it apparent that their best interests are mutual, and which does not bring about such thorough and hearty co-operation that they can pull together instead of apart."

"High wages and a low labour cost," is the watchword throughout, and Dr. Taylor assures us that this ideal has been attained in every case where he has installed his system, to the mutual and entire satisfaction of both parties.

Profit sharing is not favoured, and some convincing arguments are produced against it. Various pay systems are dealt with and compared.

The author—as a sound manager must be—is a practical psychologist: "The spending of money for good machinery appeals to them (*i.e.*, company directors), because they can see machines after they are bought; but putting money into anything so invisible, intangible, and, to the average man, so indefinite, as an organisation seems almost like throwing it away." But he quotes an enlightened manufacturer: "If I had to choose now between abandoning my present organisation and burning down all of my plants which have cost me millions, I should choose the latter. My plants could be rebuilt in a short while with borrowed money, but I could hardly replace my organisation in a generation."

The ordinary form of management wherein orders are conveyed through several intermediaries from manager to workman is condemned, and "functional management" is insisted upon, the specialists in each function being either united in a planning department, or, at any rate, pivoting thereon. This department is described at some length, and is the centre of the new organisation.

The basis of scientific management, accurate time study, is dealt with at length in a general way, but precise instructions for carrying it out are not within the scope of the book. The general application of time study is described, however, and useful tables for recording observations are included.

In Dr. Taylor's own words: "This book is written mainly with the object of advocating high wages and low labour cost as the foundation of the best management, of pointing out the general principles which render it possible to maintain these conditions even under the most trying circumstances, and of indicating the various steps which the writer thinks should be taken in changing from a poor system to a better type of management."

3. *Efficiency Methods.* An Introduction to Scientific Management. (By M. McKillop, M.A., and A. D. McKillop, B.Sc. Eng., C.E. Publishers: George Routledge & Sons, Ltd., London, 1917.)—Students of the subject, whether "lay" or technical, would do well to make this the third book of their course, though it could easily be read first, and, indeed, should be, if difficulty is experienced in obtaining Taylor's books.

"Efficiency Methods" is undoubtedly the English primer of scientific management. It deals with the whole subject in a methodical and readable manner, and is characterised throughout by unusual impartiality in the comparison of different, and sometimes conflicting, views.

The list of contents is, in itself, an example of efficiency methods, and is worth quoting *in extenso* as an indication of the scope of the book:—

1. Introduction.
2. Management: A Preliminary Discussion.
3. Modifications in Organisation.—A. The Planning Dept.
4. Modifications in Organisation.—B. The Costing Dept.
5. Modifications in Organisation.—C. The Foreman.
6. Standardisation and Classification.
7. Standardisation of Equipment.—A. The Stores Dept.
8. Standardisation of Equipment.—B. The Tool Room.
9. Standardisation of Methods.—A. Time Study and Motion Study.
10. Standardisation of Methods.—B. Fatigue Study.
11. Standardisation of Methods.—C. The Schedule Time or Standard Task.
12. Standardisation of Methods.—D. The Instruction Card.
13. Remuneration under Scientific Management.
14. Scientific Management and Welfare Work.
15. Scientific Management and Trade Unions.
16. Scientific Management and Education.
17. The Installation of Efficiency Methods.

The purpose of this article would not be fulfilled without naming the books (others than those reviewed) mentioned by Messrs. McKillop, and to which the student may wish to refer:—

H. B. Drury's "History and Criticism of Scientific Management." 1915.

R. F. Hoxie's "Scientific Management and Labour." 1916.

H. L. Gantt's "Work, Wages, and Profits" and "Industrial Leadership."

H. L. Gantt's "How Scientific Management is Applied."
A. H. Church's "Proper Distribution of Expense Burden."
Holden Evans's "Cost-keeping and Scientific Management."
Miss Goldmark's "Fatigue and Efficiency."
Muensterberg's "Psychology and Industrial Efficiency."
British Association Committee's Reports on Industrial Fatigue, 1915 and 1916.
Ministry of Munitions' Report on Health and Fatigue of Munition Workers, 1917.
Mrs. L. M. Gilbreth's "Psychology of Management."
Parkhurst's "Applied Methods of Scientific Management."

4. *Motion Study. A method for increasing the efficiency of the workman.* (By Frank B. Gilbreth. Publishers: Constable & Co., Ltd., London, 1911.)—This would appear to be the first book to be read on its special subject. It is the philosophy of motion study, and for every tenet, an example is produced in demonstration, generally taken from the craft of bricklaying. The broad headings dealt with are: (i.) General outline of motion study. (ii.) Variables of the worker. (iii.) Variables of the surroundings. (iv.) Variables of the motion. (v.) Past, present, and future of motion study. The book is profusely illustrated, and serves the double purpose of being a general introduction to the subject, and a particular treatise on bricklaying.

We could have wished, however, that the publishers had read on page 51, "There shall not be any polished surfaces . . . that will reflect an unnecessary bright spot anywhere that can be seen by the eyes of the worker." The book is printed on highly glazed paper.

5. *Applied Motion Study.* (By Frank B. Gilbreth and L. M. Gilbreth, Ph.D. Publishers: G. Routledge & Sons, Ltd., London, 1919.)—This book contains a great deal more than its name suggests. It deals with the whole question of scientific management in a detailed and technical way, and is one of the professional handbooks which the scientific manager himself will use.

Motion study is described in its application to various fields of activity, and the methods and principles of its application to any and all work are dealt with at length. The instruments of the time study engineer are described and their uses explained; they vary from the homely "movie" camera to the somewhat awe-inspiring autostereochronocyclegraph.

The book contains some interesting figures and diagrams, amongst which should be mentioned that illustrating the difference between the traditional or military type of management and functional or scientific management.

The first and last three chapters deal more generally with the subject of scientific management, but are still rather for the technician than the administrator.

6. *Fatigue Study.* (By Frank B. Gilbreth & L. M. Gilbreth, Ph.D. Publishers: George Routledge and Sons, Ltd., London, 1916.)—"Fatigue Study," say the authors, "is related to motion study in that both are branches of waste elimination. Fatigue study classifies fatigue, and outlines methods by which unnecessary fatigue may be eliminated and rest from necessary fatigue may be provided."

The authors advocate a "fatigue survey" in every works, the object of which is to:—

(*a*) Learn accurately the existing "fatigue" conditions.

(*b*) Picture the problem thoroughly to those interested.

(*c*) Analyse the problem of fatigue elimination into working units susceptible of attack.

(*d*) Arouse the interest of all employés.

(*e*) Show relation between fatigue and activity.

(*f*) Teach every worker to conserve his working powers.

A very readable treatise, primarily for the technical manager, but of almost equal interest to employer and welfare worker.

7. *Taylor System in Franklin Management.* (By Lieut.-Col. George D. Babcock, formerly production manager, H. H. Franklin Manufacturing Co., in collaboration with Reginald Trautschold, M.E., with a foreword by C. G. Barth. Publishers: G. Routledge & Sons, Ltd., London, 1918.)—For many reasons this is a wonderful book, and not least among those reasons are the enthusiasm and public spirit which prompted the Franklin Co. to have such intimate information as to its inferior economy published to the world. For this book describes in detail and graphically the working conditions and results of the company's automobile production over a term of nine years ending in 1917, covering periods before, during, and after the installation of the Taylor system.

It is essentially the advanced technical handbook on our subject, and should be read by any management before their consulting management expert commences to install the new system.

It is interesting to note the somewhat exceptional circumstance that the installation of the Taylor system was invited by the works management of the Franklin plant, rather than by the owners; an impartiality and progressive spirit on the part of the former which the directorate of an industrial company will not be wise in expecting to be often repeated—at least for some years to come, when sufficient object lessons and the effects of competition have done their work. The author faithfully relates how the Taylor system was investigated by himself and his co-workers, and describes the evidence upon which they recommended its adoption to their management. He then deals with the installing of the system in all its details, including some quite special "mechanism" such as a control-board room where exact progress throughout the plant was indicated on a number of control boards bearing numeral and symbol type, and a pneumatic tube system for sending and receiving job tickets between individual workmen and the planning department. These tubes convey some thousands of job tickets, &c., per day.

The text is adequately and graphically illustrated with figures and charts, and the enumeration of a *few* of these will give a slight indication of the scope and value of the book: Fig. 1, classification of clutch assembly (illustrating mnemonic system of identifying parts, &c.) Fig. 2, classification of materials. Fig. 6, photograph of arrangement of a tool storeroom. Fig. 10, details on control board, showing rear axle operations. Figs. 11 & 12, forms; analytical record of time and earnings of a workman, and analysis of same man's rating. Fig. 14, front and reverse of inspector's report of spoiled and defective material for a workman. Figs. 15 to 20, various forms as to rating, &c. Fig. 21, organisation classification table; a synoptic chart of the organisation under functions and duties. Chart i, production in cars and numbers of workmen over whole period of nine years. Chart iii, production time (descending curve) and hourly rate of pay (ascending curve). Chart iv, production cost of car (descending curve). As will be seen, many diagrams have had to be excluded on considerations of space.

Appendix I deals with wage rates and the necessarily elaborate method of their calculation having regard to all the factors involved. Appendix II provides details of the application of scientific management to (*a*) repair shop, (*b*) small parts factory, (*c*) plant with uniform manufacture.

8. *Scientific Management. A collection of the more significant articles describing the Taylor system of management.* (Edited by C. Bertrand Thompson, LL.B., A.M., lecturer on manufacturing in Harvard University. London publishers: Humphrey Milford, Oxford University Press, 1914.)—It is not proposed to attempt a review of this volume, which comprises 50-odd papers running to nearly 900 pages, and including a valuable bibliography of the subject which alone covers 16 pages, and which

should prove of inestimable value to the student. Needless to say, this bibliography is classified under headings and subheadings dealing with every aspect of the subject.

9. *The Science of Labour and Its Organisation.* (By Dr. Josefa Ioteyko. Publishers: G. Routledge & Sons, Ltd., London, 1919.)—The title of Dr. Ioteyko's work is a little misleading. It is really a medico-pedagogic treatise—to borrow his own expression. The author was formerly head of the laboratory of psycho-physiology at Brussels University, and this book deals with the subject of scientific management from his own special standpoint. It is a valuable handbook for the scientist taking a passing interest in scientific management rather than for the efficiency engineer in his practical work, though it forms a useful introduction to fatigue study for the latter.

The footnote references form a useful index to much literature on the subject in the French language, and the chapters on education, ambidexterity, anthropometric comparison of the sexes, &c., will be valuable to many.

10. *The Human Motor and the Scientific Foundations of Labour.* (By Jules Amar, D.Sc., Director, Laboratory of Research in Professional Labour, National Conservatory of Arts and Crafts, Paris; preface by Prof. H. Le Chatelier, Inspector-General of Mines. Publishers: G. Routledge & Sons, Ltd., London, 1919.)—This book is still at press, and by courtesy of the publishers the present writer has seen proofs of the opening chapters of Mr. E. Butterworth's translation.

It is a prodigious work, as may be realised from the fact that the mechanics of the body are dealt with in a detailed, complete, and scientific manner. The early part of the book is primarily adapted for university use, for the teacher rather than for the practitioner, but we understand that later chapters describe fully the application of human mechanics to a considerable number of different trades.

11. *Wealth from Waste.* (By Henry J. Spooner, C.E., F.G.S. Publishers: G. Routledge & Sons, Ltd., London, 1918.)—Mr. Spooner's book deserves mention as being an encyclopædia of "waste," and should be on everyone's reference bookshelf. Every sort and kind of waste is dealt with from the absence of a domestic stockpot and the ash from one's cigar, to land erosion and inefficient factory organisation. The last-named, however, is our subject and the two chapters dealing with it, while interesting to the general student of waste, may be safely ignored by the student of scientific management.

The author appears to draw his information on the subject exclusively from the Gilbreths, and their writings must be studied at first hand. One wishes Mr. Spooner had found time to give some attention to the works of Taylor, who, after all, was the founder of the science, and whose principles stand intact to-day, even when his details of application may be modified, as he himself saw they would be.

12. *The Question of Scientific Management.* (By James Richardson, B.Sc. Published by the Institution of Engineers and Shipbuilders in Scotland.)—This pamphlet comprises a paper read by the author and the subsequent discussion. The paper deals with the whole subject—functional foremanship excepted—in a concise and convincing form, and the nature of the discussion prompts one to feel that the subject will have practical developments in Scotland—both in the shop and in the University—in the very near future.

Like most experts, Mr. Richardson points out that, "generally the works with the highest actual charges due to managerial efficiency produce most cheaply."

THE FULLERPHONE AND ITS APPLICATION TO MILITARY AND CIVIL TELEGRAPHY.

By Major A. C. FULLER, R.E., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

By passing through an ordinary telephone receiver a current interrupted at a suitable frequency, a note at the frequency of the interrupter will be heard in the telephone, and audible signals consisting of long and short notes will be heard if the key is manipulated in accordance with the Morse code, in the telegraph system shown in fig. 1, p. 516. An exceedingly minute current arriving at B will give an audible signal.

The minimum current capable of producing an audible sound in a telephone receiver is certainly not more than 0.000005 ampere. No other telegraph instrument equally robust will indicate the received signal (wire telegraphy is here referred to) so positively with so small a current.

Such a system is not employed in the form shown, and is certainly not so good as the vibrator system. The latter, however, has certain very serious disadvantages. The line is traversed by vibratory currents of relatively high voltage, which induce similar currents in other lines in their proximity; hence the number of possible lines on one route is limited, owing to the interference between them. By the use of suitable apparatus these vibrating signals can be read at immense distances from the line, and hence any messages can be overheard. The use of vibrators in any area effectually jams in that area friendly listening-sets which might otherwise overhear enemy messages, and it is manifestly impossible to superpose the vibrator system on telephone lines.

In order to produce something more suitable than the vibratory system, it was necessary to provide on the line a direct current as in ordinary single-current Morse, but of as low a value as possible—at the same time converting the energy thus transmitted into vibrating or pulsating current at the distant end; further, such vibrating currents had to be closely confined to the distant end and prevented from surging back along the line.

Fig. 2 is essentially the circuit adopted. K_1, K_2, K_3 are condensers each of 1 microfarad. CH_1, CH_2 are choke coils of large impedance, each about 2.4 henries and 750 ohms resistance. The chopper is an electrically-driven vibrating interrupter fitted with two contacts, one of which is used to drive it, the other to interrupt. The chopper can be adjusted to any frequency between 300 and 600 or 700.

The receiving circuit is shown in fig. 2. Now, if a steady electromotive force is applied between the line and earth, and the circuit is closed at X, a steady current will flow through the choke coils, contact 2, and receiver. If the circuit is broken at X, the current cannot flow through the receiver, but will flow into and charge the condensers. When the circuit is again closed at X the condensers partially discharge through the receiver R.

When the interrupter X is working we therefore get an intermittent current in the telephone receiver, giving an audible note, while (if the choke coils and condensers are suitable) the line current alternately flows through the receiver and into the condensers, and remains practically constant and continuous in the line. The result is that the dots and dashes sent by the single-current Morse key at the far end are received as short or long notes in the telephone receiver at the receiving end, while the current in the line is of much the same nature as that sent by an ordinary single-current Morse set, except that it is very much smaller, as readable signals can be obtained with about ½ microampere. In practice a main battery of one dry cell is used.

The signals are much clearer than those from the "buzzer," as the commencement and end of a signal do not depend on the starting and stopping of a vibrating armature; hence the rate of working is higher than with a buzzer.

The arrangement of choking coils and condensers not only prevents any appreciable variation in the line current, but also prevents any vibrating currents (such as are produced by induction from other circuits, by a buzzer on the line, or from a telephone) from passing through the operator's head telephones. All such currents pass through the condenser K_1. Should any vibrating current make its way through CH_1 it will then take the path to earth through K_2 rather than through the high inductance CH_2; thus the telephones are doubly protected from induced currents or from telephone currents passing over the same line.

When the sending battery is connected as shown in fig. 3, the current can only rise in the line comparatively slowly, owing to the effect of the capacity of the condensers and the self-induction of the choke coils. The object of this retardation of the rise of current is to prevent clicks being heard in a telephone receiver inserted in the line. This has a twofold object: To prevent the possibility of Morse messages being read from these clicks; and to prevent the clicks interfering with telephony carried on over the line simultaneously with Morse signalling.

The Fullerphone is not a polarised instrument, and the direction of the received current does not affect the signals. The arrangement of chokes and condensers acts also in the other direction, thus ensuring that the vibrating currents in the circuit K, 2 R are confined to this circuit and cannot surge back into the line.

It is apparent that a telephone can be added on the same line without any interference between the Fullerphone and the telephone as far as speech is concerned, and in the latest Army instrument a telephone has been incorporated, in series with the Fullerphone. The Fullerphone may be superposed over telephone pairs in the usual way.

Where Fullerphone and Morse are employed in the same telegraph office, or on the same pole route, a leakage current from a single-current Morse set will cause the signal from such set to be heard in the Fullerphone receiver when the interrupter is running. A similar current from a double-current set or duplex will give confused signals. In either case they may be strong enough to interfere with the Fullerphone signals.

If such currents leak on to the Fullerphone circuit at a contact on the line, the only thing is to clear the contact. Such leakage, however, frequently occurs at the office, owing to leakage either at the test board or at the earths.

The same earth should not be used for both Fullerphone and Morse circuits, or interference is almost certain to result. The best earth obtainable should be used for the Morse, and an inferior earth used for the Fullerphone. The earths should be as far apart as possible and the wires leading to them should be kept clear. A bad earth will not be disadvantageous for the Fullerphone proper, unless very bad indeed, but the speaking (if such is required) may suffer. If there are Morse and Fullerphone instruments in the same office the circuits and their earths should be kept entirely separate.

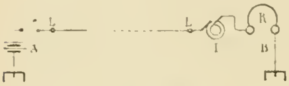


Fig. 1.—I, Interrupter; R, Receiver; L, Line.

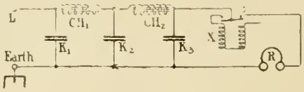


Fig. 2.

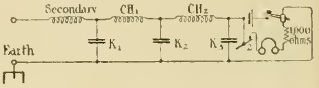


Fig. 3.

For the Army instruments for field use an arrangement has been made to send a strong buzzing current to the line for purposes of calling attention. The interrupter buzzer is used for this purpose, and its ordinary battery is reinforced by two additional cells, making three in all.

The buzzing call can be relied on in normal conditions, but if the circuit is very bad it may be possible to call and send messages on the Fullerphone when the buzzing call will not get through.

Disturbance due to Earth Currents or Leakage.—Difficulties in working the Fullerphone are almost invariably due to small currents being picked up by the line either by the earths, by earth faults, or by leakage from Morse circuits. The currents to cause this disturbance must be of a steady nature, or of a very low frequency. The effect of the steady current is to produce a note in the Fullerphone receiver of exactly the same pitch as the receiver signals, which are thereby confused and may be rendered unreadable. This disturbance can only be noticed when the local buzzer is running.

An earth current on the line causes a continuous hum in the Fullerphone receiver when the local interrupter is running. If the earth current is in the opposite direction to the signalling current sent out by the sending station, the signal received when the sending key is depressed will be that due to the difference between the sending and earth currents, while the sound when the key is not depressed will be that due to the earth current only. Hence, if the received earth current is half the received signalling current, the current will be altered in direction but not in magnitude when the sending key is depressed, and no signals at all will be received. If the earth current is greater than half the signalling current the signals will be actually reversed. If the currents are equal there will be silence at the receiving end when the key is depressed at the sending end.

If, on the other hand, the currents be in the same direction, the signalling current will always increase the earth current, and the signals will always give a louder note than the earth current alone. Hence the disturbance due to steady earth currents in a direction opposite to that of the signalling current can always be reduced (in most cases sufficiently to work the line) by reversing line and earth at the sending end, thus bringing both currents in the same direction. If the earth current gives a loud note the signalling can be improved by increasing the resistance of the circuit, which is most easily done by increasing the resistance of the earth. A good earth is not required for the Fullerphone, and may even be a disadvantage.

The disturbance from a steady earth current either from a leak or from the earths can always be eliminated by the insertion of a potentiometer in the line at the receiving end, and such a potentiometer forms a component part of the service instrument. The potentiometer consists of a length of high-resistance conductor through which flows a current from one cell. One end of this conductor is connected to one terminal of the potentiometer, and a sliding contact (which can be adjusted to make contact with any portion of the conductor) is connected to the other. The potentiometer is connected in series in the line and impresses a portion of the electromotive force of the cell on the line. If the electromotive force thus impressed on the line is equal and opposite to that producing the earth current, the earth current and its disturbances are eliminated.

Each station must adjust its own potentiometer to suit the earth currents received by it. As the currents are frequently picked up at earth faults, they will not necessarily be the same at each end of the line.

It must be remembered that the Fullerphone is very sensitive, and one 1,000th part of the current usually employed in Morse working will give strong signals in the Fullerphone.

Fig. 4 shows the circuits of the latest pattern Army field set. This instrument provides for telegraphy and telephony either independently or simultaneously on the one line without further apparatus. When the receiving buzzer is not working, the buzzing call from a distant station is heard both in the head receivers and in the hand set—or if the hand set is not plugged in, only in the head receivers. When "Fullerphoning," the Morse signals are heard in the head receivers only. When speaking and telegraphing, the speech is heard in the hand set and the Morse signals in the head receivers.

In order to show clearly the operation of the various circuits fig. 4 is dissected into its elements in fig. 5. When the 4-pin plug is inserted the line is completed through the receiver of the hand set. When the plug is withdrawn the receiver sockets are short-circuited by a spring contact.

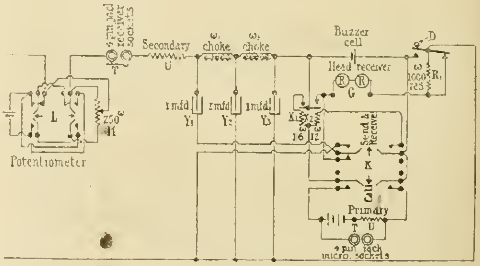


Fig. 4.

The fact that no sound is heard in a telephone receiver inserted in the line shows that the system is non-inductive.

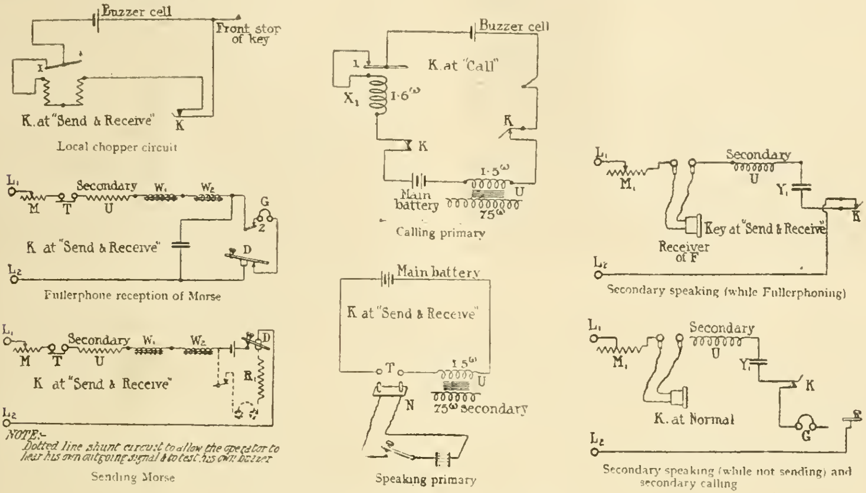
Fig. 6, which is a reproduction of oscillograms kindly made by the Research Department of the G.P.O., affords further proof. The gradual and slow rise of current shown in fig. 6, and referred to earlier, accounts for the fact that not even clicks are heard in the line.

Exhaustive tests have been made to ascertain whether the system—using a single wire and earth return—is safe from the possibility of being overheard by enemy listening-sets. It was found that under ideal conditions for the listening-set, and using the best listening-set that we could devise for the special purpose, the messages were safe from overhearing at a distance of 100 yards from the line. These ideal conditions would never obtain in practice in the field.

The minimum current required to operate for legible signals was less than ½ micro-ampere. Hence the system will work over lines of immense conductivity resistance and very poor insulation. In practice we have often worked earthy lines of which the conductivity resistance was far greater than the total insulation resistance. Before the system was adopted for the Army the author had the privilege of testing it over some specially selected lines in Flanders in 1915. The lines were selected chiefly on account of their unpleasant location and necessarily bad condition, where the ground was waterlogged and pitted with shell holes, and maintenance was anything but easy.

It seems that, provided the line is not actually broken, it can be worked by Fullerphone almost irrespective of its general conditions.

From experiments and trials recently made it has been established that the Fullerphone can replace Morse sounder sets on any hand-worked line. The advantages to be expected include the following:—



Local chopper circuit

Fullerphone reception of Morse

NOTE:—Dotted line shunt circuit to allow the operator to hear his own outgoing signal & to test his own buzzer

Sending Morse

Calling primary

Speaking primary

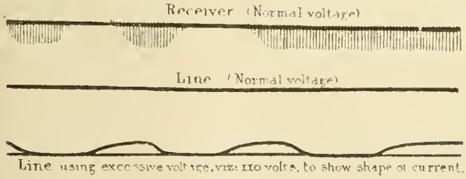
Secondary speaking (while Fullerphoning)

Secondary speaking (while not sending) and secondary calling

Fig. 5.—Dissected Elements of Fig. 4.

1. Great saving of battery power.
2. Simplicity of office wiring and manipulation of instruments.
3. Very long distances can be covered without translation or relaying.
4. Maintenance of lines can be reduced to a minimum.
5. Lines may be of very high resistance.
6. Lines may be very leaky and contacts with foliage, &c., are of slight importance.
7. No disturbance whatever is caused to neighbouring or parallel telephone circuits, and no disturbance need be feared to telephone circuits when Fullerphone is superposed.
8. It will be possible to work long stretches of land line and then cable and land line again without any conversion or re-transmission.

In order to be applicable to civilian uses the instrument is altered from that already described. In the first place, the buzzer call is objectionable and is discarded. A method of direct-current calling has therefore been devised, and this is satisfactory.



Line using excessive voltage, viz: 110 volts, to show shape of current.

Fig. 6.

The main relay which receives the direct-current call is an enclosed moving-coil instrument and is very sensitive. It is provided with a shunt (variable) so that its sensibility can easily be controlled. The relay is a slow action one, and is therefore very suited for responding to a calling dash. A second or local relay is very small, and is used in order to handle the current actuating the calling buzzer (or bell), which would be prejudicial to the prolonged satisfactory working of the main relay.

A call is sent out by pressing a push-button, which puts a small 3-cell "Ever-ready" battery in series with the working battery, thus sending a current of short duration from a battery of about 7 volts to operate the distant relay. The act of calling also tests the home apparatus for receiving a call. The local calling buzzer should operate when the push-button is pressed. This arrangement will work well through very long and very bad lines. When attention has been obtained the work is carried out by Fullerphone proper. The main relay is capable of reliable action with a current of the order of 10 micro-amperes, and will respond through a resistance of 700,000 ohms.

A further addition is a switch to enable the chopping for any number of sets to be done by one multiple chopper independent of the sets. The author has constructed multiple choppers to deal with 6 and 10 circuits each, which are driven by a 4-volt accumulator and only require a very small current—about 150 milliamperes.

Using such a system, one small 4 volt accumulator is sufficient to work the whole office. It drives the buzzer, and so effects the chopping, and it also provides the minute signalling currents for all the lines.

The instrument can be arranged for duplex working on the bridge method; this method is very suitable, and the usual objection to bridge duplex—namely, the increased battery power required—does not hold, owing to the extreme sensibility of the receiving system.

The system is admirably suited for exchange working. It makes little difference to the signal whether the line over which it is transmitted is 100 miles, say, longer or shorter; hence the present necessity for re-transmission at intermediate stations is removed and direct-through plugging can be employed.

By the use of auxiliary apparatus the system can be used quite satisfactorily where recording work at relatively high speeds is required. By means of a relay of special design invented by Capt. L. B. Turner, R.E., and modified for high-speed work, the aural signal received can be readily made to operate an ordinary telegraph relay at high speed, hence direct-printing systems such as the Creed can be employed.

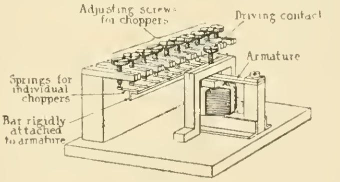

Adjusting screws for choppers
Driving contact
Armature
Springs for individual choppers
Bar rigidly attached to armature

Fig. 7.

In the same way the signals received can, after amplification, be uprighted and made to give beautiful records on a siphon or other recording device.

The author has not yet had an opportunity of ascertaining to what extent the system can be advantageously applied to cable practice, but with our present knowledge of amplifiers and the possibilities opened up by experience with the 3-electrode valve, great advances in submarine telegraphy are assured. The normal audible signal produced by the method is admirably suited for operating on the grid of an amplifying valve. The telephones are, for this purpose, replaced by the primary winding of a suitable transformer—the secondary winding being connected to the grid-filament of the valve.

To sum up, the present position is that for military work the Fullerphone has practically superseded the vibrating system formerly employed. It is now being tried for working long lines in back areas, where is will almost certainly replace all hand-worked Morse-sounder sets. It appears, therefore, that, as far as line telegraphy is considered, the Fullerphone system will be used throughout, except—for the present, at any rate—for those lines normally working high-speed Wheatstone. These Fullerphones will be of two patterns—the trench Fullerphone, which is weatherproof and well protected, for the forward area, and the office pattern further in the rear. For civilian use, one cannot expect sounder sets that are established and giving satisfaction over well-constructed routes to be discarded in favour of Fullerphones; but it is expected that the advantages to be derived from the new system will lead to its adoption in countries not already thoroughly developed from a telegraphic standpoint. An opening should also arise in tropical countries where maintenance difficulties are considerable—and it is probably not too much to say that the system described would give satisfaction wherever difficulties from any cause render Morse-sounder working precarious. For cable work the author feels—with due deference to certain experienced submarine telegraph engineers—that an investigation of the possibilities of a system combining Fullerphone, amplifiers, special existing relays, and recording and printing devices, would prove very profitable.

The author acknowledges with gratitude the help which he has received at various times from several brother officers—notably, Lieut.-Col. Evans, C.M.G., D.S.O., R.E., Major E. O. Henrici, R.E., Major Purves, and others, whose suggestions have proved very valuable.

Discussion.

Mr. W. Judd, in opening the discussion, recalled the early days of telegraphy, and mentioned experiments that had been carried out and the results that were achieved. The system described by the author had already been worked out many years ago by, he thought, an engineer in the Netherlands. The system had been used, but was discarded on account of the difficulties that were encountered. The splitting up of messages received at the end of a line so that they became audible in a telephone had also been done before. Nevertheless much credit was due to the author for the development of his apparatus and its use at the front, where it had rendered very useful service. He had had an opportunity of seeing much of the apparatus in the course of a works visit, and had been extremely interested in all he saw and what he had been told about it. He could not say much with regard to land lines, but with long submarine cables he thought the inverse-current system would have to be used. Concerning amplifying valves, he could not really say that he knew very much about them. They had tried to obtain valves with which to experiment, but that had not been possible during the war, as every valve that was made was required for Government use. However, they would be grateful for any help that such valves could afford them.

Lieut.-Col. Evans, C.M.G., D.S.O., R.E., explained that there was a good deal of prejudice against the Fullerphone when it was first used at the Front, and to some extent it still existed to-day. That prejudice had arisen chiefly because they had too many different types of instruments when the system was first introduced. At that time it was common to find a different type of instrument at each end of the same line, and leakage current difficulties further contributed their share to the raising of prejudice. With unskilled operators, any instrument that gave no trouble and required little understanding, was always popular, whereas anything that was new and required a little more careful thought and handling would have to overcome many prejudices. Since its first introduction they had learned much about the Fullerphone and its good qualities, and although he could not say they were yet in a position to dispense with the buzzer and sounder methods altogether, they hoped before very long to get the Fullerphone adopted as the standard Army instrument.

Mr. Harrison pointed out that French patents dated some years back specified very similar apparatus to that which the author had described. His methods, however, differed from the French ones chiefly in two points, one of which was the manner in which messages were filtered. Personally he could not say that he shared the author's sanguine hopes concerning the application of the Fullerphone to ordinary civil work. The chief objections to its use for such purposes were that the instrument was hand operated, and it would be difficult to obtain anything like good balances. Further, the system was subject to disturbances from outside, for instance, the instruments would become hopelessly jammed by the influence of tramways or electric railways in the vicinity.

Mr. Brown explained that he had himself invented, years ago, apparatus very similar indeed to that described in the paper, and slides were thrown on the screen illustrating the device. The apparatus was submitted to the cable companies, and was successfully used to maintain communication over broken Atlantic cables. It was also submitted to the Government, but was evidently not wanted at that time. There was no doubt that the author's device was very sensitive indeed, and, in his opinion, efforts should be made towards directionalising, which would lead up to the radiotelephone exchange, a much needed want.

Mr. H. Nash explained that by the aid of amplifiers the Germans could overhear what was going on in the British lines; acting on intercepted messages in this way they were able to cause much damage and loss of life. The range over which telephone messages could be overheard in this manner was something like two or three miles, and he did not think it was realised how intolerable the position really became. When is was known what the enemy was doing, he and others set to work to see if the state of affairs could not be altered or the conditions reversed. It was found by experiment that if a buzzer current was sent along the line in front, so to speak, of the message to be protected, a screening effect was produced, and such a jumble of noises and interfering frequencies introduced, that anyone attempting to intercept the message was completely baffled. Although that was not quite what was wanted it was a good beginning, and had lead up to very much better results. They had listened to a good deal of criticism of the paper, for some of which perhaps there was room. It was also claimed that similar apparatus or methods had already been invented many years ago. If the conditions were known or anticipated, why could not someone have come forward with the remedy? In his opinion very great credit was due to the author for the work he had done; he had really done something. Results were produced which at that time were very badly needed, and they were of very great service indeed. As a result the author had been the means of saving a large number of lives, and for that alone, he, as a civilian, was very grateful.

General Hildebrand corrected the statement that the Germans were the first to intercept messages. He stated that two French officers by the help of 75 mm. cartridge cases as earths, and ordinary telephone receivers, were the first to do so. In his opinion, there were grounds for the prejudice that existed in the Army against the Fullerphone. On its first introduction the apparatus was difficult to use, requiring constant adjustment. If a heavy fault occurred near the sending end the message would not reach its destination. Some credit was due to the Australian Corps, who appointed inspectors, and eventually kept the system in working order. In the early part of the war he had the privilege of providing facilities for the author to test his apparatus on certain lines in the Ypres sector, and the results obtained were satisfactory. The lines on which the instruments were tested were in an extremely bad condition.

Mr. Wilson, speaking with regard to sounder *versus* buzzer systems, thought the former was very much to be preferred. Concerning the advantages claimed for the application of the Fullerphone to civil telegraphy, he said that there were certainly some advantages in its favour. The saving in battery power, however, was more apparent than real, and he thought the case for simplicity of office wiring had not been made good. He was in entire agreement with the author in saying that "the system described would give satisfaction wherever difficulties from any cause rendered Morse sounder working precarious."

Other speakers pointed out that an R.E. officer at Chatham in 1880 made some experiments on the lines described in the paper, and messages were sent over 15 miles of wire laid along hedges and on the ground. The author was congratulated on having applied the principle and achieved definite results, although perhaps the principle might not be new. The telegraph was out of date, and would be superseded by the telephone. A disadvantage of the Fullerphone was that it required expert operators. A telegraph exchange was very complicated, and if it could, by means of some such system as that described, be operated on the lines of a telephone exchange it would become a much more simple matter. Doubt was expressed as to whether the Fullerphone system would work on long, high-speed lines such as London to Glasgow where 120, or London to Birmingham, where 180 words per minute, printed, each way, were handled on the duplex system.

Major A. C. Fuller, R.E., replying briefly to some of the points raised, said that although various suggestions had been made concerning the nomenclature of the device he considered it a compliment that all speakers continued to refer to it as the "Fullerphone." Most speakers had taken a very narrow view of the use of his apparatus. He did not advocate its adoption in large cities where efficient systems were already at work, but there were other places not so fortunate. Concerning the doubts expressed as to the capabilities of the system, he had not set about the thing in a light-hearted manner, he had been working at it for well over three years, and the paper set forth his considered opinion. Other apparatus, which was not his invention, he was not in a position to speak about, but much could be achieved in conjunction with it. If some speakers could obtain possession of all the facts relative to the subject, he thought they would very greatly modify some of the statements that had been made.

Faraday House Scholarships.—On the results of examinations held for entrance scholarships at Faraday House the following awards have been made:—

"Faraday" Scholarship (fifty guineas per annum for three years), R. A. Emerson.

"Maxwell" Scholarship (fifty guineas per annum for two years), D. E. Bird.

The following entrance exhibition and prizes have also been awarded:—

To J. P. H. Read, entrance exhibition (twenty-five guineas per annum for two years).

To M. W. Foulkes-Roberts, entrance prize (twenty-five guineas).

To S. J. Bausor, entrance prize (twenty guineas).

JAPAN'S ELECTRICAL PROGRESS.

During last year the capital invested in electrical industries in Japan increased by over £6,000,000. According to a report by the Department of Communications, this increase has been helped by the general industrial expansion which took place in Japan during the period of the war.

In light and power plant, £36,737,750 had been invested by the end of 1918, £4,358,680 in electric tramways, and £33,199,650 in plant both for supplying power and light and operating tramways. The total amount of capital invested amounted to £74.296,070, this figure being a gain of £6,432,145 over the close of 1917. The investment in this comparatively new line is, says the official report, bigger than that in mining, which stood at £23.928,000 at the end of last year. It even threatens to rival the investment in railways, which is £109.670,000.

The Americans are very much alive to this development, and have been actively investigating the Japanese market with a view to ascertaining in what lines of electrical manufacture there is still a good opening for sales. As a result, a bulletin has been issued by the Bureau of Foreign and Domestic Commerce in the United States, which, it may be added, also deals with prospective sales in China and Vladivostok.

So great is the demand for telephone installations in Japan, that when a subscriber is willing to give up his telephone he sells it through a broker, there being a regular market value of from £50 to £150.

There are now nearly 700 central-station systems in Japan, 530 electric power and light systems, 42 electric tramways, and 48 combined railway and lighting systems, together with 1,609 private, and 53 Government-owned plant.

In 1915 there were 3,051,925 families using electric light, and in the fall of 1917, there were 152,000 subscribers awaiting the installation of telephone apparatus, some of them having waited for more than 10 years. In December of that year there were to be some installations made from among the 4.000 "urgency applications," but only 300 of them were made, and some of these not until the March following.

In recent years Japan has changed from an exclusively importing country to an exporting one, and has established its own electrical goods industry. It is now a strong competitor in some lines in its own markets, instead of being solely a consumer of imported goods.

Heretofore American manufacturers have sold the largest percentage of generators, switchboards and switchgear. While switchboards and switchgear are turned out by Japanese works, they have not made the progress in these lines generally that they have in the apparatus lines. Americans are hopeful of being able to sell higher-voltage equipment, and considerable numbers of the instrument and relay requirements for the boards that are made up locally.

Japanese engineers follow American transmission and distribution practice quite closely. Line construction, switching stations, and sub-station arrangements are generally similar to those employed in the United States, except in a few instances. It is estimated that there is about 20,000 miles of extra high-pressure lines in operation.

The United States, Germany, and the United Kingdom have until the last few years furnished most of the requirements in motors and controlling devices, but since 1913 Japanese motors have been coming into the market more and more. While there are a few fair Japanese motors, it is not believed that they will give such continuous satisfaction as a Western-made machine.

The import figures for ammeters and voltmeters show American goods leading strongly. Schools and central stations have bought high-class American testing instruments to a fair extent.

In wattmeters the United States has had a good trade for some years. American alternating-current meters in normal times cost more than foreign makes, but at present they are meeting foreign prices closely.

There is some small opportunity for the sale of higher-class American wiring supplies, such as flush push switches, receptacles, fancy shades, semi-indirect lighting units, &c., for use in new modern-type buildings.

There is not much opportunity for arc lamps. Street lighting is the greatest field for that kind of lamp, and in Japan there are not many wide streets, so that the demands in this line are limited. The incandescent lamp is more suitable for the average narrow-street lighting conditions, where low candle-power units are all that are required.

One class of goods that will probably find a market in Japan for a time are those that are used in connection with electric signs. The Japanese appear to be taking up electric signs to an increasing extent, and appreciate the use of electricity for advertising purposes. It is believed that patented types of sign sockets, flashers, &c., will find an increasing sale. Fittings for outline lighting should have a small sale also, and some flood lighting was seen in operation.

As regards China, says the report, there were imported in 1916 electrical goods to the amount of approximately £800,000. This, in connection with the fact that the Chinese people have developed a progressive tendency, and the great population and increasing purchasing power, indicates an important future demand for electrical goods.

REVIEWS.

Physics for Technical Students, Parts IV, V, and VI. Sound, Light, Electricity, and Magnetism. By W. B. Anderson, Ph.D. London: Hill Publishing Co., Ltd. Pp. xiii + 458; 220 figs. Price $2.00 net.

It is seldom that we find an American text book with so essentially English a flavour as obtains with the volume under review. This is the second volume of Prof. Anderson's physics for technical students, and contains the sections on sound, light, and electricity and magnetism; it is intended later to bind up both volumes in one for use in first courses in college physics. In scope and size the whole treatise will closely resemble Watson's Physics, so well known in English colleges and technical schools, and the resemblance also extends to the type and diagrams.

Part IV—Sound—comprises 55 pages, and includes excellent chapters on the production and transmission of sound, characteristics of musical sounds, musical instruments, and the relations of musical sounds. The treatment of all these subjects is largely descriptive, but half a dozen numerical examples at the end of each chapter serve to give a quantitative basis to such parts of the work as can be thus illustrated, *e.g.*, the velocity of sound, the Döppler effect and beats.

Part V—Light—occupies over 150 pages, and gives a very complete account of the chief optical phenomena—reflection, refraction, dispersion, interference, diffraction, radiation and absorption, colour, and polarisation. Both the physical and geometrical aspects are represented, and, what is so important in this subject, good diagrams have been drawn. In many cases the wave front method of treatment has been adopted. Although the author has compressed many important subjects into very brief paragraphs, *e.g.*, the rainbow, defects of the eye, and the diffraction grating, we cannot find any serious omissions, while the chapters on radiation and polarisation are splendid examples of how the more advanced portions of physical optics can be brought within the understanding of comparatively elementary students. The former of these chapters is illustrated by some good spectrum photographs.

Part VI—Electricity and Magnetism. This section occupies the last 200 pages of the book. It commences with a very short but comprehensive chapter on magnetism followed by a more detailed account of electrostatics. The treatment of current electricity follows the usual lines, but here as in the other sections of the book, the author shows an unusual capacity for giving a maximum amount of information in a minimum of words. The information given is accurate, well arranged and remarkably up-to-date. The Weston cell is given rather less than its fair share of attention, and we should have expected to hear more of the Edison storage cell than is given in a five-line paragraph. But on the whole there is very little to which exception can be taken. Paragraphs are given to such recent and important developments as electric welding, electric furnaces, and nitrogen-filled lamps, and in many other matters there is ample evidence that the author is abreast of modern electrical developments.

The examples appended to the chapters on current, voltage, and resistance, heat, light, and power, and electromagnetic induction are well suited to test the student's grasp of the text.

An outline of the principles of dynamo-electrical machines is given in chapter 41, and we notice with satisfaction that the author has avoided the common practice of dragging in armature winding puzzles at the earliest possible opportunity. This is a matter which can conveniently be treated *after* the student has discovered what a dynamo is and how it works.

The concluding chapters on electrical discharge through gases and electromagnetic waves are excellent introductions to these two great branches of physics. Here again the treatment is up-to-date, and radio-telephony, Fleming valves, and determination of e and m all find a place as well as the classical experiments upon which these subjects have been built up.

On the whole Mr. Anderson's book has impressed us most favourably. There is throughout a conciseness and clarity of statement which could scarcely be surpassed. Here and there we may have expected a somewhat fuller treatment, but on the other hand, there is an exceptional air of completeness which disarms criticism. We have seldom seen such a complete treatise on physics in so few pages.—P.H.S.K.

The Practical Telephone Handbook and Guide to the Telephonic Exchange. By J. Poole, A.M.I.E.E., Wh. Sc. Pp. xxiii + 725; 585 figs. Price 12s. 6d. net. London: Sir Isaac Pitman & Sons, Ltd.

This popular handbook on telephony has now reached its sixth edition—a result which not only bears evidence of a demand for it by technical students, but likewise indicates that the author appreciates the necessity, if the book is to be referred to at all, of keeping pace with the rapid developments which have taken place within the past few years in telephony generally.

The present edition has been largely rewritten in order to bring the work more into line with the telephone engineering practice of the British Post Office, and the author has availed himself of the co-operation of Post Office engineering experts in the revision, or rewriting of those chapters which deal with their special functions. The need has also been recognised of cutting out old matter to make room for descriptions of important modern changes.

The book in its general get-up is much the same as in previous editions, beginning with the inevitable introductory chapter, which is supposed, in the space of 27 pages, to equip the student with a knowledge of electricity and magnetism sufficient to the understanding of what follows.

In Chapter II, which deals with primary and secondary cells, it is satisfactory to note that the results of the experiments carried out by the Post Office which led to the general use of powdered manganese dioxide and carbon in place of the old granular form, have been incorporated.

A short chapter on historical matter is followed by two others dealing with the types of receivers and transmitters which are now in general use.

Sub-station apparatus, intercommunication systems, switchboard apparatus, &c., follow in much the same order as in the earlier editions, and hence need but a passing reference.

The new chapters which have been added include those dealing with private branch exchanges, central battery signalling systems, multiplex telephony, transmission, telephone repeaters, and military telephones.

The two first mentioned deal exhaustively with their subjects; but in the case of multiplex telephony it is thought the high frequency system as exemplified by Squier's method might have been amplified to advantage.

The chapter on telephone repeaters gives in very brief outline the principle of repetition by means of the bulb relay which is now being successfully employed on several of our English telephone lines, and there is no doubt that the success which has attended the experimental installations justifies the hope that we are on the eve of great developments in this direction so far as interurban lines are concerned, but to this the author makes no allusion.

The final chapter of the book is devoted to what is known as the "Relay Automatic Telephone Co.'s System," and the process of establishing a connection between one subscriber and another is, with the aid of suitable diagrams, fully described. The *Electrical Review* on February 7th referred to this system as "an epoch-making advance in automatic telephony." The marvellous record of reliability established by it in connection with the State telephone system at Stockholm justified the opinion then expressed as to its inherent excellence.

Of the miscellaneous matter added to the book it is satisfactory to note that a description and diagram are given of Hay's Bridge for inductance measurements, to which, however, there is no reference in the index.

Messrs. Pitman have produced an excellent work both in the letterpress itself and the relative diagrams, which appears to be very free from typographical errors. We have no doubt this latest edition will meet with an equal success to that of its predecessors.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

9,281. "Dynamo-electric machines." P. H. H. Jantzen & Siemens Bros. Dynamo Works. April 11th.

9,294. "Electrical gear for operating bulkhead doors, &c." H. H. Bentley and Harland & Wolff. April 11th.

9,297. "Time-limit overload electric relays." R. Brooks & British Westinghouse Electric & Manufacturing Co. April 11th.

9,316. "Wireless receiving and transmitting apparatus." J. Erskine-Murray & J. C. Robinson. April 11th.

9,323. "Electric connectors and plugs and sockets." C. L. Arnold and C. R. Belling. April 12th.

9,325. "Electric cables." F. Harris. April 12th.

9,340. "Device for tramcar trolley poles." J. H. Beaby. April 12th.

9,364. "Electromagnetic wave navigational systems." M. Jeance. April 12th.

9,367. "Apparatus for electric telegraphs, &c." W. Greaves & E. Lawton. April 12th.

9,385. "Electrically-operated apparatus." C. Melano (Bagutti). April 12th.

9,388. "Means for adjusting carbons in electric arc lamps." J. Minsky. April 12th.

9,411. "Impulse sending device." Automatic Telephone Manufacturing Co. (Automatic Telephone Manufacturing Co., U.S.A.) April 14th.

9,443. "Electric signalling and indicating apparatus." McKenzie, Holland & Westinghouse Power Signal Co. & H. M. Proud. April 14th.

9,453. "Dynamo-electric machines." A. A. Price. April 14th.

9,477. "Electric heating apparatus." E. B. Miller. April 14th.

9,483. "Electrodes for electric welding." A. le Chatelier. April 14th.

9,488. "Induction coils." Lodge Fume Deposit Co., L. Lodge & Sir O. Lodge. April 14th.

9,489. "Electrical deposition of particles from gases." Lodge Fume Deposit Co., L. Lodge & Sir O. Lodge. April 14th.

9,492. "Production of aluminium nitride, &c., by electrically-generated heat." E. C. R. Marks (Armour Fertiliser Works, U.S.A.). April 14th.

9,511. "Electric heating resistance elements." L. V. Leonard. April 14th.

9,536. "Electro-mechanical propulsion and control of submersible vessels, &c." N. H. Wood. April 15th.

9,583. "Electric batteries." G. W. Roberts. April 15th.

9,603. "Transmitting selected sounds." J. L. Spence. April 15th. (U.S.A., May 2nd, 1918.)

9,624. "Brush for electrical work." W. W. Coote. April 15th.

9,638. "Ignition control of engines using inflammable vapours for motive power." J. I. Hall. April 15th.

9,654. "Wireless transmission apparatus." R. Whiddington. April 15th.

9,657. "Locking devices for electric lamp globes." E. Smith. April 16th.

9,667. "Locking devices for electric lamp globes." E. Smith. April 16th.

9,671. "Electrically-operated valves for control of steam, gas, air, liquids, &c." G. Wilkinson. April 16th.

9,676. "Electric switches." J. H. Collins & M. J. Railing. April 16th.

9,677. "Electric foot appliances." A. Rickards. April 16th.

9,704. "Electric arc lamps." P. Freedman. April 16th.

9,741. "Galvanometers, &c." W. H. Apthorpe & Cambridge Scientific Instrument Co. April 16th.

9,780. "Electric lamp and light fittings." D. Assersohn. April 16th.

9,787. "Electric heating rings or stoves." J. A. Colquhoun. April 17th.

9,799. "Sparking plugs for internal-combustion engines." F. W. Baker. April 17th.

9,800. "Electric relays." L. B. Turner. April 17th.

9,822. "Carbon-holders for arc lamps for kinematographs, &c." F. A. Thomassin. April 17th.

9,829. "Harnessing tidal energy for generating electricity, &c." M. Snee. April 17th.

9,837. "Rotary electric converters." British Westinghouse Electric and Manufacturing Co. April 17th. (U.S.A., June 17th, 1918.)

9,865. "Incandescent lamps, &c., and manufacture of same." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 17th.

9,873. "Terminal for clamping electric leads." J. C. Hutton & Spensers, Ltd. April 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

112. Apparatus for the detection and measurement of gases. G. A. Shakespeare. January 4th, 1916. (124,453.)

177. Arc lamps. G. Westercamp. January 5th, 1916. (124,455.)

1,310. Flash signalling apparatus. A. W. Sharman. January 27th, 1916. (124,485.)

1,827. Winding reels for use in wireless telegraphy installations on aircraft. C. L. V. Lee. February 7th, 1916. (124,498.)

2,066. Wireless telegraphy with undamped oscillations. E. R. Clarke. February 11th, 1916. (124,499.)

2,120. Submarine signal sound-receiving apparatus. S. M. Davison. February 12th, 1916. (124,500.)

2,201. Systems for distributing electric energy. C. H. Wordingham. February 14th, 1916. (124,502.)

2,339. Telegraphy and apparatus therefor. A. C. Fuller. February 16th, 1916. (124,504.)

2,402. Signalling by electromagnetic waves. A. Arton. February 17th, 1916. (124,506.)

1918.

5,202. Telephone receivers. J. W. Hobley. March 25th, 1918. (124,561.)

5,421. Interlocking mechanism particularly applicable to electric switches. V. G. Middleton & C. J. Baker. March 27th, 1918. (124,577.)

5,476. Telephone systems. Automatic Telephone Manufacturing Co., J. Savin & A. J. Ray March 28th, 1918. (Addition to 1,970/14.) (124,581.)

5,477. Telephone systems. Automatic Telephone Manufacturing Co., J. Savin & A. J. Ray. March 28th, 1918. (Addition to 1,970/14.) (124,581.)

5,478. Telephone systems. Automatic Telephone Manufacturing Co. & A. J. Ray. March 28th, 1918. (124,583.)

6,021. Electro massaging apparatus. H. Ashton. April 9th, 1918. (124,598.)

6,981. Electric starter for internal-combustion engines. G. Questa and Officine Electro-Meccaniche. April 25th, 1918. (124,614.)

7,164. Electromagnetic brakes, clutches, ratchets, and the like. E. C. Villiers. April 29th, 1918. (124,618.)

7,619. Electrical apparatus for controlling the curtains and lights in connection with the projecting screen or proscenium of a kinematograph or other theatre, or for like purposes. C. E. Falconbridge & J. W. Lewsley. May 7th, 1918. (124,622.)

8,639. Electro induction apparatus. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 24th, 1918. (124,631.)

8,669. Telegraphic relays. J. S. Withers (K. C. Cox). September 18th, 1916. (Divided application on 13,251/16.) (124,632.)

9,959. Electric ignition apparatus. Akt. Ges. Brown, Boveri et Cie. June 16th, 1917. (117,447.)

1919.

6,527. Interlocking mechanism for combined switches and plug-and-socket connectors. V. G. Middleton & C. J. Baker. March 27th, 1919. (Divided application on 5,421/18.) (124,703.)

12,188. Cores for pupin loading coil magnets. Western Electric Co. (Western Electric Co., U.S.A.) July 26th, 1918. (124,658.)

12,470. Control of dynamo-electric machinery. J. C. Wilson. July 31st, 1918. (Addition to 115,786.) (124,659.)

14,165. Safety gaps of ignition magnetos for internal-combustion engines. E. A. Watson & M-L. Magneto Syndicate. August 31st, 1918. (124,665.)

15,434. Automatic telephone systems. Automatic Telephone Manufacturing Co. February 4th, 1918. (123,053.)

London Electrical Strike Averted.—On Wednesday of last week, said the *Evening Standard* of last Friday, the South Metropolitan Electric Light & Power Co. discharged Mr. A. Dominay, a shop steward and member of the Electrical Trades Union. It was alleged that he was discharged for slackness of work, but the men observe that he had been ten years in the employ of the company, and that he is a prominent trade unionist. Dominay was discharged at 1½ hours' notice. The matter was taken up by the union, but the feeling among the men was so strong that, had no settlement been arrived at meanwhile, spontaneous action would have been taken by them, and the whole of them would have been out at 3 o'clock on Thursday afternoon. Just in time to avert a stoppage an agreement was arrived at, under which the company agreed to pay Mr. Dominay his usual weekly earnings until such time as the Joint Council set up between the employers and the union has determined whether Mr. Dominay shall be reinstated.

THE

ELECTRICAL REVIEW.

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The Oldest Weekly Electrical Paper. Established 1872.

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OFFICE :—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 18s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

ADELAIDE: MESSRS. Atkinson & Co., Gresham Street.
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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

OF SPECIFICATIONS.

WHEN several parties are considering the achievement of a certain aim, or result, it is more than probable that they will take various views of the most advantageous method of fulfilment. It often happens that the divergence of views on the means to be used causes more discussion and difficulty than the attainment of the result sought for.

It is the result which matters; and the result desired when electrical machinery is purchased can, in general, be stated in terms which satisfy every case. The object of the purchase of electrical machinery—probably of many other commodities also, but certainly of that one—is the provision of a reliable means of economically producing the maximum output of the product for which a market can be found.

It is, generally speaking, upon the means of securing reliability that the greatest differences of opinion are found, and the attainment of reliability supplies the chief reason why consulting engineers, supply undertakings, users of machinery, and electrical manufacturers, all go to work and prepare elaborate specifications showing what materials shall be used, and how they shall be used, in order to produce a given result. In addition to the attainment of the normal result, specifications frequently provide for the realisation of some other or abnormal result; and this second result may or may not be compatible with the first. A fruitful source of discrepancy in this respect is the question of temperature rise. The increase of temperature in an oil-cooled transformer has been known to be specified as 45° C. above the surrounding atmosphere after a continuous full-load run, as measured by a thermometer placed in the hottest part of the oil, while at the same time the specification asks that the increase of temperature above that of the ambient air shall not exceed 55° C. in the oil after a continuous overload of 50 per cent. A transformer which fulfils the second desideratum will run cool at normal rated output, while if it fulfils the first it will get too hot under the overload conditions mentioned. In such a case, what will the manufacturer do? He may quote on the generous transformer, or on the skimped one; or he may, possibly, offer alternatives. Probably some will do one thing, and others will do another, and comparison will be made on price alone, with the result that the cheap transformer will be bought, and overloaded until it gradually fries itself to death.

This is only one example, taken at haphazard out of many which might be adduced, of inconsistency in specifications. Such discrepancies as this arise from inadequate acquaintance with the machinery specified—from ignorance, in short, not necessarily culpable, but still ignorance.

Another and more objectionable class of specification is that issued by the consulting engineer or user who knows, or imagines he knows, all there is to be learned about electrical machinery. In this case the specification may easily extend to thirty or forty pages, bristling and scintillating with such efforts as:—

"The laminations shall be non-ageing, of high permeability, and low hysteresis loss.

"Insulating shields shall be placed between windings and between the core and adjacent windings.

"The coils shall be thoroughly dried.

"All insulators . . . shall be free from cracks and flaws.

"The tank . . . shall be oil tight."

And so on and so forth. The ridiculousness of such provisions can best be brought home by reversing them. "The laminations shall be of low permeability and high hysteresis loss: the coils shall be wet, the insulators flawed, and the tank as full of holes as a sieve."

Now, the British Engineering Standards Association has issued upwards of eighty standard specifications and reports. Among these may be found publications covering tramway rails, copper conductors, poles, telegraph material, insulation, conduits, lamps, meters, sparking plugs, instruments, electrical machinery, wall sockets, magnetos, &c. It may, therefore, reasonably be assumed that there is a possibility of being able to find among these publications a specification which will cover the machinery or apparatus required; and since this possibility exists, it becomes the duty of all parties interested to make the greatest possible use of these standard specifications.

Apparatus built in accordance with these specifications can be relied upon to give the results desired, and to be perfectly satisfactory in operation. This should satisfy the user's requirements.

There is, however, another and more important aspect of standardisation. Standardisation means the lessening of overhead charges, and the consequent cheapening of the finished product. Low selling prices tend to bring increase of business, and bulk of output again brings about reduction of overhead charges. Any factory, if it is to be profitably run, must produce as many articles as possible, of the smallest possible number of types. It is generally realised that it is standardisation, resulting in enormous production, that has made the Ford car so cheap. If Britain, now that the war is over, is to take the leading place in industry which is rightly hers, standardisation must be brought about to a far greater extent than ever before. And, since there is in existence an authoritative body grinding out standard specifications for every imaginable engineering product, it would not be a bad beginning if we availed ourselves of the fruits of its labours.

The National Industrial Council for the Electric Supply Industry.

The Council is at last an accomplished fact. The first meeting has been held. All parties met, and an auspiciously harmonious atmosphere prevails. So far, good. It only remains to start work in earnest. If the first year can be got through without dissonance, the Council can be reckoned an assured success. Everything appears to promise well, provided the spirit of the Whitley Reports be followed. We mention this because we understand that among the more legally-minded there is discussion as to the fixing of "plenary powers" for the delegates to the Council. The tone thus faintly adumbrates, perhaps, a conception of the Council as a ruling and mandatory body, a conception, it need hardly be said, alien to the spirit of the Reports. Whether or no we call it "Utopian," the underlying idea of the Councils is mutual agreement—and this, not merely between the two parties to the Council, but also between the individual constituents of each party. The tendency, perhaps, to conceive of the Council as a kind of quasi-legal Court which promulgates decisions from time to time is likely to be increased by the fact that, from the nature of the case, the National Council has to be formed first, in point of time, and afterwards the District Councils and the Works Committees. The National Council, however, when the scheme is in full working order, is the apex of a pyramidal organisation, of which each District Council and each Works Committee is an integral part. Moreover, the National Council is primarily representative in function, the essence of the constitution being that in the National Council the views common throughout the industry from each side respectively shall come up for adjustment and reconciliation, and thus lead to harmonious action being taken. It need hardly be said, therefore, that the first work of the National Council should be immediately to arrange for the constitution of the District Councils, and then for the co-ordination of the Works Committees under their respective District Councils. This, of course, is the machinery designed in the Whitley Reports, and success or failure must necessarily depend on the thoroughness and speed with which these constituent elements are formed and linked-up into an interdependent whole.

The Training of Disabled Men.

In past issues we have given special attention to the training of disabled fighting men in useful arts, and have been glad to publish particulars of methods which have been successfully adopted and occupations which fall within their scope. To-day we are pleased to give an account of the admirable work which is being done at the Croydon Central Polytechnic under the guidance of Mr. F. H. Taylor, as well as an interesting review of the results attained in the Glasgow Corporation Electricity Department, under Mr. W. W. Lackie and his meter superintendent (Mr. C. W. Marshall), by one of their pupils. Not only is the record of achievement most satisfactory, but also the high quality of the character and ability of the men is most encouraging, and we are glad to know that similar courses of training are in progress at many other centres. But very much remains to be done, and every facility should be given by the authorities and Committees concerned for the development of this good work. We are sorry to see that at one centre the way has been blocked for months by the failure of the Local Technical Advisory Committee set up by the Ministry of Labour to approve of the appointment of the Instructor, who was selected as long ago as September last, although the urgency of the matter has been pointed out many times. The inaction of this Committee is highly reprehensible.

Electroculture in Bondage.

It is a singular thing that directly a matter gets into the hands of a Government Department, it is immediately "hung up." We do not profess to have newly discovered this fact; it is, unfortunately, one with which we are all only too familiar—but it is remarkable with what regularity and consistency the phenomenon recurs, the only exceptions that we can call to mind being the demands of Trade Unions for more pay for less work, which are invariably granted with precipitation.

The example that we have in mind at the moment is the subject of electroculture. Various experimenters have been at work on this question for several years—some for many years—and their results, showing, on the whole, a strong preponderance in favour of the use of the electrical discharge, have been published freely from time to time. But in 1917 the Board of Agriculture decided to appoint an Advisory Committee to deal with the subject, and the Committee has laid its paralysing hand on the movement, with the expected result. We say "expected," because we predicted it.

In our issue of October 12th, 1917, we said: "It would appear to be too much to expect that a Department with a record such as that of the Board of Agriculture will not automatically follow established precedent, and in effect delay, instead of facilitating progress." "It should be understood that the results of its deliberations will be accessible to the public at any time, and that the Board's only interest is that of a Department of State paid by the public to receive and act on any recommendations made by the Committee." "We would ask whether it is not a fact that during the past year or so, public interest having been aroused, and the need for expert guidance having arisen, the Board's advisers—presumably with its concurrence—have obstructed rather than assisted the development of the movement."

The constitution of the Committee was announced in our issue of February 22nd, 1918; the curtain promptly fell, and no reports have been issued. Yet we have reason to believe that highly successful results were obtained last year under the ægis (or shall we say the "bushel") of the Committee, and a considerable sum of public money has been spent on the official experiments. The work of independent experimenters has been studiously ignored.

We maintain that (1) there is no justification whatever for concealment of the work done and the results obtained; (2) it is the duty of the Board to organise the research and to co-operate with independent workers, instead of giving them the cold shoulder; in this respect it should learn from the Department of Scientific and Industrial Research; (3) the only conceivable object of secrecy is to enable some person or persons to "acquire merit," as Kipling would say.

We are aware that it is the official view that the public should not be encouraged to adopt the system unless and until it is proved to be effective. This theory, if logically carried out, would put an effectual brake on progress. Where would the motor-car, the aeroplane, or even the electric lamp, have been now if such ideas had been allowed to delay their development? It is emphatically *not* the function of this Advisory Committee to block progress and experimentation until it shall have itself developed a commercially successful system of electro-culture—we want the results in this century. The quickest progress is made when the largest number of experimenters is at work, and if the Committee would organise and support research as widely as possible, and publish all the information available at once, it would be doing something really useful. At present it is simply blocking the way.

Super-station Efficiencies. The Hydro-electric Power Commission of Ontario recently issued a Report on the rate of coal consumption in various electric generating stations in Canada and the United States. The Report resolves itself practically into a comparison of the coal-efficiencies of stations of varying size. It goes without saying, of course, that as the capacity of the station increases, the figures show an increasing efficiency. But the interesting fact emerges from the statistics collocated in the Report, that beyond a certain point the gain in economy due to size of station slackens off materially. A comparison was made between stations of 50,000 H.P. and 200,000 H.P. respectively; but although there was a saving in favour of the larger station of about 25 per cent., yet, taking into account the higher load factor, the Report concludes that "there is no doubt that if the smaller stations operated at the same load factor as that obtained in the larger station, the difference in the rates of coal consumption would be much smaller," and this "emphasises the fact that the very large stations do not tend to make very big reductions in rates of coal consumption, as compared with those of more moderate size." The Report goes on to say, *apropos* of the statistics, that "it is evident from these considerations that coal can be better conserved by appreciably increasing the load factors of existing stations of moderate size (around 50,000-KW. capacity), than by building huge stations having only slightly higher load factors than those of the smaller sizes."

There is also in the Report another point of super-power station interest. Commenting upon the curve of coal consumption for a station of about 150,000 H.P., it concludes that with the present station equipment, methods of operation, load factors, &c., the rate of coal consumption for large stations cannot come below about 6¼ tons per H.P.-year, no matter how large a station may be. Further, that "since the equipment now in use is getting near to the maximum possible efficiency, this means that probably under no circumstances will it be possible to get below, say, 5½ tons per H.P.-year. Centralisation on a vast scale may tend to reduce costs, but cannot conserve coal very much as compared with existing conditions in the large stations." (But the Report allows that as the coal bill is 40 to 60 per cent. of the total costs, even a small saving is a good deal of money.) How far these conclusions are felt to carry weight in England is a matter on which opinion is divided. Anyhow, the facts may at least perform the function that an irritating foreign substance does in the oyster—form a nucleus for discussion, around which some pearl of wisdom may develop.

SPECIALISED CONTROL.

By MAJOR E. A. PELLS, R.E.

America could, perhaps, be described as the home of specialisation, for it is not only on broad lines that they specialise, but they go even further and make studies of, and become particular experts in, some portion of the subject of which they are already specialists. This is, of course, all part and parcel of efficiency methods, and the idea of the sub-division of supervising duties, or the encouragement of specialisation amongst foremen and overseers, so as to obtain specialised control, is bound up in it. A good engineer is naturally efficient by reason of his general training, and would not think of putting a 100-H.P. prime mover on a 20-H.P. job, nor attempting to carry out a particular operation on a machine not designed for it, nor does he expect a machine to do more than it is designed to do. Therefore, it seems peculiar that he should require a man to carry out work that is obviously beyond his powers. The average shop foreman is expected to be a superman in the various traits he is expected to possess, satisfactorily to do all that is necessary in the successful management of a shop. As supermen are few and far between, some part of the job generally suffers, but by installing different men with definite qualifications for the various departments of management or foremanship, a high degree of efficiency can be obtained.

The first thing to be done is to relieve the workshop of all that might be termed pure brain work; then to divide the various duties of a shop foreman; and instead of there being, perhaps, four foremen in a shop, each governing his particular section, their sphere of authority is extended, but the scope of their work is limited to the particular function most suitable to their respective abilities and experience.

In this direction, F. W. Taylor advocated four types of foremen in the actual shop—namely, the "gang" foreman, who runs the gang, instructs, and generally directs operations; the "speed" foreman, whose sole job is seeing that correct speeds are maintained; the "inspecting" foreman, who is responsible for all work being up to quality and in order; the "repair" foreman, who is responsible for all maintenance work in connection with shop and machines.

In addition, it is necessary to have four foremen engaged in the planning room—namely, "the order of work and route clerk," whose duties are those of a planning and progress character; "the instruction-card clerk," responsible for all instruction cards, keeping them up to date as improvements in machinery and methods are made; the "time-and-cost clerk," who is responsible for all dealings with the operatives in such matters; and, finally, the "shop disciplinarian," who is practically the "liaison officer" between the functional foremen, and is responsible for all matters appertaining to discipline.

In works of a smaller character it may not be practicable to carry out the above arrangement, but some sound modification will be found to be far preferable to the old idea of a hustling driver. The "gang" foreman could easily be your champion operative, and as the greater part of his time will be taken up instructing the operatives and arranging the work so that the best method is always used, the "speed" foreman's duties would naturally be covered by him. He will automatically become a counsellor, and the workmen will seek his advice in all things affecting their work.

The "inspecting" and "repair" foremen might be combined, and the duties of "order of work and route clerk's" work could be taken up by the "instruction card" clerk, the "time and cost clerk's" work becoming part of the "shop disciplinarian's" duties. There must be kept in view always the fundamental idea that the actual workshop should be relieved of all brain work.

Any one of the above combinations could be made, irrespective of the others, or the manager might decide on some other modification, especially suitable to his particular industry.

To be a perfect shop foreman a man would have to possess the following qualities in correct proportions :—

1. Brains.
2. Education.
3. Technical knowledge and experience.
4. Tact.
5. Energy.
6. Grit.
7. Honesty.
8. Judgment.
9. Good health ; and
10. "Reliability" in all things.

All men are endowed with different proportions of the various qualities mentioned, and it is the art of management to get the right men into the right places. In choosing functional foremen it is unnecessary to look for all of these qualities in the men you select, so that with careful discrimination you stand a much better chance of getting the most diverse functions carried out in a satisfactory manner.

One result of putting in a system of specialised control based on these principles, is that you decentralise your productive efforts in the workshop, and centralise your control in the planning office, thus putting into effect the recognised axiom in the science of organisation to decentralise detailed activity and centralise control : it is the ability to discriminate exactly when to centralise and when to decentralise, which proves the born manager.

NON-CONDENSING ENGINES IN CENTRAL POWER STATIONS.

By T. WALMSLEY, Assoc.M.Inst.C.E.

Recent experience in connection with the industrial coal economy campaign, inaugurated by the Coal Controller's Department, has demonstrated to the writer that there exists a large field of usefulness for non-vacuum steam engines in industrial works where exhaust steam can be utilised for process work or the heating of buildings. Nor is this usefulness confined to manufacturing works. In central power stations there is still a place—albeit a small one—for the non-vacuum engine. Many medium-size power stations, particularly those that have converted from reciprocating to turbine plant, retain some of their old engines. These might be put to the useful and economical purpose of driving low-pressure generators for station auxiliaries, the exhaust steam being used to heat the condensate from the main turbines. The case of a high-pressure generating station supplying an auxiliary load of 10 per cent. of the total load, through a step-down transformer, will be considered. The steam consumption per kilowatt of a reciprocating engine, discharging at atmospheric pressure, will be taken as twice that of the main turbines. In practice, this figure will alter according to the size and type of steam-alternator units, steam pressure, and degree of superheat.

As the steam consumption curve for a turbine in the neighbourhood of full load is fairly flat, no great increase in the rate of steam consumption will be caused by reducing the load on the turbines in the ratio of 10:9, *i.e.*, by allowing the reciprocating set to take the station auxiliary load. Further, the increase in vacuum which usually accompanies a decrease in load will exercise a steadying effect upon the rate of steam consumption of the turbines. With the reciprocating engine taking load from the station transformers, the total steam requirements of turbines and engines may now be represented very approximately by 9 + 2 = 11. Also the condensate from the turbine condenser together with the make-up water would be about five times the amount by weight of the steam supplied to the reciprocating engine. Taking th turbine average vacuum as 28 corrected to 30 in barometer, the theoretical temperature of the condensate would be 100 deg. F. In practice, especiall where Edwards air pumps and Parsons' augmentor are used, this figure would fall at least 2 deg. F. No great error will be made, therefore, in taking the average temperature o condensate and make-up as 80 deg. F. Afte passing through a feed-water heater, into which the exhaust from the auxiliary engine discharges, the temperature might be raised to 200 deg. F. Thus 5 lb. of condensate and make-up would absorb 600 B.Th.U. Taking steam at 200 lb per sq. in. pressure, and 100 deg. F. superheat, and assuming 85 per cent. of the heat units in the admission steam to be discharged from the reciprocating engine, the latent heat per lb. of exhaust steam would be about 890 B.Th.U. Thus the whole of the latent heat in the discharge steam would not be absorbed by the turbine condensate and make-up.

If the reciprocating set is loaded to take 7 per cent. of the total load, the latent heat will then be absorbed. Further, the greater part of the sensible heat in the auxiliary engine exhaust would be conserved if, after filtering to remove oil, the water were returned to feed. Provided the return system were efficiently lagged, 80 per cent. of the heat units supplied to the auxiliary engine could be returned to the boilers. Thus, although the rate of steam consumption of the turbines is half that of the reciprocating engine, there would result a net saving of nearly 60 per cent. in heat units necessary for station auxiliaries.

Translated into fuel, this represents an economy of 4 per cent. of the total fuel consumption. A further advantage of heating the feed-water in the manner suggested is that the problem of supplying the economisers with water at a temperature of not less than 100 deg. F. is solved. On the debit side is the possibility of the economiser absorbing less heat from the flue gases, and the extra maintenance charges of reciprocating engines. These disadvantages will usually be compensated for by the improved water circulation in the boilers, which frequently results from a high feed temperature

The figures quoted in the foregoing article are necessarily approximate. They serve to demonstrate, however, that non-vacuum engines can often be used with advantage in central power stations.

The Muscle Shoals Nitrate Plant.—A most instructive view of the preparations made by the U.S. Government for the fixation of nitrogen on a large scale is given in the *Electrical World* of April 5th. Although the cessation of hostilities has put a temporary end to the need of nitrates for military purposes, their importance in agriculture is so great that, if the plant described can be operated as economically as the projectors have thought, they may be of very great value in times of peace. The installation was a rush job of the severest character, in which the ordinary routine of design and construction had to be abandoned in favour of doing everything in the least possible time. It is greatly to the credit of the engineers that this was accomplished without their being driven by necessity from sound lines of design. The power stations must be of high economy if they are to be useful in times of peace. The plant had to be erected and put in operation within a year, and to facilitate operations it was decided temporarily to take part of the power from the transmission system of the Alabama Power Co., which is capable of supplying about a third of the total output. The remainder is to come from the steam stations. A notable fact in respect to them is that while on January 1st of last year nothing but preliminary sketches had been made and none of the apparatus for the power plant purchased, eleven months later the cyanamide process had been started up with transmitted power, the first unit of the great turbine was practically ready for use, and two others under erection or ready for shipment, while the boiler plant was so far completed as to be ready when the turbine required steam. Whatever may be the ultimate fate of the plant under commercial stress in time of peace, its preparation for action in so short a time ranks as one of the big engineering feats of the war.

A MOBILE X-RAY PLANT.

N a paper read before the ROENTGEN SOCIETY, and ublished in the *Journal* of the Society in March, Mr. Howard C. Head described an automobile X-ray wagon by neans of which it had been made possible to bring the X-ray apparatus quickly to a patient, instead of taking the atter to an establishment where the apparatus was installed. The horse-drawn wagons in use in Continental Armies efore the war were cumbrous and inconvenient, and by the doption of mechanical propulsion a great improvement vas effected. The chassis of the Austin Motor Co. was ound to be well adapted for the purpose, having a very ow loading line—an important consideration, because the nduction coil and its fittings, the distribution switch-oard, and the control board could all be manipulated from e car, the controls coming within the reach of a man of verage height, while only one step was necessary instead f four or five as with an ordinary chassis: moreover, as all e weight was kept low, there was less tendency for such a r to overturn, even when at a considerable angle, and it as practically immune from side-slip.

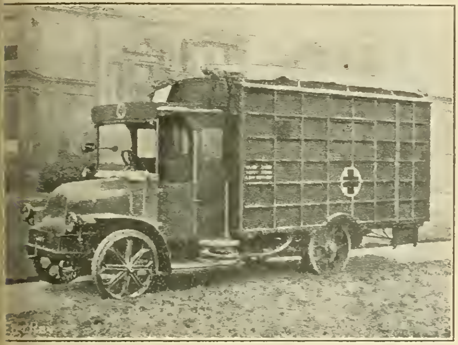


FIG. 1.—MOBILE X-RAY WAGON.

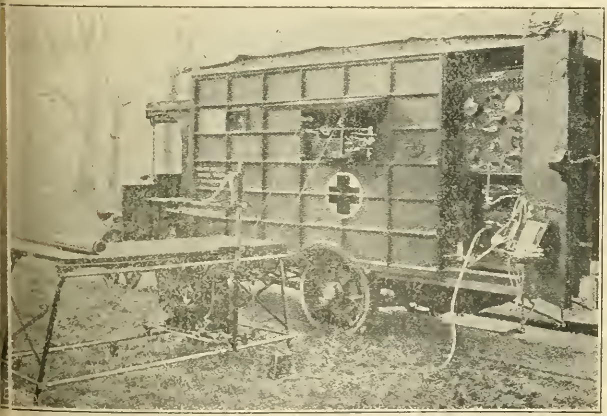


FIG. 2.—X-RAY THEATRE (WITHOUT THE COVER).

The model is a 2-3 ton chassis, fitted with a four-linder engine. The drive is distributed through sub-antial bevel wheels by a propeller shaft to each rear wheel. his special arrangement enables a light back axle to be ovided, without any massive parts in the centre; such an le will run on rough roads without the wheels losing ntact with the ground, as the springs are not subject to action through the inertia of heavy central axle parts.

One of the first equipments produced with this type of chassis was built in July, 1915, and has since been in use near Paris. The present outfit (fig. 1) is fitted with a panelled teak body 12 ft. 9 in. long, 7 ft. wide, and 7 ft. high, and this is divided into two compartments—the photographic dark room and the room containing the X-ray apparatus. The photographic dark room measures 3 ft. 4 in. long by 7 ft. wide, and is practically a tabloid studio, fitted with every arrangement to facilitate the work. It is lead-lined on the side towards the portable X-ray theatre, to protect the plates, &c., from the radiation of the tube. Water is obtained from a 30-gallon storage tank underneath. A special safe-light is provided above the sink, with easily adjusted control for either daylight or electric light. An electrically-driven fan fitted to a special flue is provided to draw off tainted air from the room, fresh air being drawn in through special vents near the floor.

The apparatus room is 9 ft. long × 7 ft. wide, and the apparatus is so arranged in this room that radiography of the extremities can be carried out with a tube stand. Every piece of apparatus has a special fitting to which it is secured, so that, however rough the travelling may be, the apparatus cannot suffer.

The portable X-ray theatre (fig. 2) is 12 ft. 9 in. long × 10 ft. 6 in. deep × 9 ft. high at back and 6 ft. 8 in. high at front. A framework of poles and tie-rods is erected on the near side when the caravan is on the road, and these, together with the cover, are stored upon the roof. The canvas covering is of special material, three-ply, and so thick and close in texture that light and water are absolutely excluded. The theatre is lit by an electric lamp, which may be connected, if desired, to the foot switch. The material used for forming the cover of this tent is so efficient that X-ray work can be carried on inside even when there is brilliant sunshine outside.

The electrical generator, which is situated on the exhaust side of the engine, is driven by a Westinghouse Morse rocker chain coupled to the main shaft of the engine; it is designed to give an output of 20 amperes at 150 volts when the engine is running at 1,700 R.P.M. The rocker chain is disconnected when the car is running on the road, and is only connected when the generator is to be used either for charging the battery of accumulators or running the X-ray plant direct. When the engine is driving the generator the whole of the starting, running, and stopping can be carried out from the position of the main distribution board at the rear of the car. The generator is of light design, having a laminated field. It is provided with special protection against dust and dirt, and has a fan on the shaft for cooling purposes. The windings are protected by a condenser and lamp in parallel to

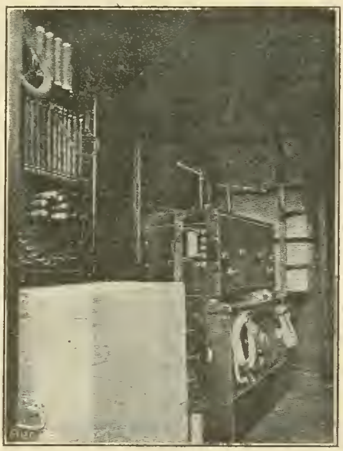


FIG. 3.—INTERIOR OF APPARATUS ROOM.

prevent high- frequency surgings from getting back to the machine.

A special battery of accumulators is fitted in two special cupboards at the back of the driver's cab, and the doors of these cupboards are fitted with louvres to ensure perfect ventilation; by this arrangement no acid fumes can enter the car, and the whole battery is most accessible, should it be necessary to give it attention. The battery is built up in special ebonite composition boxes. Each cell is fitted with a float to indicate the level of the electrolyte. The battery consists of 38 two-compartment 4-volt units, making 76 cells in all of the sealed-in type. The capacity of each cell is 80 ampere-hours (intermittent), or 10 amperes for $2\frac{1}{2}$ hours, or 30 amperes for five minutes. Therefore, the X-ray operator is provided with a supply of energy capable of undertaking the quickest work and the most difficult cases, for he has at his command 20 amperes at 150 volts from his generator, 30 amperes at 150 volts for five minutes from his battery of accumulators, or 50 amperes at 150 volts when running with generator and accumulators in parallel.

As this outfit was for use at the Front, it was thought expedient to adopt in several instances, such as the couch, stereoscope, &c., the standard War Office equipment for field service, so that in case of necessity spares or renewals could be obtained locally.

Apart from this, the outfit is provided with a 16-in. spark intense discharge induction coil (fig. 3), built up in box form and fitted with a variable primary winding. The coil is mounted on a table on pneumatic buffers to provide against mechanical shock, and beneath the table are fitted a dipper mercury interrupter, a centrifugal mercury interrupter, and an electrolytic interrupter, together with the condenser, speed regulators, and a small interrupter selector switchboard.

In order that the coil may be operated without moving it into the portable X-ray theatre, a portion of the side of the car is made to hinge upwards, and a distribution shelf for the valve tubes, milliammeter, spark gap, and rheophores is attached, and connection is established to the X-ray couch. Next to the coil is the Coolidge control outfit fitted with a 12-volt accumulator of very large capacity. This battery also supplies current for the head, side, and tail lamps of the car through a switchboard mounted on the dash.

On the same side of the car at the end is the switchgear, consisting of a main distribution switchboard and a control switchboard for the primary circuit of the coil. The former is mounted on an iron pillar on which it rotates, so that it can be manipulated either from inside the car or from the portable theatre. In the latter case a door at the side of the car is opened, when both switchboards can face into the portable theatre with the Coolidge control to the left hand. All the apparatus remains and is used in the car. The only portions of the equipment that it is necessary to bring into the portable theatre are the couch, foot switch, and tube screen. On the opposite side of the room containing the apparatus is fitted the portable field service couch, a tube stand, and all the other necessary adjuncts for carrying out the best work.

At the end of the apparatus room are tube boxes in racks for the equipment, which includes, in addition to the Coolidge tube, six tungsten target tubes and three valve tubes. On the inside of the roof is fitted the stereoscope, which can be used inverted in this position, and in addition a small portable viewing box is provided.

As one of the functions of this type of plant is to provide a powerful apparatus for use in any temporary hospital, the plant has been so arranged that the minimum number of pieces of apparatus are carried into the building. It is only necessary to take the induction coil and its fittings, together with a trestle table which is carried on the door of the car, the couch, and the small control switchboard; all the other apparatus including the interrupters remain in the car, and connection is established from the car to the temporary X-ray room in the hospital by special cable, which is wound on cable drums mounted by the chauffeur's cab. One can, therefore, carry on radiography and radioscopy, and for that matter therapeutic treatment as well, in the car itself, in the portable X-ray theatre, or in any hospital or building.

The engine may be started by using the battery of accumulators for motoring the generator in the same way as a self-starter on a motor-car. There is no necessity to leave the portable X-ray theatre, or the vicinity of the switchboard, to start up the plant, to operate it, or to shut it down. A row of fuses on the top of the board controls the interior and tent lights and ventilating fans, as well as the motors of the mechanical interrupters, and these are all supplied with energy by the accumulators. In the case of the interrupters this is very important, in order that the speed may remain constant.

Beneath the automatic cut-out is a shunt regulator for regulating the output of the generator. A regulator is provided for controlling the lights of the interior of the car, and is situated underneath the row of fuses.

The connecting-up of the various parts of the apparatus is carried out by means of special cables. The induction coil and the foot switch are connected by their respective plugs to the sockets on the control board, and the foot switch and main switch on the control board are in parallel, so that either can be used irrespective of the other. There is a regulating resistance in series with the primary of the induction coil, and an ammeter. All the plug connections are made non-reversible, with the exception of one on the control board, and this is left reversible in order that the polarity of the primary and secondary circuits may be changed instantly if occasion requires.

The secondary or tube circuit is assembled by placing the high-tension distributing bracket in front of the coil, and connecting up the coil to the milliammeter, valve tube, and spark gap.

The couch is erected in the portable theatre, a tube inserted in the tube box and connected to the distributing bracket by the spring rheophores. If desirable, the three-ply wooden top of the couch can be removed, and an ordinary stretcher used in its place.

Such a mobile X-ray unit affords exactly similar facilities to those available in the base hospitals, and the possibilities of the utility of such a unit in normal times for mining districts, scattered areas, and so forth, are obvious.

METER REPAIRING AS A VOCATION FOR DISABLED SOLDIERS.

By A. Currie.

Now that so much attention is being directed to the subject of employment for ex-service men, a few notes by a disabled man may be of interest. The writer was the first disabled soldier to get employment in the instrument workshop, Glasgow Corporation Electricity Department, and consequently has seen the progress of the work in all its stages. The principal class of work is the repair of electrical meters of the mercury bath type, and this was described in some detail in an earlier article in the Electrical Review. It is now desired to give a few notes from the standpoint of the worker.

Technically, progress has been continuous, and it may be said that all the direct-current meters in Glasgow are repaired by disabled soldiers. The types in use in Glasgow are mostly C. & H., Ferranti, and B.T.H. A brief survey of the work done on a meter in the workshop and laboratory will show the nature of the jobs tackled by the repair "squad."

When brought in from circuit, after five years' service, each meter is tested on one or two loads, and its condition is generally noted. It is then dismantled and cleaned, and all defective parts are repaired or replaced; when every part has been gone over carefully, the meter is then re-assembled and tested for starting current. If found correct, it is put into its case, and is then ready for the test bench, where it is tested and calibrated. After each batch of meters has been put through the tests, the individual meters are separated into groups according to their test performances. The first group are "passes," which, after undergoing a final examination, and having the constants entered on the ticket (which goes out with each meter), are sealed and put into stock, ready for consumers' premises. The others are subdivided into those that will pass by simple adjustments of the magnetic shunt or changing the ratio wheel, and those which are (*a*) magnetically, (*b*) mechanically defective. The man on duty in the laboratory attends to the first two groups. The meters which are magnetically defective are collected in batches and reflashed, whilst those that are mechanically defective are returned to the man who overhauled them, so that he may have an opportunity of preventing the repetition of any particular fault. By concentrating on inside work, the number of complaints from consumers has been greatly reduced.

We have a routine which we go through in turn, *i.e.*, one of us puts all the meters into their cases, which have been waiting for the meters to be cleaned; then in the following week he takes his turn in the laboratory, testing meters and carrying out adjustments that may be necessary; following that, he assists in changing ratio wheels and examining meters before passing them into stock, also making parts of instruments which are required at that period.

Through becoming familiar with the work in all its stages, the men take a keen interest in their occupation. Our chief (Mr. Lackie) and our superintendent (Mr. Marshall) induced the School Board to open one of their technical schools, which we attend at night, to be instructed in switchboard instruments and their construction, and also in the use of our tools, *e.g.*, files, lathe, vertical and other machinery necessary in the instrument-making trade. The teacher is supplied from our department, so that we have the advantage of being instructed in the work most common in the workshop. Our superintendent has been giving lectures and demonstrations weekly since we entered the employment of the Corporation, with the result that some of the disabled men are considered to have a very sound knowledge of the work. The meter tests here are much more accurate than they were when we entered the department; all meters which pass the usual tests have now to go through a lamp-load test (16 hours, dial reading). Meters must be mechanically perfect to pass this test, yet production has increased, a fact which proves that disabled men are fitted for this class of work.

All the men employed in this work have lost one of their limbs in the war.

National Electricity Supply in Australia.—In a reference to the appointment of the Electricity Commissioners, the Minister of Public Works stated that the commission would not act merely in an advisory capacity. The commissioners are to take over the whole administration of the Electric Light and Power Act, which covers all matters relating to electricity supply in Victoria. In addition to the preparation of a scheme for the establishment of electricity generating works at Morwell, the commissioners are also to inquire into and report on water power schemes. They are to investigate the means necessary to prevent further divergencies in systems of electricity and for standardising existing systems, and to make investigations as to the promotion and encouragement of the use of electricity. They have power to establish a State coal mine at Morwell and compulsorily acquire all land within a radius of 20 miles thereof, to prescribe conditions in leases of water rights for electricity generation, and to authorise the compulsory acquisition of easements over land by electricity undertakers. Power is given them to engage a secretarial and technical staff requisite for such an undertaking, and they will proceed to business without delay. In accordance with a promise made by the Premier, the total expenditure by the commissioners prior to the meeting of Parliament is not to exceed £20,000, but this will not prevent the energetic prosecution of the various duties imposed by the Act.—*Melbourne Age.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Safety Battery-Charging Device.

The author of the article on charging electric truck batteries which appeared in our issue of December 20th, 1918, has sent us the following particulars of a safety device which he has found useful in charging Edison batteries. He has often found that the temperature readings are neglected by the attendant in charge of the plant during boosting, especially in the night time, and has adopted a device which indicates to the attendant whenever the battery is receiving too high a supply of current; at the same time the device, which is automatic, reduces the charging current to a normal rate until the temperature of the electrolyte has dropped to a safe figure, after which the auto-cut-in remakes the circuit, giving the full boosting charge at which the switchgear is set.

The operation of the regulator is on the thermostatic principle; it consists of two flanged disks soldered together at the flanges so as to form a box or cavity. Inside the box there is a liquid consisting of ether or methylated spirits, which about half fills the cavity S (see fig. 1).

The vehicle battery has attached to one side or the top, whichever be most convenient, the disk arrangement above described, which may be tacked on with solder or fastened by means of a strap Soldered to the disk is a bridge which carries two contacts C_1 and C_2 on insulators I, I_1, the contacts in turn being supported from two flat springs which can be adjusted by the thumb screw A S.

The standard charging plug and socket are shown at SCP, but on the outside of them an extra contact 1 is fixed.

The ordinary current-controlling resistance is shown at AR, and a combined relay and resistance at R and RA, &c.

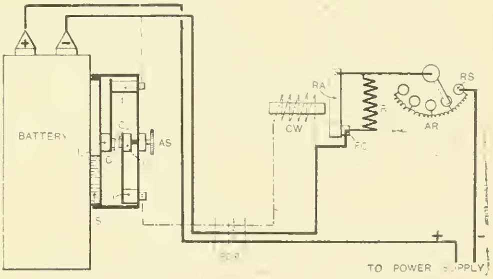


Fig. 1.—Connections of Safety Charging Device.

During the process of charging the battery the current from the source of supply flows through the controlling resistance AR, contactor armature RA, contact FC, standard plug SCP, through the battery, and thence to the source of supply by way of SCP.

If the boosting current is high, and the electrolyte in the cell becomes heated, as the thermostat is in direct mechanical contact with the steel container, the heat is imparted to the solution of spirit (good all-round results are obtained with a mixture of 1 lb. of resin to 1 lb. of methylated spirit) which freely expands, causing the front portion of the box to belly out in accordance with the temperature obtained by the electrolyte. At a predetermined temperature which can be adjusted by the screw A S the contacts C_1 and C_2 touch one another, and the relay coil CW is energised, which attracts the armature RA, thus opening the contacts FC. The main charging current has now to flow through the resistance R, and is reduced to the normal rate until the temperature of the electrolyte has dropped to a safe figure, when the thermostat contacts are disconnected and CW allows RA to fall back to its original position short-circuiting R, thus raising the boosting current to the predetermined figure.

The contact 1 of the plug S C P is totally enclosed, and is of the "foolproof" type.

The Greene Electric-Steel Furnace.

The Greene Electric Furnace Co. is being incorporated at Seattle to build, sell, and install the type of furnace controlled by the Greene Process Metal Co., of St. Louis, says the *Electrical Review*, of Chicago. This furnace, designed and patented by Albert E. Greene, is the rolling cylinder, arc type. The 3-ton furnace installed in the plant of the Olympic Steel Works, Seattle, has two 5-in. graphite electrodes, requiring from 500 to 600 KW., two-phase, at a voltage of 100 to 110. The 3-ton charge of scrap steel is melted in two to three hours, this being deoxidised by means of the Greene slag process in which a patented composition of sand and clay, or lime, is used to give the required fluidity. This slag absorbes the oxide of iron carried into the bath on the scrap, eliminating it from the bath below. The oxide of iron thus dissolved in the slag is reduced by throwing upon it finely powdered coke, ferro-silicon, or other reducing agent, resulting in the return to the bath of the iron formerly in the oxidised state. This elimination of the dissolved oxide from the molten mass obviates imperfect castings produced by blow-holes, which are caused by the presence of iron oxide. The company's newest type of 3-ton furnace has three electrodes, for three-phase current, and is equipped with a 400-K.V.A. transformer. Among other installations of this type made in Washington is a 2-ton single furnace in the new Aurora foundry, Seattle; a 1½-ton furnace at the plant of the Pacific Car & Foundry Co., at Renton; and furnaces of smaller capacity at Everett and Olympia. The first installation of a Greene electric furnace made in the Middle West was in the works of the Dayton Malleable Iron Works, Dayton, Ohio. The accompanying illustration (fi. 2) shows a Greene 3-ton electric furnace at the Olympic Steel Works, Seattle. The rolling mechanism affords easy control in tilting. The shell in this furnace is made of ¾ in. steel plate.

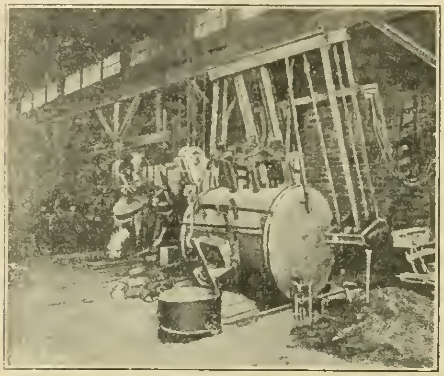


Fig. 2.—Three-ton Greene Electric Furnace.

ELECTRICITY IN HORTICULTURE.

At a meeting of the Lea Valley Growers' Association, held at Waltham Cross on April 23rd, Mr. E. S. Shoults opened a discussion on "Electric Working in Nurseries." The Association includes among its members practically all the fruit and flower growers along the valley from Tottenham to Hertford, a district famous for the production under glass of tomatoes, cucumbers, grapes, flowers, &c.

Mr. Shoults said that in the affairs of this world it was as important to have good reasons for not doing things as it was to know why things were done. Up to the present there had been a very good reason for the growers not using electricity, namely, that it was not there to use. In this respect the district was probably the most backward, considering its importance, of any place in the world.

The Council of the Association had recently approached the North Metropolitan Electrical Power Distribution Co. with a view to getting a supply for the whole valley, and it was to be hoped that the company was now interested in the subject. At present the company had mains fairly convenient for two groups of nurseries, at Brimsdown and at Freezywater. For the rest of the district there were many difficulties to be overcome.

The company, being a commercial concern, must first consider the interests of its shareholders, the interests of the community coming second. This being so, it had to be reasonably sure that the demand was likely to be sufficient to warrant the outlay on mains. High-pressure overhead mains offered the only economical scheme for distribution in such a district, and progress in this direction was stopped by the difficulty in obtaining wayleaves. It was to be hoped, however, that the legislation necessary for the removal of this obstacle would be secured before long.

The speaker contended that uses for electricity would crop up in all directions when once the supply was available. It was surely the business of the supply companies to do more to instruct the public in the benefits of electrical working; they could not expect possible users who knew nothing of the subject to do the pioneer work, or to take the risks inseparable from all enterprise.

In Germany co-operative working in agricultural communities had done much to help things forward; societies were formed, and they either put down power stations of their own, or by purchasing in bulk, or guaranteeing a certain consumption, they got the benefit of low rates that would be impossible to the ordinary small consumer. The enormous growth of such co-operation in Germany was indicated by the following figures.

Year.	1901.	1909.	1910.	1911.	1913.
No. of societies ...	1	82	257	240	650

Mr. Shoults briefly described the various systems of supply, and then proceeded to discuss the purposes to which electricity could be immediately applied in a modern nursery. At present the greatest amount of power required on a nursery was that employed for pumping purposes, and for this alone the electric motor would offer enormous advantages over the gas engine. The electric motor, consisting as it did of only one revolving part, in the place of the various reciprocating parts of the gas engine, required less expert attention, and occupied less space, particularly when the motor was direct coupled to the pump. Moreover, the motor was easily started, was provided with automatic lubrication, and required no cooling apparatus. Further, the motor could be automatically controlled by the water level in the tank, and this, coupled with the low cost for lubricating oil and spare parts, brought the cost of maintenance down to a minimum.

The power required to lift 20,000 gallons of water per hour 50 feet, allowing for an average efficiency for the pump, was 10 H.P., and taking electricity at 1½d. per unit, the total cost would be about 1s. 3d., which was roughly ¾d. per 1,000 gallons lifted 50 feet.

Another important purpose for which electric motors could be advantageously adopted would be for the driving of water circulators in the hot-water system. At present the circulation was effected by gravity and depended on the difference in temperature between flow and return, and the height of the mains above the heater; thus the forcing of fires did not necessarily improve the circulation. If electrically driven circulators were employed many advantages would accrue, such as the possibility of fixing boilers on the ground level, obtaining uniform temperature, and the ability to erect pipes where they were really required for heating considerations alone.

Other purposes in connection with which motors could with advantage be employed would be for stoke-hole pumps, spraying, chaff-cutting, soil screening, and fruit-grading machines, as well as in connection with trolleys and conveyors for the moving of fruit, soil, automatic stoking, &c.

The installation of electric light in a nursery would also be of inestimable value, not only for night work in the greenhouses, but also in the stoke-holes, sheds, and offices.

Dealing with uses for electricity that were likely to come when a supply was available for experimental purposes, the speaker mentioned, among others, the ventilation of greenhouses. At present the ventilating system of the greenhouses appeared feeble, and when the plants got up high there was no way of getting any real circulation of air amongst them. Electricity supplied the most convenient means of trying experiments on these lines. The amount of power required for this purpose would not be large, but from the point of view of the supply companies, it was only one of the many opportunities which would undoubtedly present themselves if a supply were available.

Another application which would probably come along would be power digging; here the problem was one for the grower, the implement designer and the electrical engineer to work out between them.

The adaptability of electric motors would appeal to all. They were readily portable and easily rigged up; thus there would be no necessity to have a separate motor for every purpose; a machine used for one purpose, say, in the summer would do for another in winter.

Amongst future possibilities one could mention such applications as the stimulation of growth by electroculture, the electrification of seeds, the sterilisation of soil and treatment of diseases, and the electrical heating of the houses. At present the latter did not appear practical, though it certainly offered enormous advantages. The capital outlay on its installation would be comparatively small, but the cost of running would be very much greater than that of the present system. Experiment was wanted in order to test whether the economies obtainable by the perfect regulation afforded by electricity, combined with the many other undoubted advantages were sufficient to compensate for the high cost per heat unit delivered.

Concluding, the speaker pointed out that most of the applications of science familiar to our use to-day had had their origin in the speculations of men bold enough to think and act along lines which seemed to the practical men of the times to lead nowhere.

A discussion followed, in the course of which Mr. A. H. Bennett, resident engineer of the North Metropolitan Co., gave much useful information on technical points arising in respect of the connections which it was hoped might be made in the near future.

Mr. E. Barclay also gave some particulars of apparatus and photographs kindly lent by Messrs. Crompton & Co. for the occasion.

Electric Cooking on Trains.—According to the *Engineer*, the G.W. Railway Co.'s passenger guards' vans are being fitted with a gas-ring—or its equivalent, where the vans are lighted electrically —so that guards may warm their food.

THE TRAINING OF DISABLED MEN.

By FREDERICK H. TAYLOR, A.M.I.E.E., A.M.I.Mech.E.

(*Abstract of paper read before the* Junior Institution of Engineers.)

The training of the disabled man is a matter on which the greatest efforts, care, and thoroughness have been concentrated, with results which reflect credit on the State department concerned, and all those working in connection with it. Training is carried on in various branches of engineering, but probably a very much larger percentage of candidates apply for training in electrical engineering than in others. From evidence to hand it would appear that this fact is partly due to the impression prevailing in the minds of those who have to advise a man as to a trade to take up, that electrical engineering is a "light occupation," and one which does not therefore call for any great physical exertion on the part of the trainee.

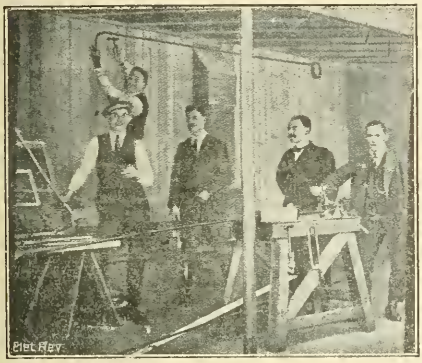


Fig. 1.

A group of disabled men at work. The man standing at the pipe-vice is a one-armed man screwing ⅝ in. conduit.

The men applying for training may be taken as representative of practically all trades and occupations. In many cases the ability of the trainee to grasp and develop the information imparted to him is beyond all expectation. In the case of a butler-valet, six months' training produced results as good as anyone could possibly wish for. The man was well able to plot curves of experimental results and make ready calculations in alternating-current work or similar subjects requiring clear, sustained mental effort. An exactly similar result was obtained with a man whose pre-war occupation was that of a farm labourer, and many records of similar results can readily be produced. Naturally the amount and nature of disablement is a factor in the case, but to nothing like the extent which might be supposed. A much more important factor is the care and method adopted in training.

The training must in every way be systematic; haphazard methods are utterly useless. The syllabus must be slowly, but surely, progressive, and carried on step by step. The utility and practical application of each section of the course of training should be made obvious to the trainee, so that his sympathy may be aroused and sustained. Whilst the practical side of the man's training must be a strong point, the theoretical side cannot be neglected, if a better type of worker than this country has had in the past is to be produced.

Approximately 24,000 men have been or are under training by the State in various subjects. Of these, approximately 3,550 have been or are being trained in various branches of engineering. With regard to electrical engineering, the number of men in training (or completed training) is approximately 882. Training is being carried out at approximately 45 centres, these being polytechnics or technical institutes, and in a few cases, the works of manufacturing electrical engineers. The training centres are well distributed over the whole of Great Britain. The disabled man does not necessarily become trained in his own home area, as it is frequently necessary to transfer him to some other locality, where the particular trade he requires is specially taught. In the event of such transfer the man has his travelling expenses paid, or a special grant towards the cost of living in the immediate vicinity of the training centre.

Treatment and training cannot usually be entirely divorced from one another, and in some cases the training may have to be regarded as, or may incidentally prove to be, a part of the treatment, that is to say, it may become more or less curative as regards the man's disablement. In many cases the trainee enters for his course within a few days of leaving hospital. It is most desirable that waiting for training should not occur. That the man's mind should lie fallow for two or three months or longer, as has often been the case, is indeed regrettable as tending to deterioration.

Friendly co-operation between men in the classes in many cases greatly relieves what would otherwise be a certain amount of lost time due to treatment.

In many cases training has unexpectedly proved to be an excellent means of diminishing disablement. This is a point which is not usually looked for, but is of immense value.

The disabled man is unfortunately often regarded by the employer as being someone so seriously handicapped as to render his services of considerably less value than those of the man who is physically sound; this view operates to the disadvantage of the disabled man, in many cases without any justification at all.

It is often suggested that a man with an artificial leg, or minus an arm or an eye, is too heavily handicapped to get level with another man not so injured, but one wants to observe what the man with such disablements can do in spite of them if he is to be properly appreciated, and if one is properly to assess his commercial value. Men with an artificial leg or foot show no hesitation, and very little loss of speed, in climbing a ladder or in walking to the extent that a man in the electrical trade is commonly required to

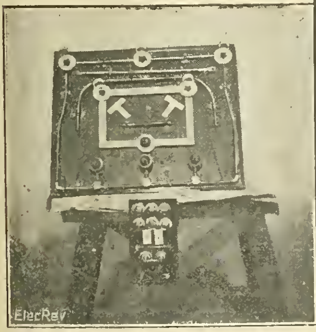


Fig. 2.

Exhibit shown at Ministry of Pensions' Exhibition in May, 1918. The items include screwed-steel pipe-work, a scarfed joint in 37-wire cable, wood-casing work, sweated joints, and a battery-charging board.

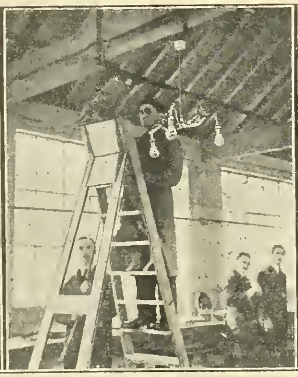


Fig. 3.

In the workshops at Croydon. The man on the steps is engaged on pipe-work on the roof timbers. His disablement is amputation of the leg.

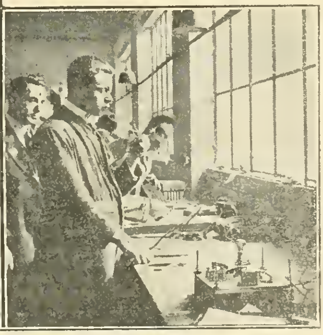


Fig. 4.

In the workshops at Croydon. The man jointing 7/18 cable has suffered amputation of two fingers and thumb of left hand and thumb of right hand, and his left eye has been removed.

do. Standing, too, does not present any difficulty. Men with one arm only are capable of performing many ordinary duties quite efficiently.

I have, for example, instances of a one-armed man bending, cutting, and screwing pipe work quite as well as any other man. A man with amputation of two fingers and thumb on the left hand, and thumb on the right hand, holds tools quite comfortably, and is quite competent to make ordinary spliced joints in small cables, and in a reasonable time. A man whose right arm was amputated at the shoulder made a very good freehand drawing unaided and without an artificial limb.

During their training men are given an opportunity of trying all the ordinary duties carried out by others who have not their particular disablement, and it is as surprising as it is satisfactory to note the ability which almost instinctively appears to be created in the man as a partial compensation for his deficiency.

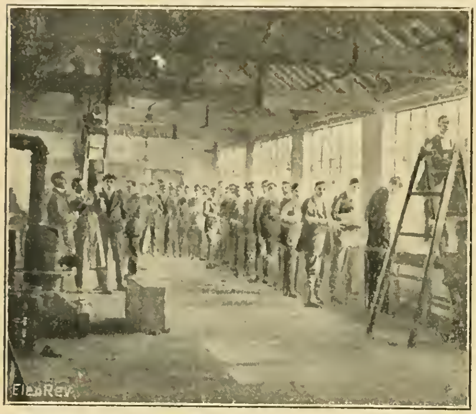


Fig. 5.

View of the workshop where installation and maintenance work is taught. The roof and walls are used for pipe-work and other wiring systems. A group on the left on arc lamp work.

The foregoing facts need to be carefully taken to heart by employers, as otherwise the disabled man is unnecessarily placed under a handicap in his chances of employment.

The branches of the industry in which training is being given at the various centres are:—

Electrical fitting.
Installation, maintenance, and repair work.
Sub-station and switchboard attendants.
Country-house plant attendants.
Armature winder.
Meter repairing.
Dynamo and motor construction.
Instrument making.
Testing and calibrating.
Switch and control gear manufacture.
Telegraphy and telephony.

At the training centre established at Croydon, initially for the three Home Counties, Kent, Surrey, and Sussex, specialisation has been made in electrical installation maintenance and repair work, although many men have been prepared for, and have taken up, central-station duty, sub-station duty, electrical instrument manufacturing, testing work, &c., private plant attendant's duty, &c.

This centre (Croydon) was opened on February 4th, 1918, and at the present time approximately 62 men are in attendance. The training provides as follows:—

(*a*) A lecture course covering elementary electrical engineering, supplemented by experimental laboratory work and experience in handling and running generators, motors, and switchboard equipment.

(*b*) A specialised course on installation maintenance and repair work, practically all the men enrolled being suitable for and taking up work under this branch of the electrical industry.

In order that instruction may be as complete as possible under section (*b*), a well-fitted workshop has been established adjacent to the main building, where every experience can be given to the men in the manifold details with which installation work is so replete.

The total number of hours that each man has to work is 30 per week, divided into 3½ hours in the morning and 2½ in the afternoon for five working days. Mostly, the morning is devoted to lecture work, laboratory and workshop practice being confined to afternoons. During the last two months of their course workshop practice may be extended to all day and every day.

The value of proper note-taking is carefully and persistently impressed upon the student. In the early days of this training centre, when classes were comparatively small in number, homework was set each day, and in almost every case was duly returned next morning fully worked out.

With the present fairly large numbers, home-work becomes impossible, and in its stead, test papers are set at fairly frequent intervals and worked out during class hours. The results are then analysed so that the instructors may know to what extent the subject matter of each question has been properly understood and remembered, and procedure arranged accordingly.

The success of work of this description very greatly depends upon the existence or otherwise of proper systems of recording the conduct and progress of each individual man, together with the fullest personal details concerning him; this involves much clerical labour, but the results are fully justified. Each man on being enrolled is handed an official training card, upon which are entered his weekly attendances and progress made, together with other particulars such as disablement and pre-war trade or occupation, &c. In addition to this, a more complete record is taken which provides amongst other points, for closer particulars as to the effects which the man has found to arise from his disablement.

A classification according to disablement is also made so that the man's ability for a given branch of his trade can readily be assessed. Personal notes, as to character, and other desirable points are also provided for. In this way, at the end of his course, the very fullest possible particulars are always at hand, so that the man can be placed out with a firm to the best possible advantage to each party concerned.

In carrying out his practical training in the workshop, each man is required to enter up, day by day, a note as to the work he has accomplished, the time occupied, and the results obtained, and to have it initialled as satisfactory or otherwise by the instructor in charge. The men are also required to take a certain part in looking after stock and materials, and in keeping their own workshops free from disorder.

During training the men are provided with note-books and stationery as necessary for training, and with overalls or shop-coats for their use whilst on duty in the workshops.

The man, having completed his training, and being ready for taking up an appointment, or alternatively continuing his training in a workshop or with a contracting firm, is allowed a grant of tools to a value not exceeding £10, provided he can show a certificate from his employer that such tools are necessary to the purpose. During his training, a portion of these tools may, if thought fit, be granted to him, in order to assist progress.

The work and duties of the Local War Pensions Committees are by no means of a negligible order. It is to his committee that the man is always invited to apply for information or assistance in almost every matter. All such matters as maintenance allowance, pensions, medical treatment, and so forth, common to the case of every disabled man, have to be dealt with by these bodies. The men whilst in training receive maintenance allowance, payable weekly by the local committee, and any cases involving special expenditure necessarily come under its purview.

Fig. 6.—"Are We Down-Hearted?"

A group of disabled men in the lecture-room. A reply to the question:—"Do you not find the men depressed and low-spirited?"

A local Technical Advisory Committee has to be formed to advise upon the more purely technical points which from time to time arise out of training.

The training is regarded by the men as filling a real want and offering them the chances, so richly deserved, of re-education, and a useful career in life. In the majority of cases, a letter of appreciation and thanks, for the training and help given, comes to hand from the man himself within a week or two of his being launched out into employment. None the less valuable are the complimentary letters to hand from the employers themselves. It is in very few cases that a man once having entered for training, withdraws, and such withdrawal commonly stamps him as being unsuitable, although such unsuitability perhaps has not been apparent.

In order that the views of trade unionism may receive appropriate consideration, the schemes of training in engineering subjects which have been drawn up are the result of collaboration between the Ministry of Labour and the Ministry of Pensions. The National Trade Advisory Committee set up conjointly by these departments included representatives of the employers on the one hand and the workpeople on the other, the latter being nominated by the Electrical Trades Union.

With regard to the employers in the engineering trades generally, and in the electrical industry particularly, one feels that they should be very much better advised of what is being done in the way of training than would appear at present to be the case. It is hoped that the present paper may assist in that direction. It is the employer who can, by personal interest in and by constructive criticism of training courses in force, assist in making these more valuable from every point of view.

With regard to the absorption in industry of the trained disabled man, the present time is naturally one of some difficulty, but as conditions become more normal, it is hoped that the true value of the trained man will be justly appreciated.

In this country we issue appeals to employers to "find a job" for the disabled man. In France apparently a Bill has been passed guaranteeing the man compulsorily employment under the threat of special taxation for those who do not comply with this obligation.

The question has been raised as to the employer's position with regard to any increased liability in respect of insurance of the disabled man. My inquiries have elicited the information that any soldier or sailor, even if disabled and whether discharged or not, is included in the policy of insurance without any addition to the ordinary rate of premium for the particular trade concerned.

CORRESPONDENCE.

Letters received by us after* 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The E.P.E.A. Award.

Mr. R. Sidwell sincerely *hopes* that there are not many more undertakings situated similarly to that to which I belong.

May I reciprocate the sentiment, though I know of some? Still, our local committee tells us to *hope*, so we "Hope on, hope ever," dutifully month by month. We still hope; but whether hope will "spring eternal," one hardly knows. Let us hope so, for the sake of our dear friends the chief engineers, the Councils, and, last, but not least, our own executive committee.

Let us hope we never disturb their equanimity by insisting that *we* are going to *act*; and let us hope also that our treasurer will—er, hope for our subscriptions to be paid; our esteemed secretary can also hope that the E.P.E.A.'s shadow will never grow less.

"Nil Desperandum," in to-day's issue (May 2nd) is absolutely right. From our chiefs, boards of directors, and Councils, we shall get nothing unless they *know* and are *shown*, that we can, and will, force justice if there is no other way.

Months and months ago, the "men" asked for certain concessions at the particular station from which I write. The Council told them they simply could not, and would not, grant such terms.

A week later notices for all hands were in, and two days before the notices expired, the *whole* of the men's demands were conceded, with *back money*. We, because we are not "men," are still hoping. In fact, "life's full of hope."

Connaught T. Smith.

May 2nd, 1919.

Telephone and Telegraph Line Construction.

I have read two letters on the above appearing in the Electrical Review for April 18th and 25th, and am somewhat surprised to find that such erroneous ideas regarding the capabilities of the Post Office engineers exist. They are fully aware of the climatic differences between Bermuda and this country, and the sole reason for re-erecting a route broken down by a storm in the same manner is just this there is no better way to rebuild it.

A moment's reflection will show that no comparison can reasonably be made between the lines of a power company and those of the Post Office; economical reasons at once forbid the erection of such heavy structures as are in use by the former for telegraphic or telephonic purposes, even assuming that it were practicable in all other ways.

As long as open wires exist they will more or less be subject to interruptions due to storms; you cannot build economically a route that will not be liable to a breakdown, given a storm of sufficient severity coupled with certain temperature and wind conditions well known to all telegraph engineers. The only remedy is underground cables, and in course of time all main routes will no doubt be equipped with cables.

Still, there will remain many places where open wires must be retained; to double or treble the existing charges, rates, and rentals on the ground that these additional charges are to cover the cost of placing all wires underground in order to avoid storm damage will not find favour with the public, who look at present to a reduction of charges rather than the reverse. Besides, even cables have been known to break down in fine weather, and they are relaid in the same way.

I feel sure that if "G.F.S." has a *suitable* method of constructing open routes which shall combine the qualities of solid construction, freedom from breakdown, storm or other, easy maintenance, electrical efficiency, and especially economical cost, better than the existing methods, which, by the way, are the outcome of many years of hard practical experience, he is sure of a sympathetic hearing from the postal authorities.

I fail to see why Mr. Broadbent should be astonished to find open wires to the coast on the Continental routes. All electrical engineers know the adverse effect that a length of high-capacity cable has on a telegraph, and especially a telephone, circuit. The engineers responsible for the building of these Continental wires merely reduced the capacity of the whole circuit to the lowest figure by running open wires of low capacity as near to the ends of the submarine cables as possible, which at that time was all that could be done to give commercial speech on the circuit. No doubt now, owing to the improvements made in "loading" cables, it would be possible to construct a loaded cable from, say, London to Paris, but considerations of cost must ultimately determine how far this method of construction may be carried out; the cost would be enormous, and the existing rates would hardly be adequate.

May I remark, in conclusion, that all the disadvantages that open lines would be subject to, as pointed out in the last paragraph of Mr. Broadbent's letter, were fully anticipated by the authorities responsible for the safety and efficient working of these circuits; to do them justice, they really have never been to sleep.

Thos. F. Barlow.

Blackburn, *April 28th*, 1919.

Referring to the remarks of "G.F.S." in your issue of April 18th, after any serious accident on a railway or in a mine, suggestions are put forward wholesale by people who have had nothing to do with railway work or mining, giving their ideas as to the best manner of preventing such occurrences. Your correspondent does not give us any information as to how he would prevent the breakdown of telegraph and telephone overhead lines by storms further than the *simple* remedy of putting them up suitably in the first instance.

For his information, I may say that the erection of Post Office wires in this country is not carried out by "rule of thumb," but is based upon engineering principles with definite factors of safety. The mileage of power companies' overhead lines in Great Britain as compared with the telegraph and telephone lines is exceedingly small; there is no comparison between the number of wires required, and, even so, power lines do break down during bad weather at times. It is practically impossible to guarantee any overhead line remaining intact through all conditions of weather, unless the line be built at an absolutely prohibitive cost.

It should be remembered, too, that a large number of the lines now under the maintenance of the Post Office Engineering Department was not erected by them, or to their specification, but was a legacy handed over to them prior to the war. Very great improvements have been carried out since then, and it is scarcely necessary to point out that a large percentage of the Post Office men have been engaged on other duties during the past five years.

I can bear witness to much work that has been done, and I am sure all Post Office engineers would be interested in reading what "G.F.S." would suggest should be put up to make a "suitable line" such as he refers to.

Telegraphs.

Hong-Kong Electric Supply.

In your issue of January 24th you did me the honour to publish a contribution, and I regret to notice either a misprint or a typist's error. On the top line of the second column of p. 92 there appears the statement, "In 1914 the Hong-Kong Electric Co. sold 614,750 units," but for "1914" please read "1904." I have referred to my draft MSS. and find "1904" there, but it is just possible that the copy sent to you was 1914, although I think not; anyhow, I am sorry for the mistake.

May I also add that on p. 117, top of second column, the paragraph: "But the management has been very unenterprising" is no reflection upon the British engineers at Canton who were the servants of the local company. The real difficulty was due—and probably still is due—to the Chinese who formed the "management."

My attention is also drawn to a misprint on p. 62, which reads, "the local quotation to-day in Hong-Kong is more than $120" (one hundred and twenty dollars); the figure in my MSS is $1,020 (one thousand and twenty dollars), which is the correct figure.

I am particularly sorry that any mistake occurred in connection with the Hong-Kong Electric Co., Ltd., because during the last three or four years all of the officials connected with it have had a time of great worry and anxiety, which I feel sure will be lessened when their splendid new power station is at work in a few months' time. But I should like to take this opportunity to congratulate them all, especially Mr. Frank Graham, the manager, upon maintaining the supply in spite of great difficulties. They have given the Chinese of South China an excellent example of the good work invariably done by British electrical engineers.

The above mistakes were due to the impossibility of sending proofs to the author, but I hope that these explanations will remove any false impressions created by them.

C. A. Middleton Smith,
Taikoo Professor of Engineering.
University of Hong-Kong.

Hong-Kong, *March 25th*, 1919.

Crompton-Burgin Dynamos.

We are desirous of obtaining a specimen of a Crompton-Burgin generator, which type was last manufactured at these works in about 1886, and until a few years ago many of them were known to be still in operation. We have so far failed to secure one of these machines, and shall be very glad if you can assist us by inserting this letter in the next issue of your journal, in the hope that it may catch the eye of someone who owns a Burgin machine, or knows where one is installed. It is probable that a number of these machines have been scrapped during the war, and it would be a pity if at least a few of them, which are now historic, could not be saved from a similar fate.

Crompton & Co., Ltd.

Chelmsford, *May 2nd*, 1919.

Fault Localising.

I am pleased to note that two correspondents have kindly remarked upon my error regarding the Murray loop test. Although I was aware that the leads had an effect on the accuracy of the test, I was more concerned at that time with reducing the test to a simple formula than troubling over the percentage error introduced. While I agree with your correspondents, that their method of handling the difficulty (as far as home-made sets are concerned) is quite a good idea, as it is practically equivalent to connecting the cable under test direct to the bridge, yet it has not been my experience to run up against an instrument maker's bridge that is minus a few divisions at either end of the scale. I would suggest to your correspondents that makers usually overcome the difficulty by constructing the ratio arms of a high resistance in comparison with the resistance of the connecting leads.

Thus correcting for resistance of leads the usual formula—

$$x = \mathrm{L}\, a/l \text{ becomes } x = \mathrm{L}\,(a + y) / (l + 2y)$$

where y = resistance of one lead.

Taking an actual case where the resistance of bridge = 20 ohms and resistance of lead $y = .01$ ohm, then taking Mr. Underwood's figures or $a/b = 2$, that is, a = one-third of the scale, the error represents 0.05 per cent. (approximate). In this case at 1/100 of the scale the error becomes 5 per cent., but I see no reason why the resistance of the ratio arms could not be considerably higher than the 20 ohms mentioned, in which case the percentage error along the whole scale would be brought within reasonable limits.

Of course the obvious remedy, when one knows that difficulty is experienced in localising a fault near the testing point, is to retest at the opposite end of the faulty line, where the fault will lie on the accurate position of the scale. While I am aware that home-made Murray loop sets are used with some success, I hardly think they bear comparison with instrument designers' types, for compactness and reliability, and makers that have specialised in Murray loop sets have overcome the difficulty connected with the lead resistance, without reducing the length of the scale.

H. Bujama.

London, N.W., *May 3rd*, 1919.

Trouble with Magnetos.

Your correspondent "Sparx" raises a point of interest which has often been discussed during the war. Extensive experimental work has been carried out with a view to determining the effect of different ignition systems on the power developed by internal-combustion engines, and as a result of these, I can assure your correspondent that there is no magic whatever in the name "Bosch."

A definite minimum voltage is required to cause a regular succession of sparks to pass across the electrodes of a plug in a cylinder containing an explosive gas at a given pressure and temperature, and the necessary qualification in a magneto is that it shall be capable of generating this voltage with certainty on the opening of the primary circuit, and at any speed at which it may be required to run.

In all good magnetos the secondary voltage, if permitted to do so, would rise far above this minimum figure, but in practice it does not do so, because when it reaches the breakdown voltage of the plug gap a discharge takes place, preventing the voltage from continuing to rise. If the plug is disconnected, the discharge then passes across the safety gap in the magneto itself.

A magneto required to ignite a high-compression engine should be capable of giving a regular succession of sparks across a 5.5-mm. 3-point gap or a ring gap consisting of a 1½-mm. rod through a 7½-mm. hole, in either case in air at atmospheric pressure and normal temperature. The regularity can best be tested on a M.L. rotating gap.

Any magnetos that can satisfy the above conditions will ignite any known lorry engine, and enable it to develop its full power. There are many makes of British-made magnetos which can do so as well as a "Bosch."

The trouble in your correspondent's case is probably due to one of the following causes:—

Sparking or incorrect setting of the contact-breaker.

Flashing-over or brush discharge at the safety gap or some internal point.

Leakage in the distributor, possibly due to carbon tracking.

Improper setting of the plug electrodes.

Defects in the wiring.

It would be interesting to see the diagram of connections of the dual system referred to, as possibly a leakage path may have been introduced when changing the magnetos owing to different terminal arrangements.

Alan Williams.

London, W.C., *May 5th*, 1919.

Searchlight Equipment and Operation.

I am obliged to Mr. Chapman for drawing my attention to what was, perhaps, a somewhat misleading phrase in my article on this subject. It is, of course, a fact that a small divergence is always present in a searchlight beam, and is in fact necessary, but this is, as Mr. Chapman mentions, only about 3 per cent., and it is usual in practice to include in the term "parallel" a beam having only this small and necessary divergence. The concentric rings do not, of course, cut off these very slightly diverging rays, but only the more widely diverging "cone of light" to which my remarks were really intended to refer. That this cone includes direct rays (from the negative carbon) is also true, but there is in addition a certain amount of reflection from the interior of the barrel, since some of the rays thrown on to the mirror are sufficiently divergent to strike that surface.

Hugh M. Goody.

London, S.W., *May 3rd*, 1919.

LEGAL.

Tramway Passenger's Claim Unsuccessful.

At the Leeds County Court, last week, Isaac Atkinson, a North-Eastern railway goods guard, claimed damages from the Leeds Corporation for injury received from a tramway trolley head, weighing over 7 lb., which came off on a car on which he was a passenger and struck him on the head. He was away from work for five weeks.

Mr. Clifford Bowling, for the plaintiff, contended there was negligence by the car being driven too quickly round a bend, and also that the trolley head was defective.

Joseph Bromley, assistant works superintendent at the tramway depot, produced the driver's report book, in which it was stated that two days before the accident the driver of the car had asked that the trolley head should be examined.

Joseph Lister said the night before the accident the trolley was examined and a new wheel put in, and the trolley was then in good order.

His Honour Judge Parfitt observed that there was no evidence that the car was driven at excessive speed. In view of Lister's evidence it was impossible to find that the defendants had been guilty of negligence. It should be publicly known that tramways were under no greater obligation to use reasonable care in the manipulation of their system than if it belonged to an individual. In his judgment the defendants had complied with the law that reasonable care must be taken to maintain the system in a condition of safety. The owners, whether a Corporation or private individuals, in no circumstances insured or guaranteed the perfect safety of the persons they carried; all they undertook to do was to use reasonable care. Judgment was given for defendants, but as plaintiff had sustained serious injury, the judgment was given without costs. The Corporation was exonerated from any sort of negligence.

Phelps v. Metropolitan Electric Supply Co., Ltd.

A claim for discount on electric energy supplied to four shops at High Holborn came before Mr. Justice Rowlatt in the King's Bench Division, on April 30th. The plaintiff was Mr. Thomas Phelps, of Northington, Overton, Hants., and the action was brought against the Metropolitan Electric Supply Co., Ltd. The claim was based on an agreement in writing dated October 31st, 1902, and was for a sum equivalent to a discount or allowance of 2d. per Board of Trade unit on the rate of charge made by the defendants for all electric energy supplied to and consumed on the premises owned by the plaintiff in High Holborn, and also for an account of all electric energy supplied to and consumed on the premises from October 31st, 1902, to March 25th, 1918, and of the charges made by the defendants, and of the amount due to the plaintiff.

Mr. Rigby Swift, K.C., and Mr. C. E. Jones were for the plaintiff, and Mr. Barrington Ward, K.C., appeared on behalf of the defendants.

Mr. Phelps is the owner of extensive premises in Southampton Row and High Holborn, and his case was it was agreed on October 31st, 1902, that in consideration of his undertaking the responsibility for the payment for the whole of the electric energy supplied to the premises for a period of three years, a discount of 2d. per Board of Trade unit should be allowed, and the agreement was by mutual assent continued between the parties until March 25th, 1918. Throughout the period payment for the whole of the electric energy had been made by the plaintiff, or his tenants, but it was alleged with regard to the premises owned by the plaintiff in High Holborn that the defendants had not allowed the agreed or any discount in respect of the energy or current.

The defendants pleaded that the agreement applied only to the premises to which electric energy was supplied upon the responsibility of the plaintiff. They said that the plaintiff never undertook to be responsible for payment of the electric energy supplied to the premises in High Holborn, the electric energy being supplied to those premises under separate contracts with the tenants.

Evidence was submitted in support of the plaintiff's case, and evidence was then given for the defence that the shops belonging to the plaintiff in High Holborn were not included in the arrangement.

Mr. Barrington Ward, for the Metropolitan Electric Supply Co., Ltd., addressed his lordship, and pointed out that this was not an action for damages. It was an action for an account, and what his friend who represented the plaintiff had got to show was that these particular premises were included in the agreement of 1902.

His Lordship; Your point is this: that this document came into existence as an engagement by this gentleman to take electricity for the whole of his premises, and to pay for it, and to get discount on it, but as regards the four shops, although they were covered, they were only covered in a reversionary sense, because there were other people on the books.

Mr. Barrington Ward: With rights.

Proceeding, counsel asked his lordship to say that the plaintiff had not made out his case.

Mr. Rigby Swift, in reply, said in 1899, when Mr. Phelps made the original agreement, there was not a single shop which was under any agreement as to the taking of electric light. Each one of the shops might have gone to the Metropolitan Electric Supply Co., or to any other electric supply company. They were under no obligation to Mr. Phelps; they were under no obligation to the Metropolitan Co. When the Metropolitan Co. entered into their agreement with Mr. Phelps, and when he undertook to be responsible for the whole of the electric light which was to be brought on to his premises, he said that he was not going to have anything to do with the shops at the present time, but he expected if they supplied the shops, they would give him discount. They did not answer his letter; they went on bargaining with the shopkeepers as to supplying the shopkeepers with electricity. In May, 1902, he reminded them he had never had any answer. There was an interview, and it was said Mr. Phelps was told the company could not give him the shops in the contract, because they had agreements with the shopkeepers. Then the time came when there were some more buildings to be added, and when the old agreement was running out. In October, 1902, he insisted on having the shops, and the shops were then expressly included in the agreement. In the document it was deliberately stated that the supply was to be to all the premises of Mr. Phelps in High Holborn and Southampton Row where electrical energy was used. Counsel pointed out that the plaintiff had lost 12 years of the money which he otherwise would have had, because he did not bring his action twelve years ago, but he asked his lordship to say that the plaintiff was entitled to have the money for the last six years, and that amounted to £345 19s. If his friend who represented the defendants did not agree that that was the right figure, then he asked his lordship for an account in order that the right figure might be ascertained.

Mr. Justice Rowlatt said that the question was whether the plaintiff was entitled, and except so far as the Statute of Limitations interfered with him, had been entitled ever since 1902, to an allowance in the shape of discount or commission or rebate on the electric lighting bills of four shops in this building which he erected in 1899. When the building was first put up, there was an agreement which took the form of a request by Mr. Phelps to the defendants to supply the electric energy. The scheme of the document was that Mr. Phelps was the customer and the company were the suppliers. As a matter of fact, the real thing was that Mr. Phelps's tenants were the actual customers, and Mr. Phelps was the guarantor, that he collected their contributions and handed them in, and for that he got a commission. From that agreement all the shops were excluded. One could very well see that the company would be glad to deal with the shops direct. Mr. Phelps wanted the benefit of the discount and wrote a letter to the defendants. The defendants did not answer that letter, but they set to work to negotiate with the shops, and they got an agreement with the shops. He (the Judge) thought they might as well have written to Mr. Phelps. In 1902 the matter came up again, and another agreement was made in October, 1902, and that agreement was worded in a rather curious way. All exclusion of the shops disappeared. The document referred obviously to the whole of the premises. It was contended on behalf of the defendants that there was another consumer *de facto* on the books at the time with regard to the shops, and the document while applying to the whole of the premises, still had only a reversionary effect as regards the shops, because they were outstanding, and the immediate operation of the agreement was suspended as regards the shops. He had come to the conclusion that that was right, and that the defendants succeeded. It seemed to him that must be what the agreement meant on the facts of the case, and that view was confirmed by the fact that this claim was never raised for 16 years. In the circumstances, he should dismiss the action without costs.

Stobie *v.* Newcastle-upon-Tyne Electric Supply Co., Ltd.

In the Chancery Division, on Wednesday, April 30th, Mr. Justice Peterson had before him a dispute between Mr. Victor Stobie, steel manufacturer, of Sheffield, and the Newcastle-upon-Tyne Electric Supply Co., Ltd.

Mr. Upjohn, K.C., and Mr. J. G. Ward appeared for the plaintiff, and Mr, Frank Russell, K.C., Mr. Tomlin, K.C., and Mr. Livingston were for the defendant company.

Mr. Upjohn said that the point for the decision of the Court was whether or not upon the construction of certain agreements the defendant company was entitled to a share in the profits of Mr. Stobie's business and a certain control over that business. In 1913 Mr. Stobie, who was carrying on business in Sheffield as a steel manufacturer. had got a process of manufacturing steel in electrical furnaces, and was desirous of starting this business at Dunston, in Durham. For that purpose he wished to obtain land upon which to erect his buildings and plant. The defendant company had works at Dunston, and a surplus area of two acres where they were not working. This they leased to the plaintiff for a period of 15 years. The defendant company agreed to erect buildings for the plaintiff at his expense, the amount to be repaid with interest in five annual instalments. It was admitted that all these instalments had been paid. The next step was to get his plant. For that purpose an arrangement was made with the Industrial Plant Co., Ltd., which was guaranteed by the defendant company at a cost of £9,000 on the hire purchase system. That the Plant Co. had been fully paid by Mr. Stobie was admitted. The next thing they wanted was the electric current, and this was obtained from the County of Durham Electric Supply Co., which was a subsidiary company of the defendant company. Their accounts were also paid as they became due. Then working capital was required to provide which Mr. Stobie put in £2,400 and the defendant company agreed to provide £7,000 as it was wanted, which was to be repaid by instalments of principal and interest. As more money was wanted further advances were made, and here again it was admitted that every penny had been repaid by Mr. Stobie. In this state of things the defendant company claimed that they were entitled to a rent of £100 a year for the hire of the plant which Mr. Stobie had bought and paid for, a share in the profits of the business, and certain control over the business to secure payment of those profits. The case for Mr. Stobie was that every penny advanced having been paid off with interest he was entitled to the benefits of the business, free from any claim by the defendant company.

Counsel after having read the agreements between the parties. contended that they could not possibly mean that the defendant company was entitled to a share of profits in respect of the working capital or other advances which had been paid off. In the alternative, he submitted that the contracts were unconscionable, and should be set aside.

Mr. Tomlin, replying for the defendants, said that the real question was whether Mr. Stobie could get out of a bargain into which he had deliberately entered. The negotiations between the parties occupied over three years before the agreements in dispute were signed. Mr. Stobie had invented a new furnace for the production of steel with which he was anxious to experiment, but he had not got the money to do it. It was under these circumstances that he approached the defendant company. It was a speculative undertaking on their part, with the knowledge that if it failed nothing could be recovered from Mr. Stobie. On the construction of the documents counsel asked his lordship to say that the agreement with regard to profit sharing, &c., did not expire until the end of the lease, and that in the circumstances this was a perfectly fair and proper working arrangement.

His Lordship, after hearing argument as to the construction of the agreements between the parties, held that notwithstanding the fact that the moneys advanced by the defendant company had been repaid, the company was entitled to a share of the profits of the plaintiff's business for the term of the lease (15 years), and to a rent of £100 a year in respect of the plant.

The action was accordingly dismissed with costs, and the counterclaim of the defendants allowed.

Workmen's Compensation Case.

At Rugby County Court, last week, the case of F. H. Petch, labourer, whose hand was crushed in an accident, was brought forward. The particulars of claim stated that there was no written agreement or award, but weekly payments of £1 5s had been made to the workman from the date of the accident. In the filed statement the B.T.H. Co. alleged that Petch had neglected or refused to continue proper medical treatment, that he had for some time past been capable of doing light work but had failed or neglected to obtain suitable employment. Respondent held that no benefit could be derived from continuing the medical treatment, that the condition of his injured hand rendered it entirely useless for work, and that no suitable work had been offered to him.

Mr. Willes, appearing for the B.T.H. Co., said that after application was made to diminish or terminate payments it was agreed that a lump sum of £115, with reasonable costs, would be a perfectly fair and adequate assessment of the workman's claim, but payments had been continued because it was felt by the employers to be fair.

In view of the agreement His Honour consented to the withdrawal of the application.

Atlantic Cable Lease.

In the Chancery Division before Mr. Justice Eve on May 2nd the Direct United States Cable Co., Ltd., moved for an injunction to restrain the Western Union Telegraph Co., Ltd., from giving, or acting upon, a notice purporting to determine a lease of a submarine cable between America and this country, which cable was leased by the plaintiffs in 1912 to the defendants for a long period at £58,500 per annum. The lease required plaintiffs to repair any breaks within a specified period, otherwise defendants could give notice to determine the lease. Owing to war conditions, however, a break which occurred in September, 1917, could not be repaired within the specified 18 months, and in March this year a summons was taken out by the plaintiffs claiming relief under the Courts (Emergency Powers) Act against defendants exercising their rights. The matter was reported at some length in the *Times* for May 3rd. The judge ultimately allowed the case to stand over on the defendants giving an undertaking that any notice to be served determining the agreement should not prejudice the rights of the plaintiffs under the Courts (Emergency Powers) Act, also that the notice of April 25th, 1919, given by the defendants determining the agreement should be suspended without prejudice to any question until the trial of the action.

Meharey *v.* Belfast Corporation.

On April 28th, in the Belfast Police Court, R. Meharey (trading as Porter Bros.) summoned the Belfast Corporation for failure to supply him with electricity for the use of motors on his premises from January 27th till February 15th, 1919, during the strike. Plaintiff's loss was estimated at £1,000, but he did not claim that sum. Evidence was given by the Town Clerk, the electrical engineer (Mr. Bloxham), and the Lord Mayor, as to the arrangements made with a view to maintaining the supply while the strike was in progress. For the Corporation it was stated that if plaintiff was successful the Corporation would be victimised by innumerable transactions, and there would be no end of it. The fault of the failure did not lie with the Corporation, but with the Strike Committee. It was submitted that the whole summons was misconceived and failed, and should be dismissed. For the plaintiff it was stated that there was no evidence of any attempt being made to get over the difficulty when the Corporation first received notice of the strike, and that all through the strike the Corporation were more or less passive. The Court will give its decision on May 12th.

Industrial Re-organisation.—The Executive Committe of the National Alliance of Employers and Employed, which consists of representatives of employers and trade unions, has had under consideration the proposals of the National Industrial Conference, and, as a result of its deliberations, has issued an agreed statement. The conclusions arrived at are summarised as follows:—

1. The acceptance of the proposals of the National Industrial Conference.
2. The importance of the necessary legislative action being taken by the Government without delay to give effect to the recommendations of the Conference.
3. The principle that the workers should have a direct share in the control and direction of industry on the understanding that there is to be full co-operation for industrial development.
4. The principle of annual holidays for all regular workers —the period and the financial provisions to be arranged according to the circumstances of each industry.
5. The desirability of supplementing joint organisation which is purely industrial in character by a system of Joint Area Boards on the lines indicated in the full statement.
6. The necessity for speeding up all machinery for negotiation and for decentralising the work of negotiation as far as possible.

BUSINESS NOTES.

Catalogues Wanted at Athens.—H.M. Consul-General at Athens reports that a catalogue library is being formed in connection with the Air Department of the Ministry of Marine, and that they would be glad to receive catalogues from British manufacturers. In the case of any catalogue of goods not used by the Air Department, it will be transmitted to the Ministry of the Greek Government, which may be more immediately concerned. Catalogues should be sent direct to Commander J. Weston, British Naval Mission, Director of Technical and Equipment Section, Royal Hellenic Naval Air Service, Ministry of Marine, Athens.—*Board of Trade Journal.*

Metallurgical Coke, Iron, Steel and Ironstone Orders.—The Ministry of Munitions has suspended as from May 1st the operation of the following orders:—

Steel Supplies (Metallurgical Coke, Iron, and Steel) Order, 1916.
Steel Supplies (Steel Hexagons, Rounds, and Squares) Amendment No. 1 Order, 1916.
Control of Steel Supplies Order, 1916.
Control of Steel Supplies (Steel Rods and Wire) Order, 1917.
Steel Supplies (Steel Scrap) Amendment No. 3 Order, 1917.
Steel Supplies (Metallurgical Coke) Amendment No. 4 Order, 1917.
Steel Supplies (Steel Plates, &c.) Amendment No. 5 Order, 1917.
Control of Steel Supplies (Amendment) Order, 1917.
Iron and Steel Scrap Disposal Order, 1918.
Cast Iron Scrap Order, 1918.

Contract Conditions at Sydney.—The Sydney, N.S.W., Municipal Council has decided that with regard to the question of the amendment by tenderers of general conditions and specifications on which tenders have been invited, by covering letter or otherwise, in future it be laid down that a tenderer must not submit additional conditions at the time of tendering, or deduct from or alter any of the conditions of tendering; and that the existing conditions of tendering, which allows such amendments, be altered by reverting to the clause dealing with this matter, as set out in the conditions in use previous to the adoption of the existing conditions, such clause providing: "The specification and general conditions having been approved of by Council will not be departed from in any particular, and any tender sent in must accept the same unconditionally. If any tender shall be made subject to any modification, addition, or alteration, such tender will not be considered in any way, and will be rejected."

Over-Zealous German Agents in Holland.—The Dutch newspapers are full of advertisements of German firms, in which all sorts of offers are made for the sale and purchase of goods, offers which, as a correspondent of the *Frankfurter Ztg.* says, are mere empty promises and by no means calculated to increase Dutch confidence in Germany's economic stability. The correspondent advises German merchants to take a leaf out of England's book and keep quiet for the present, until a favourable moment occurs in which to put their goods on the market.—*Frankfurter Ztg.*, March 21st.

British Manufacturers in Canada.—According to the *Times*, a Canadian Association of British Manufacturers has been established, with branches at Toronto and Montreal.

Alien Immigration.—The Minister of Labour states that, under Article 22b of the Aliens Restriction Order, "no employer may take steps to obtain the services of any alien resident abroad without the permission of the Minister of Labour, and subject to such conditions as the Minister may impose; and one of the general principles which govern the administration of the Order is that no alien should be admitted into the United Kingdom for the purpose of performing services for which suitable labour is available in this country."

Dinner-Hour Entertainments.—At the B.T.H. Rugby Works Canteen during the dinner-hour there are daily entertainments, arranged by Mr. G. A. Maley. These include vocal and instrumental solos, band pieces, &c.

Reconstruction.—No. 23 of the Ministry of Reconstruction series of grey pamphlets contains a survey of Public Health matters.

Excess Profits Duty.—The decision of the Chancellor of the Exchequer, announced in his Budget speech last week, to reduce the Excess Profits Duty to 40 per cent., has been received with great satisfaction by all interested in the stability and development of British industry. The National Union of Manufacturers thinks, however, that in certain cases the standard should have been raised, and the Committee of the Union has decided to press for time to be given in which to pay the duty by instalments. Further, it is considered that as many businesses could employ the money usefully for necessary extensions of their operations, firms should be allowed to keep their excess profits as a loan for repayment over a period of years.

Work Conditions in Birmingham.—A statement has been made by several of the Trade Unions in Birmingham as to the condition of unemployment. Regarding electrical workers, the Electrical Trades Union reports that there are very few of the members now claiming on the out-of-work funds, for private work, which has necessarily been at a standstill during the war, such as installations in business premises and shops that were being refitted, is now brisk.

Exports to the Left Bank of the Rhine.—No import permits, military or otherwise, are now required in connection with imports into the occupied area on the left bank of the Rhine.

Catalogues and Lists.—Messrs. Petters, Ltd., Yeovil, and Vickers-Petters, Ltd.. Ipswich.—This combination of interests, of which some particulars have already been given here, has its general sales office for London and export at 73. Queen Victoria Street, London, E.C. 4. It has issued an illustrated circular (four pages) giving descriptive particulars and weights, &c., of Petter semi-Diesel oil engines, and details and prices of the Petter semi-portable Junior oil engine.

The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C.—Folder giving table of prices, voltages, cap type, &c., of Osram Atmos type lamps.

Entertaining the Demobilised at Birmingham.—The male employés of the Birmingham Electric Supply Department number 750, and of these 233 joined the Forces. About 130 have been demobilised, and on Thursday last week they were entertained to dinner and welcomed on their return to the Corporation's service. Mr. R. A. Chattock, city electrical engineer, presided, and supporting him were the Lord Mayor (Sir David Brooks), Ald. Jephcott, M.P, (until recently chairman of the Electric Supply Committee), and Mr. Burman (Committee chairman). Mr. Chattock stated that 29 members of the Electrical Department had lost their lives, and it was proposed to provide a suitable memorial.

Birmingham Industrial Fair.—The official prospectus has now been issued of the British Industries Fair (Birmingham), which is to be held in Birmingham from February 23rd to March 5th. It is under the official organisation of the municipality and the Chamber of Commerce of the city, and has the approval and support of the Board of Trade. It is proposed that every available building in the city shall be utilised, and, if necessary, a series of kiosks and exhibition stands will be erected in the squares and main streets. The classification brings electric light fittings and other such devices. also cooking and heating appliances, into Class A (Group 1). Other classes and groups include hardware, tools. instruments, tools, belting, small machine tools, motor cycles. and motor-car accessories, &c. The primary objects of the Fair are the maintenance and extension of British trade and the capture of foreign markets. Communications respecting space and other matters should be addressed to the General Manager, at the Chamber of Commerce, New Street, Birmingham.

South American Trade Commissioner.—The Federation of British Industries Overseas Trades Committee has appointed Mr. J. McKellan as its Commissioner for the East Coast of South America. The Commissionership for the first year will cost £5,000.

French Company.—La Société Union Française d'Electrioité (U.F.E.) is the name of a new company which has lately been formed in Paris. with a capital of £40,000.

Catalogues Wanted.—The Central Electric Co., Triangle, Yeovil, invite manufacturers to send their catalogues or latest lists. Other requests for catalogues appear in "Trade Announcements" and in "Personal" column.

Association of Electric Lamp Manufacturers.—In the report published in our "Business Notices" last week (p. 503), of the registration as a limited liability company of the Electric Lamp Manufacturers' Association of Great Britain, the name of Mr. C. E. Hunter, managing director of the Edison Swan Electric Co., Ltd., should have appeared as a member of the Council of Management.

Trade Announcements.—The International Electric Co., Ltd.. have transferred their works and offices to their new factory at Ashley Road. Tottenham. N. 17, where all communications should be sent. 'Phone No. : "Tottenham 132."

The Foster Engineering Co., Ltd., of Wimbledon, ask us to state that their agents (Messrs. Hall, Scott & Co., of 9, Linenhall Street, Belfast) ceased to represent them on May 1st.

Mr. Arthur G. Foulds having become a partner in the firm of Hamilton Bros., 187, St. Vincent Street, Glasgow, the name of the firm has been changed to Hamilton, Foulds & Co. (incorporating Hamilton Bros.). The business will be continued as heretofore at the same address. In view of the increasing demand for their "W.H." direct-current motor starters, which have now been on the market for 15 years, they have taken over new premises at 23, Douglas Street, Glasgow.

The B.E. Co. (of London and Birmingham), Ltd., have removed their London offices and stores to Hendon House. 57. Upper Thames Street, London, E.C. 4. New telephone No. : "City 4047."

Mr. Herbert Senior has commenced business as an electrical engineer at Littlemoor Road, Mirfield, Yorks.

The Institute of Cost Accountants. Ltd. (by guarantee), has removed to 17, Victoria Street, London. S.W. Telephone : "Victoria 530."

The Thanet Electric Co., Ltd., has been registered to carry on business as electrical engineers and suppliers of electrical materials at 262, Northdown Road, Margate. Mr. Chas. Lill, who has recently relinquished his Commission in the R.A.F., has been appointed engineer and manager, and he invites the trade generally to forward latest catalogues, prices, &c.

The Cray Laboratory, Sugar House Lane, Southampton, have made arrangements to establish an Electrical Contracting Department, under the management of Capt. J. Young, A.M.I.E.E. (late R.E. and R.A.F.). Manufacturers and agents are invited to forward catalogues dealing with lighting, heating and power equipment for houses, works. marine craft and motor-cars.

Mr. H. A. Pearson, A.M.I E.E., who represents Messrs. Allen West & Co., Ltd., and the Reason Manufacturing Co., Ltd., in London and the South of England, has changed his address from 139, Fenchurch Street, E.C., to No. 10, Bush Lane, Cannon Street, E.C. 4, where his telephone number is "City 7493."

Rathenau on Communism.—Writing in the *Times* on Tuesday, on the attitude of the Germans in Berlin to-day. "Viator" says :—"Such men as Hugo Stinnes, the coal magnate, also Dr. Walter Rathenau, of the A.E.G., have already offered their establishments to the Communists on the promise of personal immunity for themselves and families. These men argue that after a few months of Communism they will be called back to take charge as the only men capable of managing affairs, and that they will come back on their own terms."

Electrical Wages at Southampton.—According to the *Daily Herald*, electricians at Southampton intend making a big effort to bring their rate of wages up to the same standard as that of the electricians throughout the United Kingdom, and also to obtain "dirty money" for ship repairs. Wages are about 6s. a week lower than in other ports, apart from the absence of "dirty money."

Wages Regulation.—In the House of Commons, on Monday, the Wages (Temporary Regulation) Extension Bill was read a second time. It provides for an extension for six months of the wages regulation provisions which, passed in November last, come to an end on May 21st. Wages will therefore be stabilised until November 21st next. Sir R. Horne. in introducing the measure, said that the Government was thus carrying out the suggestion of the leading employers and employed. Nothing dislocated industry so much as uncertainty. It was important that the great industries should know where they were. and that wages must continue on the present basis in figuring out their new contracts.

Dissolutions and Liquidations.—A. Vernon Ward (Consolidated), Ltd.—Winding up voluntarily. Liquidator. Mr. G. Gradon, 15, 16 and 17, Eldon Street, E.C.

Baxter Manufacturing Co.. merchants of electric lamps and electric lighting accessories, 23, King Street. Manchester.—Mr. M. Wilson and Mr. M. Hacker have dissolved partnership.

A. A. Carpenter, electrical engineers, 4 and 5, Masons Avenue, London, E.C.—Mr. C. A. Carpenter, Mr. E. Chown. and Mr. J. G. Beirri have dissolved partnership so far as regards Mr. E. Chown.

Geo. Schultz & Co., Ltd., 10, Arthur Street. London.—Winding up voluntarily. Mr. W. A. Scott, 50, Cannon Street, E.C., liquidator. Meeting of creditors. May 9th.

Book Notices.—The Library Press announces for publication shortly a new "Universal Wages Calculator," for the use of all trades where wages are paid by the hour.

"Jane's Pocket Aeronautical Dictionary." 64 pp. + 4 figs. London : Sampson Low, Marston & Co. Price 1s. 6d.

Messrs. Siemens in Australia.—According to the *Industrial Australian and Mining Standard*, the Sydney Municipal Council has now reversed its decision of October 22nd. 1918, and has placed Messrs. Siemens Bros. on its list of tenderers. Their tenders will now receive the same consideration as offers from other British firms.

Bankruptcy Proceedings.—*Re* L. A. Thomson (trading as Saville & Walton), late of 59, Victoria Street, Westminster, electrical engineer.—The application of this bankrupt for an order of discharge, was again before Mr. Registrar Mellor. at the London Bankruptcy Court on May 6th. He failed in November, 1915, with ranking liabilities £2,922, and assets that have realised £6. Mr. J. B. Knight, Official Receiver. reported that the application stood adjourned to give the bankrupt an opportunity to make an offer for the benefit of the creditors. A letter had been received offering to submit to a judgment for £40, and enclosing £20 on account, the balance to be lodged on or before June 8th. His Honour further adjourned the hearing until June 17th to enable the balance to be lodged in Court.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for May 6th.

LIGHTING AND POWER NOTES.

Aberayron (Cardiganshire).—Proposed E.L. Scheme.—It is proposed that the U.D.C. should adopt an E.L. scheme and utilise the water power available for generating electricity.

Accrington.—Proposed New Plant.—The electrical engineer has been instructed to report as to the desirability of establishing a new sub-station and laying down additional high-tension cables to cope with the present and prospective supply of electricity to the Church area.

Ascot.—Price Increase.—Under sanction from the B. of T., the Gas and Electricity Co. has advanced the price of electricity to 9d. per unit. as from the reading of meters at Lady Day.

Batley.—Cable Extensions.—In 1915 the L.G.B. sanctioned the borrowing by the T.C. of £4,118 for cable extensions in the Healey, Staincliffe, and Halifax Road districts, and application is now being made to the Board for permission to proceed with the works without further delay.

Blackburn.—New Generating Station.—The T.C. has approved a resolution to borrow £250,000 for the erection of a new generating station at Whitebirk. It was intimated that the Blackburn undertaking would form part of the Government electrical scheme, and that the new station would be erected to coincide with that scheme. It was mentioned by one member that the Government proposed to establish an extensive generating station near the docks at Preston.

Burnley.—Proposed New Works.—The Electricity Committee has been in communication with one of the leading consulting engineers with a view to preparing a scheme for submission to the L.G.B. to obtain power for the erection of new works to cope with the rapidly increasing demands.

Continental.—Norway.—The local authorities of South Trondhjem are to consider a Bill for the distribution of electricity in the country. It is proposed to build hydro-electric works costing in all £2,800,000 to be completed in four years. The country will be divided into six districts, each having its own power station.

Spain.—A concession has recently been granted to the Sociedad Electrica Aguera to put down plant to utilise the water power of the River Chirla at Guriezo (Province of Santander), for the generation of electricity for lighting and power purposes.

Cork.—Price Increase.—The Cork Harbour Board has been notified by the Cork Electric Tramways and Lighting Co. of its intention to increase the price of electricity for power purposes by 15 per cent. This is the third increase since the outbreak of war.

Dorking.—Minimum Charges.—The U.D.C. has passed a resolution protesting against Messrs. Edmundson putting in force the minimum prices Act for electricity, under which the minimum payment per quarter is to be 13s. 4d.

Dundee.—Extensions.—The electrical engineer has issued a report regarding the proposed extensions for which the Secretary for Scotland is to be asked to grant borrowing powers. It is proposed to install in the present turbine house two 5,000-kw. turbo-alternators to run at a speed of 3,000 r.p.m., with condensers and auxiliary plant. Additional steam boilers will also be required. Owing to the exigencies of the war, no extensions were allowed to the existing system except a certain necessary amount of cable work, with the result that the margin of reserve, particularly of boiler plant, had been seriously encroached upon. The demands show no signs of abating. The present scheme will only meet the immediate requirements of the district. It is felt that there are good grounds for considering the possible water-power schemes in connection with Dundee if the Government could assist during the earlier stages.

Dublin.—May-Day Stoppage.—On a complete stoppage of work in this area on May 1st, in celebration of Labour Day, the Corporation power station at the Pigeon House ran as on Sundays, so that no electric power supply was available for carrying on industries, but electricity for household and street lighting was supplied. The tramway system was suspended for the day.

Ealing.—Fire.—A fire occurred early on Friday morning, last week, at the electricity department's generating station at Dean Gardens. Part of the plant had become ignited owing to overheating, but the fire was quickly suppressed.

Folkestone.—Proposed Price Increase.—At a meeting of the T.C., a letter from the Folkestone Electricity Co. was read regarding its intention to increase the price of electricity from 7d. to 8d. per unit, and stating that if the Council still withheld its sanction it would have to take steps to enforce its decision. The town clerk explained that there was a contract between the Council and the company that the latter should not be allowed to charge more than 7d. per unit.

Fuel Control.—The whole question of the control of coal is being investigated by the B. of T. The Coal Controller is considering the modification of fuel control, so far as electricity and gas supplies are concerned. It is expected that the control will be continued for at least another year, but on July 1st certain modification in regard to gas, electric heating, and coal will be introduced.

The present Order expires in June next.

The B. of T. notifies that it does not now consider it necessary to limit the discretion of local authorities in regard to the consumption of gas and electricity for public lighting.

Halifax.—Yorks. Centre I.M.E.A.—The Electricity Sub-Committee has consented to the electrical engineer acting as secretary and treasurer to the Yorks. Centre I.M.E.A.

New Cables.—The B.C. is recommended to authorise the expenditure of £4,604 for about 1,620 yards of d.c. feeder cable and pilot cable from the Electricity Works to Heath Junction. The Sub-Committee has authorised mains extensions, costing £255, including one to Salterhebble U.M. Chapel, subject to agreements as to part payments.

Loan Application.—The Committee has decided to apply to the L.G.B. for sanction to borrow £3.000 for electric motors, £3.000 for transformers, and £10,000 for mains.

Hatfield.—Proposed E.L. Supply.—The R.D.C. has ascertained that in the district only nine persons and firms out of 44, have written to desire a supply of electricity for power and lighting. The Council has decided to forward particulars to the North Metropolitan E.L. Co., who had been asked to extend their mains to the district.

Hastings.—Proposed Loan.—The T.C. has applied for a loan of £13,719 for new work in connection with the E.L. undertaking, and £5,000 for mains.

Heywood.—Year's Working.—The Corporation Electricity Committee reports a loss for the past year of £290, as against a loss of £741 the previous year.

Huddersfield.—Wages.—The following negotiations between the Corporation Wages Committee and representatives of the workmen of the electricity and gas departments, it was agreed that double time for Sunday work, instead of the existing time and a half, should be paid as from April 1st until such time as a national award is made, the men agreeing to accept such award when it is made.

Keighley.—Loan Application.—The T.C. has approved the Electricity Committee's proposal to apply to the L.G.B. for power to borrow £72,773 to meet expenditure already incurred (£39 773), and estimated to be required during the next two years (£33,000), in the electricity department. It was stated that the Committee had at present applications for additional power amounting to 1,600 h.p., and, on the present load, four of the five boilers are kept steaming at full capacity. It was recommended that an additional water-tube boiler be installed, capable of evaporating 35.000 lb. per hour, and that certain extensions and alterations to the buildings be made.

Kidderminster.—Power Supply.—In reply to the criticisms passed at a meeting of the local Chamber of Commerce as to the shortage and unreliability of the electric power in the borough, the Shropshire, Worcestershire, and Staffordshire Electric Power Co. has informed the Chamber that the company was dismantling turbine plant and boilers of large capacity for immediate transference to the Kidderminster power station, and everything was being done to expedite the work and give to the borough largely increased power.

Lancaster.—Proposed New Plant.—A deputation has been appointed to report on the production of electricity with up-to-date plant, and, if necessary, to inspect plant at other towns. There is also a suggestion regarding the production of electricity from the River Lune.

Llandyssil (Cardiganshire).—Proposed E.L. Supply.—It is reported that Mr. Isaac Thomas has acquired property in the town with a view to the establishment of E.L. works.

Leicester.—New Plant.—The Tramways and Electricity Committee has recommended the T.C. to erect a transformer house containing two 1,000-kw. rotary converters, at an estimated cost of £18,000. The tender of Messrs. Dick, Kerr & Co. for the plant was accepted in February last.

London.—Stepney.—Loan.—The Finance Committee reports having received a reference from the Electric Supply Committee upon the question of taking up loans for refunding money expended by consumers during the war for connecting their premises to the Council's mains. The Electric Supply Committee states that up to date £3,800 has been expended on house services, and £2,250 on meters, &c., and in order to provide capital for the future, recommends the Council to take up a loan of £10,000 in respect of house services, and £7,500 for meters. The Finance Committee recommends that application be made to the L.C.C. for sanction to borrow the above amounts.

Ludlow.—Prov. Order.—The R.D.C. has received an intimation from the gas company that the company intended to make an application under the Electric Lighting Act for an order to supply electricity to Craven Arms.

Nelson.—Year's Working.—There was a loss of £1,147 on the electricity undertaking, attributed to the increased cost of material and labour, restrictions on lighting, and the running of the light railways. There was a profit on the tramways of £705.

New Zealand.—Hydro-Electric Scheme.—New Plymouth B.C. proposes to borrow £40,000 for hydro-electric extensions.

The Waingawa Meat Co. estimates its firing costs at £17,000 per annum, plus the cost of handling and storage of 8,000 tons of coal, of which 5,000 tons is used for electric power purposes, costing £10,625 per annum. It is considered that by utilising the water power of the district that the cost would be eventually reduced by one half or less when the whole of Wairapapa was connected up.

E.L. Scheme.—The engineer (Mr. G. T. Wilson) has recommended an a.c. supply for the whole of the Hamilton, Claudelands, Hamilton East, and Frankston, N.Z., as this would place the electrical undertaking on a sound basis when the hydro-electric scheme eventuated. He considered that by going into the matter now the Council would hasten the Hora Hora scheme being made available for local bodies.—*Tenders.*

Peterborough.—Expert Advice.—The T.C. has decided to obtain expert advice on the suggested development of the electricity works, which proposes capital expenditure of £100,000 or more.

Proposed Extensions.—A report has been presented by Mr. T. Rowland, the acting city engineer, in which he questions whether it is worth while expending large sums on the present plant. He considers the time is ripe for remodelling the generating plant and providing H.T. transmission. The expenditure may amount to £100,000 or more.

Ripon.—Prov. Order.—The City Council has adopted the E.L. Committee's recommendation to apply for a prov. order for the supply of electricity next September.

Rochdale.—Bulk Supply.—The Town Council has approved the agreements for the supply of electricity in bulk to the Committee to meet the big demands. At the Town Council meeting last week, Alderman Walker referred to the recent decision to apply for sanction to borrow £68,500 for the electricity undertaking, and outlined the scheme. The output of the works, after 18 years' working, had reached an approximate total of 16 million units per year. It was expected that the output for the D.R. Cotton Mills in the next two years would alone exceed 20 million units, and a still further increase by other firms of 7 million units was expected. With such large demands the Committee had considered the extension of the present station, but it could not recommend that course, whilst the erection of a new power station would involve capital expenditure of £400,000, and could not be completed in time. It had, therefore, decided in favour of a bulk supply from an adjoining authority. Oldham and Bury Corporations were asked to submit estimates, and later the Lancashire Electric Power Co., and the Manchester Corporation. Manchester would not be able to supply for some 2½ years, and the Corporation had accepted the tender of the Lancashire Power Co. The terms were very reasonable, and would not handicap local consumers. The Power Co. would be responsible for all expenditure on plant, mains, &c., outside the Rochdale boundary, expenditure in the borough being incurred by the Corporation. It was mainly this for which the loan was required, and the L.G.B. had intimated that an inquiry might not be necessary. The agreement with the Power Co. would be for 10 years, and it would contain clauses to cover any increase or decrease in the cost of labour. The Corporation's offer to the D.R. Mills had been accepted, and it was also for a period of 10 years. The Committee would be prepared to consider the question of the renewal of the contract at the end of six years. The D.R. Mills Co. would require the full load of 8,000 KW. by about July, 1920.

Shanghai.—New Plant.—The municipality is endeavouring to get the two 2,000-KW. A.E.G. turbo-alternators, which have given considerable trouble in the past, repaired in Japan, after which they will be used as stand-bys. Another 18,000-KW. G.E.C. unit has been ordered, and four boilers, each of 80,000 lb. per hour capacity, are to be ordered. It is expected that the capacity of the plant will reach 103,000 KW. by 1924.

South Wales.—Threatened Strike.—The stokers at the South Wales Electric Distribution Co.'s power station at Treforest claim to come under the Sankey Award, and threatened to strike on Monday unless the claim is granted by the company.—*S.W. Daily News.*

Stoke-on-Trent.—National Electricity Supply.—It has been decided to oppose the Walsall Corporation (Extension of Electricity Powers) Bill, which seeks powers to supply electrical energy in the Cannock and other areas.

Extensions.—Five tenders for building extensions at the central power house were considered by the E.S. Committee, and that of Mr. T. Godwin, amounting to £13,059, was accepted and a contract entered into. The tender of the Stirling Boiler Co., Ltd., amounting to £29,000, has been accepted, and the necessary contract entered into for the extension of three water-tube boilers.

Street Lighting.—Following a report by the borough surveyor on the percentage of pre-war lighting now reinstated in the borough, it was recommended that the 50 per cent. basis for street lighting be not exceeded at the present time, except in the case of lighting by electricity.

Wallasey.—L.G.B. Application.—The Electricity Committee has decided to recommend that application be made to the L.G.B. for sanction to borrow £11,300 for the extension of the electricity station, including mains required during the next three years.

Watford.—Loan Sanction.—The U.D.C. has received sanction for loans amounting to £19,550 for E.L. purposes.

York.—Loan Sanction.—The T.C. has obtained sanction for loans of £10,685 for mains and £4,315 for services, sub-station, and transformers.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—New Track.—A new form of tramway track was submitted to a town meeting last week in connection with a Bill being promoted in Parliament. Rails carried on a sleeper track are proposed as a feature of great ring roads which are being designed as part of the town planning schemes. The track will occupy the middle of the thoroughfare, but it will be higher than the rest of the roadway and have appointed crossing places. The scheme was approved.

Blackpool.—Additional Tramcars.—The Tramways Committee has decided to purchase six second-hand tramcars from the London United Tramways Co.

Bradford. — Permanentway Reconstruction. — The Tramways Committee is putting in hand, at once, certain reconstruction of lines and roadways, and is also resuming work in connection with the extension of the Thornbury depôt, held up during the war, so as to help to provide work for the unemployed.

Bury.—Year's Working.—It was reported to the T.C. that on the Bury sections of the tramways there had been a profit of £8,277 during the past year, and on the Radcliffe sections a profit of about £500. Wages during the year had increased by £10,168. The gross traffic receipts showed an increase of £20,300.

Bacup Corporation is to send a deputation to the L. & Y. Railway Co., pressing for better railway facilities for the town. Electrification of the line to Bacup and a better service are chiefly desired. The company is also to be asked to establish a service of circular trips for motor tramways between Bury, Bacup, and Rochdale.

Continental.—Portugal.—The daily Press reports that the strike of the electric tramway employés still continues.

Glasgow.—Maintenance and Renewals.— A Special Committee of the T.C. has recommended that work in connection with the maintenance of the tramway track and cars be proceeded with as fast as possible, but that further extensions be delayed until repairs on the existing lines are completed. The Committee has also recommended that one mile of single track be treated with the rail-hardening process *in situ* by Messrs. Scholey & Co.

Golcar.—Proposed Motor-'Bus and Tramway Service.—The U.D.C. has decided that negotiations be re-opened with the Daimler Co., Ltd., the Yorkshire (Woollen District) Electric Tramways Co., Clayton & Co., Ltd., Messrs. Tilling, Stevens, Thorneycroft and Co., Ltd., and the Huddersfield Corporation respecting the provision of motor-'buses and tramways for the district.

Halifax.—Tramcar Tires. — The tramway engineer has been authorised to purchase 25 tramcar tires from John Brown & Co., Ltd., Sheffield, at the price of £45 per ton, and a similar number at the same price from Brown, Bayley's Steel Works, Ltd., Sheffield.

Depôt Extension. — The tramways engineer has been instructed to prepare plans and estimates required for the extension of the Skircoat tramway depôt.

Haslingden.—Bulk Supply.—As the result of a conference between the Accrington, Rawtenstall, and Haslingden T.C.'s regarding the supply of electricity in bulk to the latter authority, satisfactory terms have been arranged.

Hull.—Wages. —The Tramways Committee has acceded to the request of the car depôt nightmen engaged on general repairs and maintenance that their working hours be considered, and that they be placed on the same footing as the men doing the same class of work during the day—*i.e.*, 47 hours per week, with extra pay for overtime—and that any overtime worked since January 1st last, when the alteration was made to the hours of the day men, should be paid for.

Lanarkshire.—Strike.—Developments are announced by the daily Press in connection with the tramway employés' strike in Lanarkshire now entering upon its third week. The Miners' Union has called upon all miners in the county to abstain from using the cars, and representations are to be made to the B. of T., and to the local authorities to take over the system as a going concern. The Miners' Executive has been guaranteed substantial backing in its appeal to the B. of T. The tramway company is endeavouring to maintain the service with imported labour. It has 20 cars on the system, and claims that all routes are being served. The "blacklegs" complain that housing accommodation cannot be found, and that landladies decline to give lodgings to imported labour. The company's solicitors have published an advertisement offering a reward of £10 to those who furnish information of specific threats by Union officials, or others, to the new employés of the company.

Leeds.—Conductresses.—Tramway conductresses have now all been replaced by demobilised soldiers. Since 1916 1,500 girls have been employed in this capacity, and as cleaners and armature winders.

London.—Traffic Congestion.—London Members of Parliament are taking up the whole question of traffic in London—tubes, tramways, and 'buses—and also the question of fares. The view is taken that the present acute congestion is a passing phase, but the need of greater facilities for dealing with a big permanent increase in traffic is regarded as imperative. The construction of more underground railways will, it is understood, be urged.

At a meeting on Monday last, Mr. F. Pick, representing the electric railways and motor-'bus services, delivered a statement regarding the profits and expenses of the undertakings during the war, the reasons why the fares had been increased, and the arrangements that were being made to improve transportation facilities. The meeting afterwards adopted a resolution calling on the Government to appoint a Select Committee to consider what could be done to relieve the congestion of traffic. Mr. Pick stated that between 1914 and 1918 the traffic increased by 92 million passengers a year; owing to the decreased number of omnibuses available, the railways carried 152 million passengers more in 1918 than in 1914—an increase of 69 per cent. The traffic of London had increased abnormally during the war. The tube railways had been unable to renew their rolling stock, and the number of cars available had diminished. The company had works in hand that would cost £3,650,000; the cost of one mile of tube railway, fully equipped, was £1,000,000. It had built up a reserve fund of £1,904,000 to replace the existing fleet of 'buses, the average life of an omnibus being five years; the normal cost would be £1,000 per 'bus. The average dividend paid on all the company's stock was 3·64 per cent. At present 40 trains per hour were run on the District Railway—the maximum possible. The total number of passengers carried in 1918 was 901 millions. The fares on the railways have been raised by 33⅓ per cent. during the past six years.

Increased Train Facilities.—From Monday last the District Railway was to have resumed running through trains between Ealing, Acton Town, and Southend.

Commencing Monday last the Metropolitan train service on the Willesden, Harrow, and Uxbridge lines was to have been increased between 10 a.m. and 4 p.m.

Increased train facilities will also be provided on the District Railway on Sundays to Kew Gardens and Richmond.

On the Hampstead line there will be a five-minute service between Charing Cross and Golders Green, and Charing Cross and Highgate, between 10 a.m. and 1 p.m. This will provide a 2½-minute service between Charing Cross and Camden Town.

On the Bakerloo the quarter-hourly service between the Elephant and Castle and Watford will be reinstated. Additional theatre trains will be run.

Stepney.—The Finance Committee reported that the resolution containing the Council's consent to the proposed extension of the L.C.C. tramways to Aldgate Station and the Council's recommendation that an extension of the tramways down Mansell Street to the Tower Hill area, returning by way of the Minories, had been received by the County Council, and in reply it was intimated that the suggestion would receive careful consideration in connection with the preparation of further tramway proposals.

Burdett Road Electrification.—An informal conference with the L.C.C. was held recently on the condition of the carriageway in the Burdett Road and the question of electrification from West India Docks to Cassland Road. As a result, the L.C.C. intimates that that the Highways Committee of the L.C.C. considers that any proposal for electrifying this route must provide for the overhead system, which has already been agreed upon by neighbouring B.C.'s, and inquiring if the local Council would now be prepared to agree to the use of this system, and pointing out that the Council had since June 24th, 1903, consistently refused to sanction the use of the overhead system. After further consideration, the Works Committee of the B.C. recommended that the L.C.C. be informed that the Council does not see its way to the use of the overhead system on the portion of the route in question.

Owing to the high tide in the Thames, on Sunday night, at Kew Bridge, the North London Railway line, which is in a cutting below the level of the river, was flooded for about an hour. The electricity had to be cut off, and the Acton and Kew trains could only just reach the London end of the platform.

Newcastle-upon-Tyne.—Year's Working.—The report for the year ended March 31st, 1918, shows that the revenue amounted to £418,028, compared with £356,534, the traffic revenues having been £409,114 and £346,334 respectively. Working expenses had gone up from £203,299 to £248,394, and the gross profit was £169,634, against £148,235. The balance left in the reserve and renewals fund was £155,251, against £105,894.

Street Accidents.—Last year, according to Home Office figures issued last week, 262 people were killed and 7,294 injured in tramway street accidents in the British Isles. For London the figures were 57 killed and 2,817 injured.

The Transport Bill.—Omnibus Routes.—In the House of Commons Committee on the Transport Bill, on Tuesday, an amendment was agreed to, providing that where a licensing authority refused to grant a licence for a new omnibus route or imposed conditions, the applicant should have the right of appeal to the Ministry of Ways and Communications, which should have power to make an order.

TELEGRAPH AND TELEPHONE NOTES.

Aerograms.—In a lecture, on April 30th, before the Industrial Reconstruction Council, on "The Aeroplane in Industrial Development," Mr. Holt Thomas gave some details of a projected scheme of communication which combined the telephone or telegraph with the aeroplane. Messages sent by the system would be described as aerograms. The general idea was to telephone or telegraph a message to the aerodrome, where it would be taken down in shorthand, carried, say, to France in a plane, and forwarded there to its destination. Such a system would be invaluable for dealing with long Press cables. A message of 3,000 words between Paris and London could be delivered by aeroplane long before it had got across the cable. Moreover, the aeroplane would probably be carrying millions of words and other things as well at the same time. The economy in labour by the use of such a method would be enormous. The public would have to pay for speed in the aerial mail.—*The Times.*

Australia.—Mr. E. T. Fisk, managing director of Amalgamated Wireless (Australasia), Ltd., in the course of a statement concerning the offer made by the Marconi Co. to establish a direct wireless service between Great Britain and Australia, stated that the cost of erecting the necessary high-power stations in England and Australia would probably amount to something like £100,000, and the Marconi Co. was prepared, at its own expense and risk, to do that. The company did not ask for any monopoly of trans-oceanic wireless communication, and its proposals consisted merely of an offer to provide valuable service and to send and receive messages at the outset for one-third less than the existing cable rates. The only concession asked for by the company was that its terminal wireless station should be connected with the inland telegraph system, so that the messages could be promptly dispatched over the Post Office lines to and from all parts of Australia, and that the necessary permission be given to erect a station. The company undertook to hand over the station, if required, immediately upon the outbreak of war.

Cable Delays.—Cable conditions are seriously affecting British commerce in the Far East, says the *Times.* Ordinary telegrams are taking from 10 to 14 days to reach their destinations, and the privilege of being able to send urgent messages operates only from China, and not from Britain. Meanwhile cables to America are getting through in two days—ironically enough, *via* Australia and Canada.

Duplex Wireless.—Mr. E. F. W. Alexanderson, of the General Electric Co., Schenectady, N.Y., on April 2nd, delivered a highly important technical paper before the Institute of Radio Engineers, New York, describing interesting results relative to duplex radio telegraph and radio telephone operation, together with highly selective and stray-reducing receivers. The title of the paper is "Simultaneous Sending and Receiving."—*T. and T. Age.*

Japan.—An exchange to connect wireless and wire telephones was established in Kobe, Japan, at the beginning of the year by the Government Department of Communications, states *Wireless Age.* A wireless tower, 180 ft. high, is now being erected in front of the largest of the Kobe telephone exchanges. Wireless telephone messages from vessels within 100 miles of the South Japan port will be connected by central operators with the telephones of subscribers in Kobe, Osake, Kyoto, and neighbouring cities, thus serving the most densely populated section in Japan.

London-Paris Wires.—Preparatory to the calling of the Peace Conference, the British Government laid 10 private telephone lines between Paris and London, including cables under the Channel, not touching the system owned by the French Government at any point. All wires and cables are covered with lead, preventing tapping.—*Telephone Engineer.*

New Zealand.—Press and telegraph censoring ceased as from May 2nd.

Snowstorm Damage.—Interesting figures regarding snowstorm damage to telephone lines in the South Lancashire district on January 4th, are given in the *P.O. Electrical Engineers' Journal.* Manchester telephone district comprises 39 exchange areas, including trunk and local lines. The overhead mileages are:—Main lines, 9,172; local lines, 22,639 miles. Trunk routes nearly all carry between 50 and 60 wires; many local routes carry over 100 wires, and some over 150. The snow froze on the wires as it fell, to an estimated diameter of 2 in., and some of the heavy lines were entirely wrecked. There are about 25,500 exchange lines and external extensions in the district. Of these, 12,849 were listed as faulty on January 6th, and on March 15th the number had increased to 25,637. By the latter date, 22 688 faults had been cleared, leaving a balance of 2,949 outstanding. The maximum listed at one time was 14,782. At one time there were over 5,700 subscribers' line faults in the Manchester City area, also 250 junction faults, and 1,500 of the 2,000 private wires were interrupted. On the evening of January 11th, the Manchester Corporation power mains broke down, and burned through two cables carrying about 500 subscribers' lines. The list of damage was as follows:—Number of poles broken, 120; down, 150; deflected, 4,954. Roof standards damaged, 3; stays broken or down, 6,632. Length of wire to be re-erected, 8,700; regulated, 7,900 miles. With the exception of slight damage in the Lymm Exchange area, the whole of the Liverpool telephone exchange area escaped.

The Telegraph and Telephone Services.—At the annual dinner of the Newspaper Society on Tuesday last, the Postmaster-General stated that additional underground cables were to be laid for both telegraphs and telephones, and between six and seven millions would be spent this year on the improvement of the services. The number of Government telegrams dealt with had increased from 44,000 in February, 1914, to 875,000 in February, 1919, and private messages had increased by 10 per cent.

The Postmaster-General stated in the House of Commons that the numbers of Government telegrams in the first quarters of the years 1914, 1918, and 1919, were 145,856, 2,624,599, and 2,687,807 respectively.

The Postmaster-General is to be asked if he can arrange for the carriage of telegrams to Paris by the ordinary daily train, by which they would reach Paris in 10 hours, and might be delivered at once without the delay of two, three, and even four days which takes place now when they are telegraphed over by wire.

U.S. Cables.—Mr. Burleson, Postmaster-General, announced, on April 29th, that the cables which the Government took over shortly after the armistice was signed would be returned to their owners not later than May 10th. Telegraph and telephone wires would be returned to their owners "as soon as legislation could be obtained from Congress safeguarding the interests of owners."

A powerful new wireless equipment, the nature of which is a secret, was used on the recent trial flights of American seaplanes preparatory to the trans-Atlantic flight, says *The Times*.

Wireless telephones are to be used by the fire patrols in the national forests of the United States.

Wireless Weather.—An Admiralty notice to mariners in the *London Gazette* gives particulars regarding the system of collecting meteorological data from vessels at sea in all parts of the world, by wireless telegraphy, by means of which it is hoped that accurate forecasting of the weather will be greatly facilitated. Endeavours are being made to secure international agreement on methods of procedure; in the meantime the British Meteorological Office is developing the scheme.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Australia.—BRISBANE.—June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.) from the offices of the company at Brisbane.—*Tenders.*

SYDNEY.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

June 23rd.—Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department. Town Hall, Sydney.

London.—L.C.C.—May 12th. 5,000 driving-wheel tires, and 3,500 trailing-wheel tires for electric tramways. General Manager. L.C.C. Tramways, 23, Belvedere Road, Lambeth, S.E.

LAMBETH.—May 20th. B. of G. One electrically-driven hydro-extractor. Boardroom, Brook Street, Kennington Road, S.E.

Manchester.—May 21st. Electricity Committee. Wet air filter for the Stuart Street station. (May 2nd.)

Natal.—May 20th. Corporation. 12 miles steel girder rails (95 lb. per yd.) with fishplates, bolts and nuts, and 4,300 tie bars, and 1,500 copper rail bonds and 300 cross bonds. Webster. Steel & Co., Agents to the Durban Corporation, 5, East India Avenue, E.C.

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Australia.—P.M.G.'s Department, Victoria :—

Telephone accessories, £2,137.—Western Electric Co. (Aust.), Ltd.

Department of the Navy—

Underground cables and accessories at Flinders naval base, £6,650.—W. T. Henley's Telegraph Works Co., Ltd.
Insulators, &c., £307.—Australian Porcelain Co. (Pty.), Ltd.
Electrical materials, £115.—Lawrence & Hanson Electrical Co., Ltd.
Cables, £531.—Noyes Bros. (Melbourne) (Pty.), Ltd., £1,491.—B. I. and Helsby Cables, Ltd.

SYDNEY.—City Council—

H.T. cables, £12,716.—B. I. & Helsby Cables, Ltd.—*Tenders.*

Chorley.—B. of G. The Liverpool Electrical Engineering Co., £2,235, for the lighting scheme at the Institution.

Halifax.—Electricity Sub-Committee. Chloride Electrical Storage Co., Ltd. Battery for the ashes vehicle at the electricity works, £236.

London.—HACKNEY.—Electricity Committee. Recommended :—

Replacement of economiser, £1,185.—E. Green & Sons, Ltd.

Sub-station switchgear :—

Johnson & Phillips, Ltd.	(recommended)	**£7,183**
B.T.H. Co., Ltd.		8,120
A. Reyrolle & Co., Ltd.		8,125
Ferguson & Pailin, Ltd.		8,548
British Westinghouse E. & M. Co., Ltd.		8,766

STEPNEY.—B.C. Maintenance of storage battery at Whitechapel sub-station; renewal of contract for a period of 10 years. The Tudor Accumulator Co. asked that the rate of consideration should be revised from £34 per annum to £44 per annum, the Council. in addition, paying at the end of each half-year a further sum of 6s. 6d. for every £1 by which the average price of lead exceeds £15 per ton, should the mean daily quotation of foreign lead in the Public Ledger exceed that amount; this is intended to provide for variations in the price of lead. The Council has decided to enter into a new agreement on the terms proposed.

Coal-handling plant for Limehouse station—

E. Bennis & Co., Ltd.	(not including tackle and labour)	£738
Goodall, Clayton & Co.		997
New Conveyor Co., Ltd.	(accepted)	**761**
Babcock & Wilcox, Ltd.		1,448

Lamp standards—

12 standards for street lighting, £135.—British Mannesmann Tube Co., Ltd.

The Electricity Committee has accepted the following offers for coal for the electricity works :—

E. Foster & Co.—1,010 tons nutty slack, at 29s. 4d. per ton; 3,000 tons of West Cannock n.s. nuts, at 33s. 1d. per ton; 2,000 tons 2-in. nutty slack, at 27s. 7d. per ton.
A. Blackmore & Co.—150 tons Granville Derbyshire 1½-in. nutty slack, at 29s. 6d. per ton.

HAMMERSMITH.—Annual contracts. Recommended :—

Electrical goods.—General Electric Co., Ltd.
Insulated wires (flexible cord).—Macintosh Cable Co., Ltd.
Copper fuse wire.—B. I. & Helsby Cables, Ltd.
Meters.—Electrical Apparatus Co., Ltd.
Insulating compound.—Dussek Bitumen Co.

250 yd. L.T. concentric cable—

Pirelli-General Cable Works, Ltd.	(recommended)	**£118**
Western Electric Co., Ltd.		132
Callender's Cable and Construction Co., Ltd.		138
British Insulated & Helsby Cables		138 10

W. T. Henley's Telegraph Works Co., £980 per mile, £189 per length.

Additional boiler-house plant. Structural steelwork—

Measures Bros. (1911), Ltd.	(recommended)	**£434**
H. Young & Co., Ltd.		536
Aston Construction Co., Ltd.		587
Foster Construction Co.		605

Safety Tread Syndicate, Ltd. (total sum not quoted).

Morecambe.—T.C. Tanks and water cooler for the electricity department. Mr. Gardner, £270.

Salford.—Electricity Committee :—

One 300-K.V.A., three-phase transformer, £460; one E.H.T. oil-switch cubicle, £278.—British Westinghouse E. & M. Co., Ltd.
Renewal of economiser, £1,270.—E. Green & Son, Ltd.

Having regard to increased labour costs due to Government awards the Council is recommended to agree to the payment of £250 to the British Westinghouse E. & M. Co., Ltd., as compensation for increased expenditure in the manufacture of plant recently supplied to the electricity department for £7,341.

Stoke-on-Trent.—B.C. Accepted :—

Extension of three water-tube boilers, £29,000.—Stirling Boiler Co., Ltd.

York.—T.C. Tramway curves. Hadfields, Ltd., £1,648.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 9th. At 7.30 p.m. At 39, Victoria Street, S.W. Lecturette on "Pneumatic Tires as Applied to Road Vehicles, and their Automatic Inflation," by Mr. R. Barnfather, junr.

Friday, May 16th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Notched Bar Tests," by Major H. P. Philpot.

Royal Institution of Great Britain.—Saturday, May 10th. At 3 p.m. At Albemarle Street, W. Lecture on "Chapters in the Psychology of Industry; Modern Industrial Organisation, where it fails to observe the Humanities of Industry, and the Result," by Prof. H. S. Foxwell.

National Foremen's Association, Engineering, Shipbuilding and Allied Trades (West London Branch).—Saturday, May 10th. At 6.30 p.m. At the Norfolk Arms Hotel, Burwood Place, Edgware Road, W. Ordinary meeting.

Industrial Reconstruction Council.—Tuesday, May 13th. At 5.30 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Costing in Relation to Scientific Management," to be opened by Mr. J. H. Boyd (Director of Costs and Efficiency Methods, Ministry of Munitions).

Wednesday, May 14th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture on "The Economic Limits of Nationalisation," by Brig.-General Cockerill, C.B., M.P.

Royal Automobile Club.—Wednesday, May 14th. At 8.15 p.m. At Pall Mall, S.W. Paper on "Electric Vehicles," by Mr. F. Ayton, Hon. Secretary of the Electric Vehicle Committee of Great Britain.

Royal Society of Arts.—Wednesday, May 14th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "Railway Transport in the United Kingdom," by Mr. H. Kelway-Bamber.

Institution of Electrical Engineers.—Monday, May 12th. At 7.30 p.m. At the Chartered Institute of Patent Agents. Informal meeting; discussion on "The Regulations Issued by Electricity Supply Undertakings," introduced by Mr. W. E. Bradshaw.

Wednesday, May 14th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "Wireless in the Royal Air Service," by Major J. Erskine-Murray, R.A.F.

Thursday, May 15th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Telephone Service of Large Cities, with special reference to London," by Mr. E. A. Laidlaw and Mr. W. H. Grinsted.

(North-Eastern Centre).—Monday, May 12th. At 6.45 p.m. At the Mining Institute, Newcastle. Annual general meeting and lecture on "Dielectrics in Electric Fields," by Mr. G. L. Addenbrooke.

(North-Midland Centre).—Tuesday. May 13th. At 7 p.m. At the Metropole, King Street, Leeds. Annual general meeting, and discussion on "The President's Address to the Territorial Centres."

THE ELECTRICAL TRADES BENEVOLENT INSTITUTION.

FURTHER contributions received in response to the appeal made by Mr. Hunter, the chairman, are as follow :—

H. A. Burge	£0 10 6	F. W. Maine	£1 0 0
Waste Heat & Gas Co.	15 0 0	H. Greenwood	10
T. Bolton & Co.	1 1 0	H. C. Wellden	10

NOTES.

The Hopkinson Chair of Thermodynamics.—For the Bertram and Cecil Hopkinson Memorial Trust Fund, Mrs. John Hopkinson has offered £2,000 towards the endowment of another chair connected with the School of Engineering in order to carry on the work so brilliantly developed by her son, Colonel Bertram Hopkinson, C.M.G., Professor of Mechanism and Applied Mechanics, who lost his life while flying last August. The professorship is to be called the Hopkinson Chair of Thermodynamics. A further sum of £1.000 is offered by Mr. George A. Wills, £500 by Mr. Melville Wills, and £250 by Mr. Stanley Wills.—*The Times.*

Paris May-Day Celebrations.—Serious disturbances took place at Paris during the celebration of May Day, resulting in considerable casualties. The Metropolitan and Nord-Sud Railways, as well as the tramways, stopped running, and the electric generating stations closed down at 7 in the morning. Certain employés in the electrical and gas works ceased work for 24 hours, and shift workers stopped work for two consecutive hours on each shift. At least one lightless interval occurred during the hours of darkness. Telephone operators stopped work for half an hour at ten and again at five in the evening.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Thursday evening last week, Dr C. Chree, F.R.S., delivered an interesting lecture on "Magnetic Storms," before the Institution. The lecture opened with a statement regarding the title, which sounded rather ambitious. It was not meant to be so, it had been chosen to differentiate between natural and artificial storms. Disturbances set up by tramways and electric railways were sometimes worthy of being called storms. The first part of the lecture dealt with records taken in the U.K., and the second half with records taken all over the world, including some taken by the Scott Expedition in the Antarctic. A large number of slides were shown, the lecturer giving a most interesting explanation of how and why records taken in different parts of the world differed. Certain similarities in some of the records were also explained. The lecturer laid stress upon the importance of selecting suitable instruments according to which stations they were to work in. It was sometimes assumed that an instrument could be moved from one station to another, and give equally good results at both places, but that was by no means the case. An instrument that would not be quite sensitive enough, say, in Europe, if taken to the Antarctic might be so sensitive that the recording needle would sweep off both edges of the chart, and most of the record would be lost. Interesting magnetograph charts taken simultaneously, but in different parts of the world, were shown on the screen, the manner in which they differed being explained.

The times of day or night at which magnetic storms occurred most frequently and of the greatest intensity were discussed. Until recently they could say very little about those times with certainty, but some important work had been carried out lately in connection with the Institute of Mining Engineers. This point was of particular interest to surveyors, as it was essential to know the exact magnetic conditions during a period of time in which a survey was being carried out. A day or night might be practically free from disturbances when taken on the whole, yet during that day or night quite violent disturbances might occur, lasting perhaps only a few seconds, which would introduce serious errors into calculations if not allowed for. Generally magnetic storms were more frequent and violent during the night, and this point should be remembered, as it was general practice in observatories to take records at night. It was also shown that identical disturbances might occur for several days in succession, then disappear, and reoccur later exactly as before.

With regard to the criticism levelled against Kew Observatory, the lecturer said that excellent work had been done there, and it was essential to keep magnetographs running there in spite of all drawbacks. He, personally, was not alarmed by the artificial disturbances which were said to affect Kew; if the whole facts were considered, other stations might not prove to be as free from disturbance as they were generally thought to be. In his opinion, Eskdalemuir station in Scotland was by no means ideal, it had many drawbacks, and was subject to more disturbances than was apparent. If the whole of the facts which they now knew had been taken into account, he thought they would never have gone to Scotland for such a station. The point that did really trouble him was whether they had not exaggerated the external interference at Kew in the past. It had been assumed that the instruments at Kew were similar to others of the same type used elsewhere. It was now found that in reality they were about 30 per cent. more sensitive, and this point would very probably account for the large number of records taken in the past, which were supposed to be seriously affected by external influences.

In conclusion, the lecturer stated that much important work had recently been carried out, and when the examination of certain records from other parts of the world had been completed, very interesting facts would become available.

An interesting discussion on the electric furnace took place at the inaugural meeting of the Sheffield Sub-Centre of the Institution which was held on April 29th. The Institution has recently adopted the plan of sub dividing its organisation, and the advantages of this method were explained to the meeting by the President (Mr. C. H. Wordingham). The excellent attendance at the meeting was an augury for the success of the new sub-centre. Mr. R. H. Campion, of Dewsbury, presided. Four papers were presented: "The Booth-Hall Electric Furnace," by Mr. W. K. Booth; "Electric Furnaces in the United Kingdom, 1918," by Mr. R. G. Mercer, of the Ministry of Munitions; "A New Type of Electric Furnace," by Mr. A. Sahlin; and "Large Electric Steel-Melting Furnaces" by Mr. Victor Stobie. Mr. S. E. Fedden (general manager of the Sheffield Corporation electricity department), gave an interesting *résumé* of the growth of the use of electric furnaces in Sheffield. In 1902, pig and scrap iron were made into steel on a commercial basis. The man from Sheffield, however, took some time before he would even try the experiment. In 1914 they put in one furnace; in 1915, three (one of which was the first war furnace); in 1916, 11 furnaces, taking 13,000 KW.; in 1917, 18 furnaces, taking 14,000 KW.; and in 1918, seven furnaces; altogether they connected up, in a very short period, furnaces taking an output of no less than 35,400 KW. They had the ordinary load in addition. They obtained from the Ministry a permit to put down a special telephone system, and got in connection with all the furnaces. This arrangement was of very great assistance, and enabled them to take on more furnaces than they really ought to have done. Mr. Fedden analysed some figures of output given in Mr. Mercer's paper, arriving at the conclusion that the steel manufacturers' load-factor was only 15 per cent. He said if they asked anybody else what they ought to pay, for a 15 per cent. load-factor, they would be given a figure of 3d. to 3½d. Yet the Sheffield Corporation, at which they were always shouting on the score of high prices, had been giving it them for 0·6d., and practically losing 3d. a unit, for the benefit of steel-making in Sheffield. Mr. Ernest Wells, of Edgar Allen & Co., said that when he went to the Ministry of Munitions electric furnaces were very much over-rated. The output of good steel castings from the electric furnace until quite late in the war was negligible. However, his own firm had confidence in electric furnaces. Mr. Travis (Sheffield) took exception to Mr. Wells's statement. He said he thought all manufacturers resented Mr. Wells's action at the Ministry. The fact was that people who had stock converters or other methods of making castings in their works, and who installed electric furnaces, had shut down their other plant and carried on the electric furnaces, which proved conclusively that the electric furnace gave them the result they required at the lowest cost. The very fact that Messrs. Edgar Allen & Co. had installed two electric furnaces, which he understood were ordered just before the Armistice, showed their belief in the furnace which Mr. Wells attempted to damn to everyone else. Mr. Howard (Sheffield Corporation) expressed the opinion that in many of the older furnaces the voltage was far too low. It ought to be increased by 25 per cent. This would lead to a considerable reduction in cost.

At last week's meeting, the president (Mr. C. H. Wordingham) read a letter from Mr. J. J. Fahie, M.I.E.E., offering to present the Institution with a number of books, documents, and articles, some of which dated back a considerable number of years, and which were of considerable interest to engineers. The Council had that afternoon considered the offer, which had been gratefully accepted.

Rontgen Society.—An X-ray photograph of the interior of the carburetter of an aeroplane engine, showing a block in the petrol feed, was one of many interesting exhibits, on April 29th, when a joint meeting of the Röntgen and Faraday Societies discussed radio-metallography. It is now possible to take photographs through 2 in. of hard steel, and to detect flaws in castings and new alloys. A difference in thickness of a 200th part of an inch is revealed in a steel casting 2 in. or 3 in. in thickness by X-ray photography. Prof. Bragg, F.R.S., showed X-ray photographs of various mechanisms in which flaws were detected without taking the intricate parts to pieces.

Royal Institution.—The annual meeting was held on May 1st, Sir James Crichton-Browne, treasurer and vice-president, in the chair. The annual report of the Committee of Visitors for the year 1918, testifying to the continued prosperity and efficient management of the Institution, was read and adopted; 24 new members were elected in 1918, and 63 lectures and 19 evening discourses were delivered. The following gentlemen were amongst those elected as officers for the ensuing year:—President, the Duke of Northumberland; treasurer, Sir James Crichton-Browne; secretary, Brigadier-General E. H. Hills.

Diesel Engine Users' Association.—The announcement was made at the last meeting that the Committee had further considered the question of endeavouring to obtain better terms from the Inland Revenue authorities with regard to the allowance made for depreciation of Diesel and semi-Diesel engines in connection with income-tax assessment, and the constitution of a Special Committee to deal further with the matter was approved. The Association has already been instrumental in obtaining somewhat better terms for the users of Diesel engines, but the position of users of semi-Diesel engines in the matter is very unsatisfactory. Those interested in this subject are invited to communicate with the Honorary Secretary, at 19, Cadogan Gardens, London, S.W. 3.

A suggestion that the new French Association of Manufacturers and Users of Internal-Combustion Engines should be affiliated was cordially approved.

Mr. H. S. Brackenbury gave a report of an explosion which had occurred on a Diesel engine at Wealdstone, and an interesting discussion followed. It was decided that the matter should be discussed further at the following meeting of the Association, when the breakdown of a Diesel engine at Weymouth is also to be reported by Mr. G. W. F. Horner and discussed.

Electricity in Agriculture.—Durham County Council has had a resolution sent to it by the North-Eastern Agricultural Federation, emphasising that present-day requirements in connection with agriculture require that the utmost use should be made of electricity.

Legal.—Scott Anderson *v.* Clayton & Shuttleworth, Ltd.—On Monday, May 5th, in the King's Bench Division, Mr. Justice Rowlatt heard an action by Mr. T. Scott Anderson, of Sheffield, against Messrs. Clayton & Shuttleworth, Ltd., of Lincoln, in which plaintiff claimed for a balance of £1,263 10s. alleged to be due for the price of goods sold and delivered, and charges for storage, insurance and carriage.

Mr. Lewis Thomas, K.C., for the plaintiff, said that the action was brought in respect of the balance of the price of certain electrodes. Plaintiff carried on business as a manufacturing engineer at Sheffield, and defendants at the time of the transactions were manufacturing munitions. In November, 1916, Mr. Anderson was asked to tender for different gauges of electrodes for electric welding. In 1917 a quotation was made for 750,000 ft. of gauge 8 electrode, which was accepted. The first instalment was duly delivered and paid for. Then a question was raised about infringement of patent. The Quasi-Arc Co., Ltd., of London, were suggesting that the plaintiff's electrode might be an infringement of their patent. Mr. Anderson said he would indemnify defendants for any liability for any action brought with regard to infringement of the alleged patent of the Quasi-Arc Co. Plaintiff still took up the attitude that he was making his electrodes long before the Quasi-Arc Co. got a patent. Ultimately it was arranged that plaintiff would leave unclaimed £500 of the price of his material for six months after the completion of the contract for 750,000 ft. of electrodes. Defendants had always retained that £500. On Russia going out of the war, defendants wrote plaintiff not to make any more deliveries. Plaintiff replied that he was prepared to meet their convenience, but said that an instalment of 100,000 ft. was on the way. That was accepted, and only the final instalment remained. After negotiations, defendants' representative assented to plaintiff's suggestion that he should retain the last instalment, and try to dispose of it for them on condition that they returned his £500. On his reminding them of their promise to release the £500, they replied that the matter was receiving their consideration. Plaintiff sued for the balance of £1,263, which included the £500.

In their defence, defendants said it was agreed that 100.000 ft. of electrodes delivered pursuant to order February 5th, 1917, being part of the order sued on, should be returned to the plaintiff, and the order form should be kept open, and the defendants should not be required to take delivery of the 100,000 ft. until March, 1919. The 100,000 ft. invoiced October 31st, 1918, were never ordered by, and had been rejected by the defendants. As to the balance of the claim, after deducting £750, the price of these invoiced goods, the defendants said they were entitled to retain £500, for the plaintiff agreed that the defendants should retain this sum as an indemnity against claims made by the Quasi-Arc Co. against the defendants for alleged infringement of patent in respect of the electrodes, and that such sum should be retained until a decision was legally made that plaintiff was not infringing this or any other patent.

After hearing Mr. R. W. Turner, for the defendants, and Mr. Lewis Thomas for the plaintiff, Mr. Justice Rowlatt gave judgment for the plaintiff for £500 only, the action for £750 being premature. The defendants, said his Lordship, were entitled to some relief as regarded the costs.

Draughtsmen Taking Action.—At the half-yearly Conference of the Association of Engineering and Shipbuilding Draughtsmen, which concluded on Sunday, at Birmingham, it was decided to ask branches to give authority to incorporate in the rules of the Association an instruction that members should only offer their services to those employers who submitted their vacancies to the Association. It was reported that a strike of draughtsmen at Rochdale—the first on record—ended successfully for the members concerned.—*The Times.*

Standards for the Measurement of Electricity.—The Board of Trade announces that the coils and instruments referred to in the Schedule to the Order in Council of January 10th, 1910, which approved the several denominations of standards set out in that Schedule as denominations of standards for the measurement of electricity, as from May 8th, 1919, will be deposited at the National Physical Laboratory, instead of at the Board of Trade Standardising Laboratory, Whitehall. All communications respecting electrical standards and instruments for test should be sent to the Director of the National Physical Laboratory, Teddington, Middlesex.

Peace Celebrations.—We learn from the Director of the Electrical Development Association, as we go to press, that the Board of Trade (Coal Mines Department) has confirmed the statement which we published recently—namely, that the D.O.R.A. orders with regard to public lighting and illuminations will be suspended for four days, in order to permit of the due celebration of the return of Peace. The dates will be announced later.

Appointments Vacant.—Test-room assistant (£160 to £180), for the Wakefield Corporation Electricity Department; electrical inspector, for the War Department, Northern Command; meter tester (45s. + 28s. 6d + 12½ per cent.); and installations inspector (50s. + 28s. 6d. + 12½ per cent.), for the Walsall Corporation Electricity Supply Department; shift engineer (£234) for the Corporation of Accrington Electrical Engineering Department; chief of the Electrical Engineering Department (£400), for the City of Coventry Technical Institute; two shift engineers (£200), for the Kilmarnock Burgh Electricity Works; charge engineer (80s.), switchboard attendant (60s.), for the City of Gloucester Electricity Works; assistant engineer (£500), for the Stalybridge and Hyde Joint Tramways Board: shift engineer (76s. 7d.), for the Corporation of Ayr Electricity Works; meter and test-room assistant (50s. + bonuses), for the Borough of Islington Electricity Department: assistant to electrical engineer and tramways manager (£200 to £300), and charge engineer, for the Keighley Corporation Electricity Works; chief assistant in Testing Department (£400), for the City of Manchester Electricity Department; electric wireman (67s.), for the Croydon Mental Hospital; Shanghai Municipal Council require the services of the following: Boiler-house chemist, 350 taels per month; assistant mains engineer, 400 taels per month; two assistant mains engineers, 350 taels per month; assistant draughtsman, 350 taels per month; assistant installation inspector, 230 taels per month; assistant meter tester, 230 taels per month (the tael may be taken as equivalent to 3s. on the average, the present rate of 5s. is abnormal). See our advertisement pages to-day.

Goodby-ee.—At Accrington, on April 30th, there was a re-union with demobilised Service men, and opportunity was taken to say *au revoir* to the female servants in the employ of the Tramways Committee. Alderman T. E. Higham, chairman of the Electricity Committee, paid a tribute to the Service men, and presented the Meritorious Service Medal to Sergeant G. Rushton, of the 15th Hussars, a member of the staff.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The St. Helens Corporation Tramways Committee has appointed to the position of tramways engineer and manager Mr. W. Bellamy, who was previously assistant at St. Helens under the company. Mr. Bellamy is a son of the late engineer to the Liverpool tramways. He has been in the Army since 1914, and has put in four years' service in Rangoon. The St. Helens tramways will be taken over from the company by the Corporation on the expiration of the lease this autumn; but Mr. Bellamy's appointment dates for some months ahead of that period.

The Newcastle-under-Lyme Town Council has increased the salary of the borough electrical engineer, Mr. A. J. C. De Renzi, to £390 per annum.

Three electric supply men from other towns have been asked to appear before the Morecambe Council on May 13th for interview concerning the appointment of electrical engineer vacant through the resignation of Mr. A. W. Annetts.

The Bridlington T.C. was recommended to increase the salary of Mr. A. J. Beckett, borough electrical engineer, from £375 to £475 per annum, inclusive of bonus, rising by annual increments of £12 10s. to £500. On Monday the Bridlington Electricity Committee resigned *en bloc* as a protest against the Council rejecting its recommendation.

Mr. E. W. Sleight, manager of the Carlisle Tramways Co., has resumed duty after service with the Royal Fusiliers and the K.O. Royal Lancaster Regt. He was severely wounded.

Mr. C. A. Walker, rolling stock superintendent at the Rotherham Tramways Depôt, who is leaving to take up a similar appointment at Lowestoft, has been presented by the staff with a leather suit case. He is succeeded by Mr. Sharpe, of Bradford.

Mr. Long, electrical engineer to the Grays U.D.C., has retired from the position.

Stoke-on-Trent B.C. Electricity Supply Committee has decided that the maximum salary of the electrical engineer be fixed at £1,000 and that his salary be increased from £700 to £900 as from April 1st last, and that he be granted two further increases of £50 on April 1st next and April 1st, 1921.

The Heston and Isleworth Electric Lighting Committee recently decided to adhere to its previous decision requiring Mr. Rycroft, the electrical engineer, to resume his full-time duties on March 31st. The clerk, acting on the instructions of the committee, wrote to him to that effect, adding: "If you do not comply with the Council's request, your non-return will be understood as, and will be taken to be, a termination of your engagement as electrical engineer and manager." Mr. Rycroft has replied stating that as far as he was concerned, it was not understood that by failing to comply with the committee's requirements his engagement was terminated. The committee has again confirmed its decision.

Captain F. H. Brandreth has resigned the post of resident engineer and manager to the Urban Electric Supply Co., Ltd., at Stamford, in order to accept a similar appointment with the same company at Grantham.

Mr. C. L. Holman has resigned the post of resident engineer and manager of the Lymington Electric Light and Power Co., Ltd., in order to accept a similar appointment with the Urban Electric Supply Co., Ltd., at Stamford.

The Hull Corporation Tramways Committee held several meetings during the month of April at which the position of the tramways manager was under discussion. At one of these it was resolved to ask him to submit his resignation.

This Mr. W. J. McCombe did under date April 26th, and it was accepted unanimously, but the committee in reporting the matter to the Council asked that body to express its opinion as to whether having regard to the strain under which his work had no doubt been carried on during the war it would be possible to reinstate Mr. McCombe in his late or some similar position. The Council discussed the matter fully on May 1st and with one dissentient it was resolved that Mr. McCombe be not engaged in any capacity under the Corporation. One of the speakers said that it was known last December that there was something wrong in the office. Another member said he had lost all confidence in the committee as well as in the manager; he thought that the committee should resign, and that there should be a public inquiry into the finances and management of the undertaking. This attack on the committee was described by subsequent speakers as a scandalous one, and it was denied that the "irregularities" were known about a year ago.

General.—The Electrical Research Committee has appointed Mr. E. B. Wedmore, who is at present with the B.T.H. Co., Ltd., as Director of Research.

Mr. G. S. Lockwood was last week presented with a pair of bowls by the employés in the general stores of Messrs. Dick, Kerr & Co., Ltd., car works department, Preston.

The *Times* states that Sir Ernest Rutherford, the newly-appointed Cavendish Professor of Experimental Physics at Cambridge, has been elected to a Fellowship at Trinity.

Major K. Edgcumbe, M.I.E.E., London Electrical Engineers, has been restored to the establishment of the corps, of which he was a supernumerary officer whilst employed extra regimentally. Major Edgcumbe has been long associated with the London Electrical Engineers, and rose to field rank in July, 1914, a few weeks before the war opened.

Captain J. Young, A.M.I.E.E., has been engaged by the Cray Laboratory, Sugar House Lane, Southampton, as manager of their electrical engineering department. During the war he has served in the Tyne Electrical Engineers, R.E., and the R.A.F., previous to which he was employed in the estimating department of Messrs. Reyrolle & Co., Ltd., Hebburn-on-Tyne.

Major Frank Vandervell, who has just started in partnership with his brother, Lieut. Percy, under the name of "Vandys" as motor car agents, &c., at Pembridge Gardens, Notting Hill Gate, was from 1902 and until the outbreak of war intimately connected with Messrs. C. A. Vandervell and Co., Ltd., at Acton, of which his brother Charles is the head. The Major was mobilised two days before the declaration of war (being then a member of the Artists' Rifles), and served with distinction both in Gallipoli and France.

Mr. F. Raylton Hodges, late manager for Baker Bros., Middlesbrough, has now taken up the management for Messrs. T. B. Morley & Co., Ltd., Jameson Street, Hull, where he is inaugurating an electrical supplies department, and invites information from actual manufacturers of accessories, &c.

Captain S. B. Haslam, R.E., M.I.E.E., M.I.Mech.E., who has been in the Army since 1914, and in Salonika for the last three years, has now been demobilised, and has rejoined Messrs. Haslam & Stretton, Ltd., as joint managing director. The firm are extending their operations, and will shortly be opening additional premises at 33, St. Helens Road, Swansea.

The appointment of Mr. William Noble to the position of engineer-in-chief at the G.P.O., in succession to Sir William Slingo, who will retire at the end of this month after 50 years' service, is one that will command the approval not only of the staff of the Post Office, but also of the public generally. Mr. Noble, like his predecessor, has risen from the ranks, and in every grade through which he has passed he has given proof of the possession of exceptional qualities and sterling merit; he entered the service of the Post Office in 1877 as a telegraphist in the Aberdeen office, and from the first took a keen interest in the technical side of his work, as evidenced by the winning of medals in both telegraphy and telephony. For some years he was a lecturer in those subjects, and in magnetism and electricity, and many of his students honoured his efforts by becoming medallists. For some years he has been one of the examiners of the City and Guilds of London Institute.

In 1893 Mr. Noble was appointed second-class engineer at Aberdeen, and in 1897 he was promoted to a first-class engineership in the engineer-in-chief's office, where his character and ability soon made themselves felt. He took part in the preparations for the development of the P.O. telephone service, and in 1901 he became assistant superintending engineer in the Central Metropolitan District, in which capacity he was responsible for a large share of the telephoning of London. In 1905 he became a first-class staff engineer, and took charge of the Telegraph Section at Headquarters; two years later he was appointed superintending engineer of the Central Metropolitan District, a post which gave full scope to his administrative capacity, as well as his technical knowledge. In 1910, with the Controller of the London Postal Service, Mr. Noble visited Berlin, Vienna and Paris to investigate Continental practice, and he has served on many technical and advisory committees with great distinction. He was promoted to the onerous position of assistant engineer-in-chief in 1912, and since then has been engaged on work of the first importance.

Mr. Noble's technical qualifications for his new post, it will be seen, are of the first order; they are equalled by his personal characteristics—his friends are legion, and when we tender him our sincere congratulations on the high honour which his merits have gained for him, we but echo the sentiments of all his well-wishers.

Photo by] [*Elliott & Fry.*

Mr. W. Noble.

CITY NOTES.

Indo-European Telegraph Co. Ltd.

Mr. J. H. Tritton presiding at the annual meeting, on April 29th, said that during 1918 their communications remained totally interrupted between this country and Russia. Their lines in Russia were being repaired, and they hoped before long to have the line through between Odessa and Teheran. Owing to the unsettled state of Russia it was impossible to make any forecast. We have had many difficulties to contend with during the war. In Persia the wires were subject to constantly recurring interruption by the marauding bands of Turks who were constantly raiding parts of the territory traversed by their line. During the armistice period there had been fighting between the Georgians and Armenians, and again their line suffered. The country south of the Caucasus had always been a danger zone owing to the large number of Kurds who occupied many villages in that district, and these tribes had been particularly active during these troublous times. The fighting in the Northern Caucasus between the Turks and Russians also led to total interruptions, but they had been able to restore communication between Odessa and Tiflis, although for the moment they were again interrupted on that section. There still remained the section of line between Tiflis and the Russo-Persian frontier, but the company was receiving every assistance from the British military authorities and Georgians, and they hoped that before long they would be able to get the line through. It would be some time before it was in a pre-war condition. The cable between Odessa and Constantinople was reopened for telegraphic traffic on December 1st, 1918, and had been working satisfactorily since that date. The Odessa end of the cable was worked by this company's staff, but communication was, they believed, again suspended. Although this cable linked their system with that of the Eastern Telegraph Co., the carrying capacity of the cable was only sufficient for the local traffic, and they were unable to use it for India or trans-Indian traffic. They had made definite proposals to the British Government for the restoration and strengthening of the Indo route, and these proposals were under consideration. The whole question must, to a great extent, depend upon the peace terms. They were acutely alive to the shortcomings of the present telegraphic communication with India and the East, and were extremely anxious to leave no stone unturned to re-establish that portion which was their own concern. The directors were carefully following developments in radio communication. Great strides had been made during the war, more especially in reception, and it was quite possible that the company might avail itself of radio communication to strengthen further its communications with the East. Th accounts for 1917 had recently been issued. Owing to the liberal action of their partners in the Cis-Indian Joint Purse, there was a sufficient sum, after crediting local traffic receipts and interest on their reserves, to pay all expenses and provide a dividend of 7 per cent. on the share capital of the company. There was no balance to account for, and there were, consequently, no special allocations to reserve funds. They could only hope that when the peace terms were settled, the British Government would be able to determine what route should be followed by the company in the future. They wished to utilise to the fullest possible extent the excellent lines of communication that they possessed in Russia and to ensure the provision of their efficient route with the minimum of capital outaly.

W. T. Glover & Co., Ltd.—The result of trading in 1918 was a credit balance of £38,673. Added to this is the balance brought forward, £10,770; excess profits refund, £4,859; cash investments balance, £966; making £55,269. Deducting directors' remuneration and expenses and the interest on the 4½ and 5 per cent. debenture stocks, also £4,000 transferred to the trustees of the second debentures, £42,091 remains. Out of this the 5 per cent. preference dividend is paid, less tax, £3,562, there is transferred to the first mortgage debenture redemption fund £2,500, the dividend of 5 per cent. and bonus of 2½ per cent. on the ordinary shares, less tax, absorbs £6,137, £20,000 is transferred to reserve, and £9,891 is carried forward. The first debenture redemption fund now stands at £48,000, the second ditto at £49,000, and the reserve fund at £100,000, making a total of £197,000. The annual meeting will be held on Monday at Trafford Park.

In a circular which has been issued to the shareholders, under date April 30th, 1919, the chairman, Mr. A. L. Ormrod, states that the directors have recently been approached on behalf of Vickers, Ltd., with a view to that company acquiring the controlling interest in the company by means of an exchange of shares. As the result of negotiations Vickers, Ltd., have now agreed to purchase the shares from the respective holders, or such of them as think fit to adopt the agreement, at the following prices: For every preference £1 share, 17s. 6d. in cash; for every four £1 ordinary shares, five fully-paid £1 ordinary shares of Vickers, Ltd. Both shares will be delivered ex dividend. Further, it is proposed that the shares in Ashover Mines, Ltd., held by W. T. G. & Co. (and which stand as an asset in the company's balance sheet at £23,907), shall be reserved for or distributed amongst its ordinary shareholders by way of a special dividend. Unless at least two-thirds in value of the preference shareholders and nine-tenths in value of the ordinary shareholders agree to sell their shares to Vickers, Ltd., that company will have the right to determine the agreement. The directors are of opinion that the terms of the sale are favourable to the shareholders, and will agree to sell their own shares accordingly. The completion of the sale is to take place on June 30th next.

Anglo-American Telegraph Co., Ltd.—The three quarterly interim dividends on the preferred and ordinary stock paid in May, August, and November, absorbed £157,500, and the directors on February 1st last paid the final dividend for the year on these shares and 30s. on the deferred stock. These payments absorbed altogether £262,500, being the rent paid by the Western Union Telegraph Co. for the year, equal to 3¾ per cent. on the ordinary stock, 6 per cent. on the preferred stock, and 1½ per cent. on the deferred stock. A bonus of 1s. 9d. per cent. upon the ordinary stock and 3s. 6d. per cent. upon the deferred stock was paid on February 1st, 1919. The balance at credit of revenue account (£66,932) includes £1,307 interest received, and the balance of £65,625 is available for the payment of dividends for the quarter to March 31st, 1919.

North of Scotland Electric Light & Power Co., Ltd.—With further reference to the report summarised last week, the connections in Montrose increased during 1918 from 1,173 KW. to 1,217 KW.; in Brechin they increased from 837 to 857 KW.; and in Inverness from 1,784 KW. to 1,996 KW., making a total of 4,070 KW. connected in the three towns. In order to meet the large power demands in Montrose it will be necessary to purchase extra genearting plant before next winter. Additional capital is to be sanctioned for this purpose.

Craigpark Electric Cable Co., Ltd.—Net profit for year ended March 31st, 1919, £11,028, after making provision for excess profits tax, plus £932 brought forward. To depreciation of buildings and machinery, £2,000; to reserve, £2,000; 6 per cent. on the preference shares, £2,850; 8 per cent. on the ordinary shares, £3,000; carried forward, subject to directors' fees, £2,110. The business has been maintained over the period covered. Next year it is proposed to hold the annual meeting in June instead of May.

Melbourne Electric Supply Co., Ltd.—Interim dividend on the consolidated ordinary stock at the rate of 10 per cent. per annum, free of British income tax.

Evered & Co., Ltd.—It is proposed to increase the capital of the company, and, in view of the probable amalgamation with other companies, the directors propose to bring the present articles of association up to date. The capital is to be increased to £300,000 by the creation of 100,000 new shares of £1 each.—*Financier.*

Ramsgate & District Electric Supply Co., Ltd.—Including £665 brought forward the gross profits for 1918 were £2,690. After allowing for interest at the rate of 5 per cent. per annum on outstanding accounts due to contractors, the balance is £1,543, of which £800 is put to reserve and £743 carried forward. Mr. A. D. Chamen has been appointed a director in place of Mr. W. T. Pressland, deceased.

Shanghai Electric Construction Co., Ltd.—Dividend of 5 per cent. and bonus of 5 per cent. (together 20s. per share), less tax, on the ordinary shares, making 15 per cent. for the year; £10,000 to reserve for renewals; £8,000 written off preliminary expenses; £19,103 carried forward, subject to excess profits duty.

Alderley & Wilmslow Electric Supply, Ltd.—During 1918 the total lamp connections increased from 1,193 KW. to 1,218 KW. The profit was £2,133, against £2,664 for 1917. £996 was brought forward. Interest on debentures and loans £1,597. To reserve £1,000. Carried forward £532.

Oriental Telephone & Electric Co., Ltd.—Final dividend of 3 per cent. on the preference shares, less tax, making 6 per cent. for the year; 6 per cent. on the ordinary (free of tax) making 10 per cent. for the year. Annual meeting: May 29th.

Globe Telegraph & Trust Co., Ltd.—Final dividends now announced bring the total for the year on the preference shares to 6 per cent., less tax, and that on the ordinary to 8 per cent. net.

Marconi International Marine Communication Co., Ltd.—An extraordinary meeting, held last week, confirmed the special resolution increasing the capital by the creation of 900,000 shares of £1 each.

City of Buenos Ayres Tramways Co. (1904), Ltd.—Dividend of 1s. 3d. per share (5 per cent. per annum), less income tax, for quarter ended March 31st.

Oldham, Ashton & Hyde Electric Tramways Co., Ltd.—Dividend at rate of 7 per cent. on the ordinary shares.

Adelaide Electric Supply Co., Ltd.—Interim dividend on the ordinary shares at the rate of 10 per cent. per annum, free of British income tax.

Auckland Electric Tramways Co., Ltd.—Interim dividend of 6d. per share, less tax, on ordinary shares.

Calcutta Electric Supply Corporation, Ltd.—Final dividend on ordinary shares for last half of 1918, 6½ per cent. actual, plus a bonus of 1 per cent., making a total of 11 per cent. for the year.

Vickers, Ltd.—Final dividend of 1s. 6d. per share, free of income-tax, on the ordinary shares.

British Ever-Ready Co., Ltd.—Final dividend of 10 per cent. on the ordinary shares.

Johnson & Phillips, Ltd.—Dividend for 1918 on the ordinary shares, 10 per cent. per annum.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets have been inflamed with strength by the unexpectedly favourable nature of the Budget. No increase in income-tax and a halving of excess profits duty took people by surprise. The Stock Exchange happened to be closed on the day after the Budget speech, and markets did not really get into swing until Monday in this week. Then there was a thorough rush to buy. Mostly to be affected were rubber and oil shares, with a few particular industrials. But the strength was very contagious and general. Investors, speculators, gamblers, all wanted to buy. The pace was over-hot to last. Reactions occurred in some cases. On the whole, however, prices kept the greater part of their rises, and the Stock Exchange is busier than it has been for fully five years.

In the markets covered by these notes, there has not been much change. The Budget cannot influence electricity supply companies to any great extent, while, so far as the cable group is concerned, the fact of income-tax being retained at the trifling (!) level of 6s. in the £ has rather cooled the recent ardour for securities upon which dividends are paid free of tax. The list of prices is well maintained, and a revived feature is a jump in Marconis to ⅛ above the round fiver. Marconi Marines advanced to 5 1/16. American Marconis dropped back to 27s., from which price a smart recovery lifted them to 28s. 6d. It is announced that the United States Government is handing back to private control the American telegraph and telephone companies; Globe Telegraphs have risen to 15 on the declaration of a dividend making 8 per cent. for the year as against 7 per cent.

Home Railway stocks have advanced with the rest. Metropolitans and Districts are slightly better. Underground £10 shares rallied to 3¼ after a dip to 3⅛; the income bonds did not move. Steam-cum-electricity stocks are decidedly better. Nobody seems quite to know why they should be, and the amount of business that brought about the change was meagre. Relief over the Budget is considered sufficient to account for any otherwise unexplainable movement. Investment stocks of most kinds are harder, and a renewed demand is experienced for all good-class pre-ordinary issues. Melbourne Electric 7 per cent. first cumulative preference are inquired for at 5½, at which the yield comes to 6⅜ per cent. on the money. The security is excellent, and the preference dividend was covered, on the last figures, 6½ times over. North Metropolitan Electric Power 6 per cent. cumulative preference at 18s. 6d. ex dividend pay six guineas per cent. on the money. General Electric 6½ per cent. preference at 10⅝ give 6½ per cent. on the investment; dividends are due January and July.

General Electric ordinary are a good market at 19. Rumour loves to play around these shares, and the latest concerns itself with possible developments on an important scale next month. Edison Swans, after being dull and heavy at 19s. 6d., have spurted to 22s. 6d., on the success of the new issue, and their supporters talk them higher in the near future. Did dignity and caution permit, we might feel disposed to underline this optimism. Electrical manufacturing shares of all kinds are very firm, for which the previously-mentioned reports of amalgamations and arrangements are, in the main, responsible. Electric Constructions are a good market at 13/16. Babcock & Wilcox hardened up in company with other engineering shares. Siemens have improved to 6⅝.

In the foreign division, Brazilian Tractions are again better by reason of a rise in the milreis. Mexicans continue depressed, and the bonds of the utility companies are weak by reason of the revolution news. Anglo-Argentine Tramways second preference have fallen ⅛. British Columbia Electric deferred stock is 5 points lower on a small pressure to sell. Rubber plantation shares broke out into a condition akin to booming on the reduction in excess profits duty and the fact that no other impost has been substituted in its place.

SHARE LIST OF ELECTRICAL COMPANIES.

HOME ELECTRICITY COMPANIES.

	Dividend 1917.	Dividend 1918.	Price May 6, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	10	8	6¾	—	£5 8 16
Charing Cross Ordinary	4	4	8⅝	—	6 18 4
do. do. do. 4½ Pref...	4½	4½	8¼	—	6 18 4
Chelsea	6	8	8 11/16	+ 1/16	4 1 1
City of London	8	8	11¾	—	6 16 2
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 8
do. do. 6 per cent. Pref.	6	6	9¾	—	6 3 1
Kensington Ordinary	7	6	6⅞	—	5 2 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref...	6	6	3⅞	—	7 14 10
Metropolitan	4	5	8⅛	—	8 0 0
do. 4½ per cent. Pref. ..	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅞	—	7 0 4
South London	6	6	2¾	—	7 5 6
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6½	—	6 8 1
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. T l. Pref.	6	6	98½xd	—	6 1 10
do. Def.	1½	83/6	22½	+⅛	7 8 0
Chile Telephone	8	8	7¾	—	5 8 6
Cuba Sub. Ord.	7	7	11½	—⅞	*6 7 4
Eastern Extension	8	8	16½	+¼	*4 18 6
Eastern Tel. Ord.	8	8	162½	—	*4 18 6
Globe Tel. and T. Ord.	7	8	15	+½	*5 6 8
do. do. Pref.	6	6	10½	—	6 14 8
Great Northern Tel.	22	22	30½	—½	7 4 0
Indo-European	13	13	67½	—	5 18 0
Marconi	20	20	5⅛	+ 1/16	3 18 0
Oriental Telephone Ord.	10	15	2⅜	+⅛	6 3 0
United R. Plate Tel.	8	8	7⅞	—	*5 1 7
West India and Panama	1/3	1/3	1 5/16	+ 1/16	*4 3 4
Western Telegraph	8	8	16¾	—	*4 15 10
HOME RAILS.					
Central London Ord. Assented ..	4	4	63½	—	6 6 0
Metropolitan	1	1¼	27	—	4 12 7
do. District	Nil	Nil	23½	—	Nil
Underground Electric Ordinary..	Nil	Nil	3¼	—	Nil
do. do. "A" ..	Nil	Nil	9/3	—	Nil
do. do. Income ..	4	5	96	—	*5 4
FOREIGN TRAMS, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	8¼	—	—
do. do. 2nd Pref. ..	—	—	9	—⅛	—
do. do. 6 Deb... ..	5	6	68½	—	7 8 6
Brazil Tractions	—	—	68	+½	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	6	59	—	8 10 0
do. do. Preferred	Nil	Nil	32½	—5	Nil
do. do. Deferred	Nil	Nil	37½	—	Nil
do. do. Deb. ..	4¼	4¼	62	—	6 17 4
Mexico Trams 6 per cent. Bonds..	Nil	Nil	60	—1	Nil
do. 6 per cent. Bonds..	Nil	Nil	47½	—1½	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	67	—1	—
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	16	3⅞	+⅛	4 0 0
British Aluminium Ord.	10	10	1 11/16	+ 1/32	5 18 6
British Insulated Ord.	25	12½	2 1/16	—	6 1 1
British Westinghouse Pref. ..	7½	7½	2½	—	6 8 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	8¼	—	6 3 1
Edison-Swan, "A"	—	—	1⅛	+⅛	6 13 4
do. do. 5 per cent. Deb. ..	4	5	76½	—	6 12 8
Electric Construction	10	10	1 3/16	—	8 8 6
Gen. Elec. Pref.	6	6½	10⅝	—	6 5 4
do. Ord.	10	10	19	+½	*5 5 0
Henley	25	25	2⅛	+⅛	6 0 0
do. 4½ Pref..	4½	4½	8⅞	—⅛	5 16 2
India-Rubber	10	10	16¾	—	*6 0 4
Siemens Ord...	—	10	6⅝	+⅛	*7 8 0
Telegraph Con.	20	20	25	+⅛	4 15 0

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 7th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/6	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£78	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£45	£2 inc.
a Copper Sulphate	"	£42	..
a Potash, Chlorate	per lb.	1/9	..
a " Perchlorate	"	1/9	..
a Shellac	per cwt.	£12	£1 inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	"	£31	..
a " Lump	"	£23	..
a Soda, Chlorate	per lb.	10d.	1d. dec.
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	11⅜d.	..
c " Tubes (solid drawn) ..	"	1/2½ to 1/2⅝	..
c " Wire, basis	"	1/-	..
c Copper Tubes (solid drawn) ..	"	1/4	..
g " Bars (best selected) ..	per ton	£114	..
g " Sheet	"	£114	..
g " Rod	"	£114	..
d " (Electrolytic) Bars ..	"	£81	..
d " " Sheets ..	"	£161	..
d " " Wire Rods	"	£91	..
d " " H.C. Wire	per lb.	11⅝d.	..
f Ebonite Rod	"	5/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	2/4½	..
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small ..	per lb.	9d to 4/6	..
e " " " medium	"	5/- to 10/-	..
e " " " large ..	"	12/6 to 25-/& up.	..
d Silicium Bronze Wire	per lb.	1/8½	..
r Steel, Magnet, in bars	per ton	..	..
g Tin, Block (English)	"	£223 to £221	..
n " Wire, Nos. 1 to 18	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Joint Industrial Council for the Electricity Supply Industry.—The first meeting of the above Council was held at the Offices of the War Cabinet, 2, Whitehall Gardens, London, S.W., on May 1st. Mr. G. J. Wardle, C.H., M.P., Parliamentary Secretary to the Ministry of Labour, who presided during the early part of the proceedings, pointed out that this was the thirty-third Joint Industrial Council to be set up, and the fourth Council which had been established for industries or services in which Local Government Authorities were concerned, the Councils for the Waterworks Undertakings Industry, Local Authorities' Non-Trading Services, and the Gas Industry having held their first meetings on April 3rd, April 11th, and April 30th respectively. The Joint Industrial Councils for the electricity supply, gas, and waterworks undertakings industries include both municipal and company-owned undertakings. The constitution of the Electricity Supply Joint Industrial Council provides for the appointment of a chairman and a vice-chairman, selected from the members of the Council, one from each side of the Council, and two secretaries, one for each side of the Council. Ald. W. Walker, of the Incorporated Municipal Electrical Association, was elected chairman, and Mr. A. de Turckheim, Secretary of the Incorporated Association of Electric Power Companies, was appointed secretary *pro tem.* for the employers' side of the Council. The Trade Union side of the Council will nominate the vice-chairman, and will appoint its secretary at an early date. All communications for the Joint Industrial Council should be forwarded for the present to Mr. A. de Turckheim, Sanctuary House, 33, Tothill Street, Westminster, S.W. 1.

Shaft Pressing.—A method of heat shrinking instead of press fitting parts of electrical machines on to their shafts is described in the February issue of the *General Electric Review*. The method overcomes the difficulties usually experienced with press fitting on the erection site. For flywheels and couplings water or steam heating is used, while for armatures and field systems rheostats placed in convenient positions are found to be quite satisfactory. One case cited is that of a large armature, the shaft being 35 in. in diameter. Cold pressing was expected to require a maximum pressure of 600 tons, whereas heating the armature to about 80 deg. C. enabled the shaft to be pulled in with a 5-ton chain hoist.

LARGE POWER TRANSFORMERS.

By A. G. ELLIS, A.M.I.E.E., and J. L. THOMPSON, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

While British manufacturers have had ample opportunities of taking a front place so far as large turbines and generators are concerned, equal opportunities have not been afforded in transformer and switchgear work. This has been due largely to the limited home demand for such apparatus, which demand will, in the near future, be much extended, and British manufacturers have experience available which will cope with this demand.

For home service it is desirable to transport transformers complete in their tanks, thus minimising erection work and cost. Where possible it is also desirable to ship the transformer complete in oil, generally obviating drying out on site.

The size of transformer which can be transported and handled complete is limited, first, by the loading gauge restriction and maximum truck size and loading, and second, by the handling facilities and crane capacity on the customer's premises.

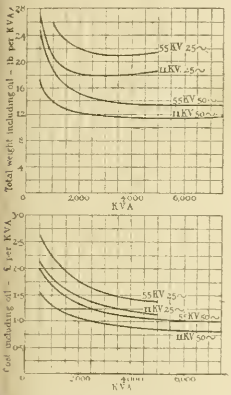


Fig. 1.—Approximate Weight and Price per k.v.a. for Self-cooled Transformers.

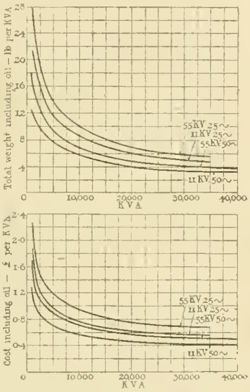


Fig. 2.—Approximate Weight and Price per k.v.a. for Force-cooled Transformers.

The maximum rating of single and three-phase transformers of the self-cooled and artificially cooled types which can be shipped complete (with terminals removed) is given in Table I.

TABLE I.

Cooling.	Shipment.	Phase.	Periods.	Limiting rated output.	Approximate total weight complete with oil.
				K.V.A.	Tons.
Self-cooled	Complete in oil	1	50	3,000	17†
			25	2,000	20†
		3	50	5,000	30†
			25	3,500	33†
	Transformer and tank separately	1	50	6,000	30‡
			25	4 000	32‡
		3	50	7,000	42‡
			25	5,000	48‡
Water-cooled or forced cooled*	Complete in oil or dismantled.	1	50	10,000	26
			25	6,500	30
		3	50	15,000	42
			25	10,000	45
Forced cooled only*	Complete in oil	1	50	25,000	37§
			25	12,500	40§
		3	50	40,000	58§
			25	20,000	58§
	Dismantled	1	50	35,000	50§
			25	17,500	50§
		3	50	50,000	70§
			25	25,000	70§

Weights include oil coolers for forced cooled transformers.
† Tanks built for shipment complete in one piece.
‡ Tanks with detachable external radiators.
§ Limiting ratings for a 50-ton crane to handle heaviest part.

In Table I are given approximate weights and dimensions. These data are based on, and developed from, the designs of the largest transformers that have actually been made.

Figs. 1 and 2 are representative curves of price and weight per k.v.a., of 3-phase, oil-immersed transformers, showing the influence of the following variables. These curves are all based on the British standard rating.

In general a large single-phase transformer is about 7 to 10 per cent. cheaper and about 12 to 15 per cent. lighter than a three-phase transformer of the same rating. A large three-phase transformer is, however, about 5 to 8 per cent. cheaper and 10 to 15 per cent. lighter than a group of three single-phase transformers of the same three-phase group capacity.

From the manufacturing standpoint any size of transformer can be constructed that is likely to be called for with the largest generating units. Assuming a 50-ton crane, the limiting rating for a three-phase 50,000-volt transformer would be about 50,000 k.v.a. at 50 cycles, and 25,000 k.v.a. at 25 cycles.

On the average, large 25-cycle transformers are 35 per cent. dearer and 40 per cent. heavier than 50-cycle transformers of the same rating.

The curves are shown for high-tension voltages of 11,000 and 55,000 volts, and for a maximum low-tension voltage of 6,000 volts. The price and weight increase by 1 per cent. for the smaller ratings, down to 0.6 per cent. for the largest ratings, per 1,000 volts normal pressure above 11,000 volts. The influence of the voltage is greater the lower the rated output.

The curves shown all refer to oil-immersed transformers, self-cooled up to the practicable limits of rated output (see Table 1) and water-cooled or forced-cooled (with external oil circulation) for all rated outputs up to the maximum figures given in the table. At 1,000 k.v.a., 50 periods, the present-day prices of the self-cooled and water-cooled types are not appreciably different; the larger self-cooled units are, however, appreciably dearer than water cooled, up to a difference of 15 to 20 per cent. This may be to some extent offset in certain cases by the cost of water, pumping, storage, &c.

The system of cooling adopted is determined largely by the size of unit involved and the situation and cooling facilities available.

For isolated sub-stations where continual attendance is not available, self-cooled units are to be recommended up to 5,000 k.v.a. three-phase and 3,000 k.v.a. single-phase at 50 cycles. The same rule would apply for sub-stations and power stations with continual attendance where cooling water is dear.

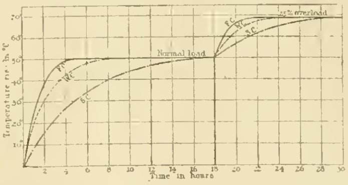


Fig. 3.—Temperature Curves for 4,000-k.v.a. Oil-immersed Transformers. s.c. = Self-cooled. w.c. = Water-cooled. f.c. = Forced Cooled. Copper Loss to Iron Loss = 2 : 1.

There is a decided tendency nowadays towards large self-cooled units. In designing sub-stations, the following points should be borne in mind:—

Particular attention should be paid to ventilating the transformer chambers so that the air temperature should not be raised above 25 deg. C. if possible. Ample headroom should be provided above the transformer, and clearances allowed between the tank and any adjacent wall or cubicle should not be less than 1 to 2 ft. up to 1,000 k.v.a., and 2 to 3 ft. for larger sizes.

The quantity of air should be approximately 200 cu. ft. per min. per kw. loss for a temperature rise of air of about 10 deg. C.

In fireproof cubicles the ventilating apertures might be fitted with automatic dampers which would close at a set maximum temperature.

In power stations or sub-stations with attendance, where a plentiful and cheap water supply is available, water-cooled units are generally recommended for outputs above the following:—

Three-phase, 2,500 k.v.a., 50 cycles, or 1,700 k.v.a., 25 cycles; single-phase, 1,500, k.v.a., 50 cycles, or 1,000 k.v.a., 25 cycles.

Although water-cooled transformers (with internal cooling coils) can be built in very large sizes, forced cooling with external oil circulation is to be recommended above the following limits:—

Three-phase, 5,000 k.v.a., 50 cycles, or 3,500 k.v.a., 25 cycles; single-phase, 3,500 k.v.a., 50 cycles, or 2,500 k.v.a., 25 cycles.

The relative merits of single and three-phase transformers for three-phase groups have often been discussed. There is no specific rule which can be formulated, as the choice depends almost entirely on local conditions in each case. In general, where a number of groups are installed three-phase units will be more suitable, and where few groups are installed single-phase are preferable. In the latter case single-phase units ensure greater reliability of supply, as a group of three single-phase transformers operating in delta-delta can still run at about 58 per cent. of the group output with two of the transformers in open delta, should one transformer fail and be cut out.

In large sub- and central stations, where the number of units installed may be three or more, three-phase units will in general be preferred. If a number of three-phase units are installed, one complete three-phase transformer can be carried as a spare, without an undue increase in the capital cost. The floor space occupied will be appreciably less than for single-phase groups.

In sub-stations of plant capacity up to, say, 5,000 K.V.A. it will not generally be economical to install more than two or three groups. In such cases the choice tends towards single-phase units of medium capacity, forming one or two three-phase groups, with one single-phase transformer as spare for the sub-station.

With regard to the overload capacity of large power-station transformers of the water-cooled and forced-cooled types, the overloads specified for such step-up units should correspond to the generator overloads, since such transformers rapidly reach their final steady temperature. This is shown in the comparative curves in fig. 3. On such artificially cooled plant it is inconsistent to specify short-time overloads, as the plant for such overloads will generally have to be designed to stand the overload continuously.

It is desirable to rate such plant on the maximum continuous rating, as specified in the B.E.S.A. Report, so that both generators and transformers are capable of the same duty.

In sub-stations the most economical proportion of iron to copper loss depends on the load factor of the individual sub-station, and no specific rule can be laid down.

TABLE II.

Ratio of iron to copper loss	1 : 1	1 : 1·15	1 : 1·5	1 : 2
Efficiency at 1,400 K.V.A. ...	99·0	99·0	99·01	99·02
„ 1,500 K.V.A. ...	99·0	99·0	99·0	99·0
Iron loss, watts	7,500	7,000	6,000	5,000
Copper loss, watts at 1,400 K.V.A.	6,500	7,000	7,800	8,700
Copper loss, watts at 1,500 K.V.A.	7,500	8,000	9,000	10,000
Annual charge for losses at ⅜d. per unit	£193	£193	£189·5	£188·5

An illustration of the method of arriving at the best proportion is set forth in Table II, which shows the annual charges for losses for different ratios of iron to copper loss for an average load of 1,400 K.V.A., peak load of 2,000 K.V.A., and normal rating of 1,500 K.V.A.

The above case is typical and shows clearly that where the load factor is high the ratio of iron to copper loss is of little importance. Similar considerations must be made for each individual case.

Specified overloads where required must be taken into account in conjunction with economical considerations in settling the most suitable proportions of iron and copper losses.

It is, however, becoming usual to adopt the British Standard rating. On this basis no overloads are permitted, the rating being the maximum for 50 deg. C. temperature rise in oil, at 40 deg. C. air temperature, giving a maximum oil temperature of 90 deg. C., which is the safe working limit.

Where the plant is not rated on this basis it is customary to call for a lower temperature rise of 40 or 45 deg. C., which allows for specified overloads. It is very desirable to rate all plant on the same temperature basis, and it is to be hoped that the British Standard rating will be generally adopted.

(To be concluded.)

Discussion at Newcastle-upon-Tyne.

On March 17th the paper was read and discussed before the North-Eastern Centre of the Institution of Electrical Engineers.

Mr. A. A. **Hughes**, opening the discussion, said the portion of the paper which appeared to call for most comment was that dealing with cooling. It should be borne in mind that for forced cooling continual attendance was not absolutely necessary, even though desirable. On their system they had forced-cooled transformers in sub-stations situate some distance from the nearest power station, and which were only visited one or twice during each shift. They installed in each transformer two thermostats, one operated a "buzzer" in the power station when the temperature of the oil reached 80 deg. C., and the other tripped the transformer switches when the temperature reached 90 deg. C. With regard to self-cooled transformers, he agreed that good clearances were necessary between the tank and the chamber wall. The authors' figures were on the small side, and he suggested allowing a clearance all round equal to half the width of the transformer tank. He thought sub-station transformers should be of the core type to facilitate repairs. Spare coils could be fitted in case of breakdown inside 24 hours, whereas a shell-type transformer had almost invariably to go to the makers for repairs. A further disadvantage of the rectangular-shell type was that the coils were not in direct contact with the oil. The wave-shaped distance pieces which formed the oil ducts would in time become blocked with sludge, and as to adjustable coil supports, he thought the arrangement of springs seemed to be the better one.

Mr. H. S. **Ellis**, referring to forms of protection between the high and low-pressure windings, said he was interested in that subject more particularly in small transformers. He had in mind Regulation 20 of the Home Office Rules, and also the B. of T. regulations.

Mr. **Longman** referred to the undue heating of the iron in transformers. Was there any likelihood, he asked, of transformer iron being improved in quality?

Mr. J. R. **Beard** referred to the limitation in the size of transformers being affected by the methods of transport, and suggested they might be conveyed by road. He drew attention to outdoor transformers, which were used a good deal in the U.S.A. He was surprised there had been no mention made of oil; it was a very important matter.

Mr. **Stobie** suggested that the change in the iron in transformers might be due to a change in the granular formation owing to the temperature at which transformers worked; the crystal grains, probably, would become greater than they were originally. They found that in steel that accounted for a great loss in physical qualities; it was possible, too, that there might be a chemical change, not a change of the total elements, but in the combination of elements in the steel itself.

Mr. J. L. **Thompson**, in reply, said that as to temperature rises, the figures given were based upon actual test results. As to protection between windings, personally he did not recommend earthing shields. They could be replaced by earthing a neutral point on one side of the low-tension winding and on one side of the transformer.

THE INDUSTRIAL SITUATION.

At the quarterly meeting of the **British Electrical Federation**, held on April 28th, Mr. E. **Garcke** delivered an address on "The Industrial Situation." He said that the war was not the only cause of the present unrest. It certainly had accentuated the troubles by increasing the cost of living, by giving the masses a greater consciousness of their power, and by strengthening the feeling that a nation which was able to spend seven millions a day for four or five years on war was not entitled to deny to the masses the means of decent subsistence. The war had, in many instances, torn the scales from the eyes of employers, and forced them to see things as they really were. By the light of this clearer vision many employers had come to regard conditions as intolerable which before had only seemed inevitable. This was especially true of the conditions in which unskilled labourers were living before the war.

A new readjustment of the social order of things was imperatively necessary if we wished to repair the economic ravages of the war, to inaugurate industrial peace, and to prevent a famine of capital a few years hence. The time and opportunity for introducing these changes had come; but we required enlightened public opinion and far-reaching statesmanship, and not merely time-serving politics.

Writers and speakers on the subject might be divided into three classes:—(1) Those who urged the supremacy of Capital and were for "fighting it out"; (2) those who claimed that Labour was paramount, and who advocated nationalisation, municipalisation, and other forms of communalisation, which would give Labour the control of industry; (3) those who took a middle course and looked for reconciliation and adjustment, and who advocated Whitley Councils, conferences, &c., as a means of settling disputes.

The third of these categories was a mixed one, including a large proportion of the people who were not interested in the aspirations of Labour or of Capital. Representatives of Labour and of Capital were also to be found among this class, recognising, as they did, that both Labour and Capital had just grievances against each other, and sincerely believing that the trouble could be lessened by a spirit of compromise, and by the enlightenment of the masses in economic principles. It also included a large sprinkling of people who were in the habit of letting others think for them, who, led or deterred by phrases which they did not take the trouble to understand, condemned the profiteer and added to the clamour for nationalisation and municipalisation.

It was mainly to the last of these classes that we had to appeal to find a permanent solution of the industrial difficulties.

The temporary settlement with the miners had been possible because they had in view the certainty of the Sankey Committee recommending nationalisation of the mines in some form. The nationalisation of railways would follow, and we should go from one industry to another in this direction. Nationalisation had been described as the last hope of a bankrupt statesman, because there was a feeling that there was no satisfactory alternative between unlimited competition and collectivism. When it was too late and the mists had cleared, we should find ourselves deluded; and then perhaps an effort would be made to find the natural equilibrium, and not merely the political mean.

It was the duty of every man who was able to think about these matters to formulate proposals with a view to strengthening the foundations, and not merely patching up the cracks in the wall.

The proposition which he submitted was that we should discard the dual conception of Capital and Labour, and regard the productive capacities of societies as conjoint for the production of the surplus necessary for continued progress. We required both Labour and Capital to utilise the resources of Nature. Capital and Labour were as the two halves of a pair of scissors, and we should make no headway in this discussion until we were thoroughly imbued with the conviction that either half by itself would do very little cutting. Without capital there could be no collective employment of labour, and in order to provide capital there must be abstinence, the reward for which was profit. Without labour there could be no use for capital, and to induce labour to make the best use of capital it must have its fair share of profit. There could be no industrial peace, nor any industrial progress, until Labour and Capital recognised that production must be increased, and that this could only be achieved by their concerted action, better organisation, and the far greater use of machinery. The belief that labour-saving machinery brought unemployment in its train must be dispelled. In 1907 the census of production showed that the net yearly output per worker was £102. It was surely clear that with such a standard of production it was not possible to attract capital and ameliorate the conditions of labour. But a knowledge that Capital and Labour were working to one end, and a knowledge that the more that was produced the richer was the community as a whole, would not be sufficient to assuage the unrest. What was required further was the creation of some satisfactory machinery for the distribution of the surplus or profit between the various parties who had contributed to its production, according to their claims, merits, and rights respectively.

The old ideas of profit-sharing were inadequate. Labour must be identified with the surplus—not merely entitled to a share of it dependent on sliding scales and other formulæ which had no permanent basis, but were apt to be upset by alteration of prices, new inventions, foreign competition, and other varying conditions. There must be complete economic combination of the elements of production—not merely an artificial mixture of parts which were oscillating, colliding, and conflicting.

Thoughts on these lines suggested that a complete solution might be obtained by the machinery of "pooling" the net profit or surplus for division among all who had contributed to it by their work, whether manual or mental, and by their abstinence and enterprise. Under present conditions an employé had little inducement to work fully and well. The employer benefited more by good and hard work than the worker; consequently, the latter had little inducement to make efforts beyond the point necessary to keep him in his employment.

The process of "pooling" the whole of the profits presented a difficult but, he believed, not insurmountable problem of statesmanship. Broadly speaking, the profit or surplus in modern industry was the difference between the selling price and the cost of production, in which latter should be included: (*a*) wages to provide for the human needs of labour; (*b*) the cost of raw materials and all standing charges; (*c*) the replacement of renewable capital, the adequate maintenance of fixed capital, and the provision of proper reserves for contingencies; (*d*) reasonable reward for managers, inventors, designers, and brain workers generally who have taken part in the production; and (*e*) necessary interest on the capital embarked. After these items had been provided for out of the selling price or revenue, the surplus should be distributed equitably between the various contributors, manual workers, brain-workers, and capitalists in proportions to be settled for each industry, area, and undertaking.

It would require some machinery to do this, but a large bureaucracy, say a Ministry of Profits, would be better employed in framing principles to govern this distribution than by hampering production in the futile attempt to run national industries on commercial lines. The existing organisation for settling liability for income tax offered an anology to the sort of machinery required. Such a Ministry would be subject to Parliament, and linked to the business and industry of the country by commissioners, whose functions would be to see that the correct surplus was paid into the "pool," and that claims to an equitable division of the surplus were fairly adjusted.

The management and administration of undertakings would be left to private enterprise as at present, with the lure of profit and success to make them efficient, but all those who contributed to the production of its surplus should be afforded ample opportunities of understanding the object and intricacies of the organisation, and should be represented in its control.

The underlying merit of this proposition was that we should not abolish profit, but, on the contrary, enormously increase it by adding to every man's stimulus to augment it. The scheme might look like socialism, but it was also individualism, and thus we should get not alone a balance of natural forces, but also the happy mean which was the aim of our political system, and the feature of all economic experience.

Production of wealth—though it was not the only thing for making contentment—was the paramount condition of well-being, but the world had now for the first time in history reached a point at which well-being was seen to be dependent also on the problem of how the wealth could be equitably distributed. The solution could not be found by destroying profits and eliminating capital, but it could be found, by a recognition of the first principle, that profits belonged to the producers of profit, and all that was required was the necessary machinery to ascertain who were the producers and what was their fair share in an equitable division of the product. To take the view that capitalists paying wages to the workers were entitled to the whole of the profits, ignored even the more moderate temper of the proletariat, according to which labour paying interest to the capitalist should take all the profits. The other notion that one man's profit was another's loss applied only to operations in the nature of gambling, where there was a transfer of counters, but no production of wealth.

THE BELFAST EXTENSION SCHEME.

A special meeting of the Belfast Corporation in committee was held on April 26th to consider reports from Sir John Snell and Mr. J. H. Rider on the extension scheme of the electricity works. It will be remembered that the total estimate submitted to the Local Government Board inquiry last year was £310,000, but it was recently discovered that this estimate will be greatly exceeded. It now appears that the buildings instead of £48,000 are to cost £217,000, and the cost of the plant will be £411,000. This, with £20,000 for the site, makes a total of £648,000. The lowest tender for the foundations alone was £115,000. The Corporation has entered into agreements to supply the shipyards with electricity for ten years at prices based on the original estimates, which prices cannot be varied except by variations in the price of coal. Mr. Rider attended the meeting, and gave a lengthy explanation of the revised estimates, and made suggestions for overcoming the present difficulty. The new detailed estimate which is based mainly on tenders, is: Land, £20,000; buildings, £216,960; plant, £345,000; accumulators, £4,500; cables and laying, £61,500; total, £648,590. The great excess over the original estimate is in the cost of buildings and foundations, namely, £162,000. It is admitted that the original estimate of £48,000 was too low, and was made before plans had been prepared. As soon as preliminary plans were made (including an engine room to accommodate 25,000-kw. sets) it was evident that larger and more costly buildings would be required. Regarding the contracts with the shipyards, if the capital charges were to be taken on the former basis and on the present capital estimates, they would involve an annual loss of £16,400. It was suggested that a longer period for repayment of the loan be obtained, and new estimates were submitted, with the new capital charges based on an equated period of 30 years in place of the old figure, with interest payable at 5 per cent., and sinking fund payments spread over 30 years, and re-invested at 4½ per cent., on which basis the undertaking would be in a sound financial position with a net surplus of about £7,400 as soon as the first section of the harbour station was at work. The promotion of a Bill was recommended to authorise the payment of interest on the new capital out of capital and the suspension of the sinking fund payments during the construction period. It was also suggested that the L.G.B. be asked to grant loans for the following periods; 100 years for buildings, 60 years for foundations and river work, 25 years for plant, and 30 years for cables, or an equated period of 30 years for the whole. Consideration of the matter was adjourned.

Chemical Actions in the Lead Accumulator.—The usual equations for the chemical actions in a lead cell are not sufficient to explain the facts, says a writer in the *Bulletin* of the Société Française des Electriciens. The e.m.f. produced does not agree with the value theoretically calculated from the thermochemical reactions involved, and a number of physical phenomena are not explained. According to the usually accepted theory the weight of the positive and negative plates should vary to the same extent, whereas the positive plates are actually practically unaltered in weight during charge and discharge. Other circumstances, such as the changes of colour observed in the positive and negative plates, do not bear out the usually accepted theory. The researches indicated by the author tend to show that an oxide richer in oxygen than PbO_2 is present at the beginning of the discharge, and that the positive active material is not PbO_2, but Pb_3O_7 or Pb_2O_4. Regarding the negative plate, it is concluded that the negative active material does not get transformed on discharge into $PbSO_4$, but into Pb_2SO_4.

THE PROPULSION OF THE MODERN SUBMERSIBLE TORPEDO BOAT.

By Captain NORMAN H. WOOD, R.A.F.

(*Abstract of paper read before the* Institute of Marine Engineers.)

Almost without exception, modern submersibles have their main propelling machinery arranged engine-clutch-motor-clutch-propeller shaft, and to all outward appearances this procedure would appear to be perfect. In practice, however, it has been found to offer considerable drawbacks, especially in war time, due principally to the negative reciprocating action of the Diesel engine on the clutches. The only type of coupling available is the claw, and no matter how carefully the machining of the dogs may be carried out, eventually a rattling and hammering is set up which causes considerable trouble.

One of the principal requirements of an ocean-going submersible in war time is that it shall be able to dive or rise to the surface without the slightest trouble and loss of time in changing over from one prime mover to the other, or in the starting up and stopping of the same. Under existing circumstances, after a dive, it is imperative to start up the Diesel engines by means of compressed air owing to the grave injuries that might be sustained in the event of water having leaked into the cylinders and the engines being brought up to speed by the main motors. The usual practice is to stop the electric motors, turn the engines by means of their toggle gear until the couplings can be inserted, and then turn the engine, motor, and propeller shafts through the same medium until the correct starting position for the pistons has been reached, and then to turn on the compressed air. Trouble in starting the engine may cause large quantities of compressed air to be drawn from the main storage system in a few minutes, which may take as many hours to replace.

Every practical seagoing marine engineer will appreciate the very important disadvantages of having the main propelling shaft split up into three separate lengths, each connected by a sliding dog-clutch, and the practical impossibility of maintaining these in true alignment under seagoing conditions.

The starting-up of the Diesel engines by means of compressed air has been found to present a number of serious disadvantages. Experience has shown that the cylinder heads of Diesel engines often crack after the machines have been running some time and are then stopped, and restarted with compressed air which on entry to the cylinders must (on expansion) be at a refrigerating temperature.

High speeds on the surface demand very greatly increased outputs by the prime movers. Efficient submersible type Diesel engines of 150 to 200 h.p. per cylinder have been successfully constructed, but as soon as larger units are attempted difficulties multiply rapidly. The Diesel engine increases in weight per h.p. as the size of the engine increases.

Perhaps the greatest disadvantage of the modern type submersible is the fact that the rate at which the battery can be charged is practically in direct ratio to the speed of the prime movers and thereby the speed of the vessel. The great war has proved that the underwater craft are only dangerous when submerged, and, on the other hand, that a submersible's only chance of escaping from high-speed surface craft lies in being able to submerge quickly and for a long period. On rising to the surface again there are times when all possible speed must be crammed on in an endeavour to escape, but after night-fall it may be found advisable to cruise slowly about and at the same time charge the battery in the least possible space of time. Two courses are open to the commander: (*a*) to travel at a good speed, and thus revolve the dynamos at high speed; (*b*) to uncouple the propeller shaft and utilise the full power of the engines to charge the battery. The first procedure entails the unnecessary consumption of oil fuel and thereby lowers the cruising radius of the vessel; the second places the vessel at the mercy of enemy underwater craft.

A short summary of the disadvantages claimed for the present system of propulsion is: the couplings; difficulties experienced in starting up the Diesel engines and the dangers entailed by using compressed air to effect this purpose; the possible uncertainty of messages transmitted through the voice pipe or engine room telegraph being correctly given or received when reliance is placed on the human element; the necessity of carrying large quantities of compressed air; the probable loss of the vessel in war time should one of the prime movers break down hopelessly on the high seas; and lastly, the almost impossibility of charging the battery quickly when the vessel is proceeding slowly on the surface.

To eliminate entirely these disadvantages the "Wood" system of propulsion has been projected. With this system a submersible would be fitted with high-speed prime movers directly coupled to light-weight electric generating sets and electrically coupled to low-speed, light-weight electric motors directly coupled to the propeller shafts, making use of the electrical elements to effect a reduction in speed without resorting to gear boxes, &c. With this arrangement the greatest possible efficiency in every way is achieved so far as the marine propeller is concerned, and the manœuvring capabilities of a submersible thus equipped are increased enormously. As the propeller shafts are directly coupled to the main propelling motors loose couplings are entirely eliminated. The vessel can be driven "ahead" or "astern" at full speed or any other speed by controlling the main propelling motors without interfering with the speed or direction of rotation of the prime movers. It is possible therefore to fit high-class reliable governors to the engines driving the dynamos. In the event of the propellers coming out of the water racing does not occur, and the cruising radius of a submersible thus equipped is considerably increased.

The fuel consumption of the internal-combustion engine increases very quickly if the load is taken off, but in the "Wood" system each prime mover is kept always as fully loaded as possible, and the r.p.m. constant. At very low speed the current consumption of the main propelling motors will be so calculated as to ensure one of the prime movers being fully loaded. At half speed the current consumption will ensure two generating sets being fully loaded, and so on until full speed is reached, when all the generating sets will be in commission. It is, however, only on rare occasions that full speed is necessary; the ordinary cruising speed is about three-quarters full speed, so that one or more generating sets are always available to charge the battery up or act as "stand-bys." The great drawback of the battery charging rate being in direct ratio to the r.p.m. of the propelling machinery is entirely eliminated by this system, as one generating set can be utilised to supply the main motors and all other sets can be placed on the battery charging load. The great elasticity of the system is further proved by the fact that should the vessel be travelling at its lowest speed, and only one generating set be on load, and this break down, no alteration or diminution in the vessel's speed would be possible as the battery would at once pick up the load and carry on until one of the other generating sets could be brought up to speed and switched on to the main busbars. Should engine trouble develop, little damage would be sustained, as the dynamo would motor at practically the same speed in the same direction, and the failure of the set to supply current would immediately be recorded by the ammeter. Should the dynamo break down, the fuses would blow, isolating the set, and the governor would prevent the engine from racing, and here again the ammeter would show that something was wrong. In the event of ordinary internal-combustion engines being installed as prime movers, any delays in starting up would offer very few, if any, disadvantages as the vessel could be driven by the battery until the engines could be brought up to speed and made to take over the load. It would still be necessary, after a dive, to start up the engines pneumatically, but starting is simplified enormously owing to the no-load conditions. As the motors and generators are separate units, the distribution of the whole plant is rendered much more elastic in every way. To save weight it is advisable to reduce the lengths of the propeller shafts to the utmost, which procedure demands that the main motors shall be placed as far aft as possible, but the generating sets can be distributed about the vessel at will and thereby prevent the whole submersible from becoming inoperative, as is the case under existing conditions if the engine room is flooded. The greatest danger lies in the main motor compartment being damaged by shell fire or other such cause, and springing a leak. This eventuality is minimised to a great extent by the fact that the after portion of the watertight pressure hull in a submersible is always well below the water line, even when travelling on the surface, so that the chance of such a trouble occurring can be accepted as a legitimate war risk.

To reduce their diameters and to facilitate starting and speed regulation, the main motors would be split up into two units, each capable of delivering half the total output required for each propeller shaft. The same methods of construction would be applied to the generators, to ensure the base plates and diameters of the yokes not being greater than the width of their respective engines, and thus allow of the complete sets being efficient so far as stowing space was concerned. The "Wood" system enables greater speeds with increased displacements to be achieved, as an increase in the total output merely demands an increase in the number of main propelling motors attached to each propeller shaft, and a corresponding increase in the number of generating sets.

In all cases the main control switch-gears would be placed as close to their respective units as possible, to reduce to a minimum the lengths of heavy cable necessary to effect control. Automatically operated switchgear would be made use of, however, with the operating auxiliary controllers placed adjacent to the conning tower and periscopes and so arranged that they could be worked from the bridge, conning tower, or inboard steering position, and thus enable perfect control of the whole propelling machinery to be undertaken by the officer on watch without the necessity of resorting to voice pipes, bells, telegraphs, or telephones. Instructions would be issued to the engine-room staffs to open the valves controlling the prime-mover exhaust boxes after each dive as soon as the vessel was completely on the surface, and to start up each engine pneumatically and allow it to run on no load for a few seconds, and then shut it down. This method of procedure would ensure that any water that had leaked into the engines whilst the vessel was submerged would be blown overboard, and thus enable the engines to be started up by the officer on watch at any moment by switching the dynamos on to the main busbars and causing them to motor until the engines could pick up and carry on. The current for the first set started up thus would be taken from the battery.

Should the vessel be proceeding at slow speed on the surface and a crash dive become necessary, the officer on watch on the bridge would immediately ring the diving gongs to summon the members of the crew to their diving stations, and then quickly take each generating set off load by means of the automatic control gear before leaving the bridge. He would then descend through the conning tower into the inboard steering position, and take over the control of the vessel from this position. But no stopping of the propellers or starting-up of the main motors as at present would find place in the programme, because as soon as the generating sets were shut down the battery would pick up the load, and the vessel would proceed at the same speed.

A submersible fitted with the "Wood" system of propulsion would therefore be able to dive very much quicker than theretofore, because as soon as the diving gongs rang the coxwain and his mate would immediately operate the diving rudders to cause the vessel to slip under water, without waiting for instructions from the engine room to the effect that the engines had been stopped, their couplings undone, and the main motors started up, &c.

This system would, of course, entail a great deal more work on the part of the vessel's commanding officer, but at the same time relieve his anxiety and trouble during a crash dive, as the engine-room staff would not be tumbling over each other to carry out their duties as under existing conditions.

As an example, it is assumed that the power required to drive a submersible displacing 1,200 tons on the surface at 18 knots = 2,400 B.H.P. To comply with the requirements of the "Wood" system four high-speed generating sets, each capable of delivering 530 KW. at 220 to 300 volts with 750 R.P.M. continuously, would be installed in conjunction with two electric motors, each capable of delivering 1,200 B.H.P. at 220 to 300 volts with 50 to 200 R.P.M. continuously, together with two electric storage batteries of 120 cells each, coupled in parallel, with the following total outputs.

8,000 ampere-hours at the 1 hour rate of discharge.
11,650 ampere-hours at the 3 hour rate of discharge.
15,100 ampere-hours at the 10 hour rate of discharge.

This battery would have a sufficiently large output to drive the vessel at very nearly full speed for roughly an hour or lesser speeds for greatly increased times before the voltage of each cell fell below 1.8 volts.

Each of the main propelling motors would be split up into two separate units of the shunt-wound open type, fitted with compensated windings and commutating poles. Series-parallel speed regulation would be used.

The dynamos would be of the same construction as the motors, but with the armature windings always coupled in series.

To permit all the controlling switchgears to be automatically operated from the centre control position, in the "Wood" system, ordinary quick-break knife-type switchgear would be installed, but the individual switches would be caused to cut in and out very quickly by means of small gear wheels and clutches operated by small high-speed series-wound electric motors with flywheel attachments to gather up inertia and discharge the same where needed whilst working the gears. The starting of these motors would be effected by means of the master hand-operated controllers in the centre control position, and stopping by the action of small limit switches attached to each switchgear.

To increase the efficiency and to decrease the slip and thereby the cavitation of the propellers the submersible will further be fitted with the "Birkett Regenerative Stator" propellers, which ensure an increase in speed of from 5 to 10 per cent. in the case where the existing propeller is used, and from 10 to 15 per cent. in the case where a new propeller, designed to operate with the stator propeller, is fitted, without in any way increasing the normal output and revolutions of the prime mover.

After considerable study and research work to find a suitable prime mover for the "Wood" submersible, the conclusion has been arrived at that an interesting type of engine, the invention of Capt. Wm. P. Durtnall, embodies not one, but many features which are highly desirable and significant.

In adopting the "Paragon" cycle for submersible prime movers, the fact has been taken into consideration that a very considerable increase in the travelling radius at various speeds is possible, owing to the high thermal efficiency of Capt. Durtnall's double-acting engines. The six-cylinder design is capable of developing 750 B.H.P. at 750 R.P.M. It operates on the 4-cycle principle, and is fitted with light-weight pistons of ordinary steam engine design (but cooled by means of pure water circulation) and crossheads.

The engines are further fitted with balanced-piston-type valves, a feature that is possible owing to the better general heat conditions under which these engines will operate. As the valves are "pulled" instead of being "pushed" off their seatings their duty is considerably lightened, especially when it is borne in mind that the expansion is taken down to about 3 lb. above the pressure of the atmosphere before the exhaust valve opens.

A very important feature in this design of engine is the fact that being of the "double-acting" type, the cylinders are entirely sealed up, and no burnt or other gases can possibly be liberated into the engine room. For a given power and speed the height is less than the "single-acting" type, the moving parts are lighter, the momentum and inertia losses are consequently smaller, the bearing surfaces are reduced with safety, the turning moment is extremely even (in fact almost as good as a turbine), and consequently no fly-wheel is required. Each engine is estimated not to exceed about 10.45 lb. per H.P.

In the "Wood" submersible these engines would be started electrically by the dynamo being made to run as motor from the battery; the ordinary atmospheric air being used and compressed to about 300 lb. per square inch, the maximum pressure the cylinders will have to stand. Bearing in mind that the explosion pressure of the "Otto" cycle type of engine reaches this pressure and the cylinders have to be designed to withstand this, the "Paragon" engine need not be constructed to weigh more than the ordinary "Otto" type engine installed in the earlier type submersibles. This very important feature, combined with the fact that the necessity for a flywheel has been entirely eliminated, ensures the production of a light weight, simple, reliable, and efficient type of prime mover, automatic in action, and yet combining the maximum of output with the minimum of weight and stowage space.

These engines will operate on gas made at about 400 lb. pressure from a special liquid fuel prepared from coal or crude residue oil, in oil-gas producers, very small in size, yet possessing high thermal efficiency with the minimum of weight.

INSULATION FOR INSTRUMENT TRANSFORMERS.

Mr. C. Sarkar, electrical engineer, of Jamshedpur, India, has sent us the following particulars of a method which he has devised for improving the insulation of high-pressure instrument transformers, with particular reference to the attainment of reliability and safety in this admittedly weak link in the chain of connections:—

Hitherto it has been customary to insulate the high-pressure coils of instrument transformers by wrapping round them empire cloth, rubber tape, or the like, but this method is not sound and reliable; it is impossible to get uniform wrapping all round the coil and its corners under manufacturing conditions. It is quite possible to find six layers in one place and three layers in another. It is also impossible to determine by inspection whether a coil has been insulated with three or four layers of insulating material. Empire cloth insulation may stand a high-voltage test for a short time, but the strain of the high voltage may injure the insulation, and it may give way afterwards. The designing engineer has no reliable figures to calculate the insulation, but has generally to depend on an empirical rule. The accuracy of the instrument transformer depends to a large extent upon putting the primary, secondary, and core close together, but we cannot employ a large factor of safety without increasing the distance between

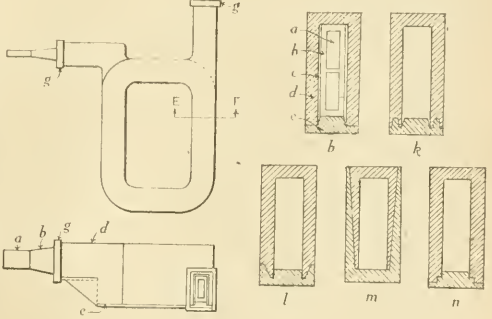


Fig. 1.

these parts; this will increase the inaccuracy of the measuring instruments and decrease the sensitiveness of the protective gear. There is also great difficulty in bringing out the two ends of the primary winding. The instrument transformer is the weakest point in the whole of the switchgear; except the generator itself there is no weaker point in the whole circuit. Hence it is very desirable to have a more reliable and accurate instrument transformer. Compound or oil immersion does not improve the insulation between primary, secondary, and core to any great extent.

A better plan is to have a trough or housing made of porcelain, bakelite or similar hard insulating material. In this trough the high-pressure coil, which is insulated with empire cloth for ordinary voltage, is completely enclosed. The trough may be of any convenient shape to suit the form of the coil. It may, for example, consist of a hollow central body having at two points tubular branches, the body being adapted to receive the lightly-insulated finished coil, and the branches the terminal leads thereof; a similarly shaped lid or cover is put over the trough, thus completely covering the coil. Two rings can then be slipped over the ends to keep the trough and its lid in position, and in addition it may be bound with string at different places.

In fig. 1 is shown the completely insulated high-pressure coil of a current transformer in a trough; *a* is the copper strip terminal, *b* is a wrapping of empire cloth, *d* is the trough made in one piece, and *c* is the lid, *g* is the ring made of insulating material to keep the trough and lid in position.

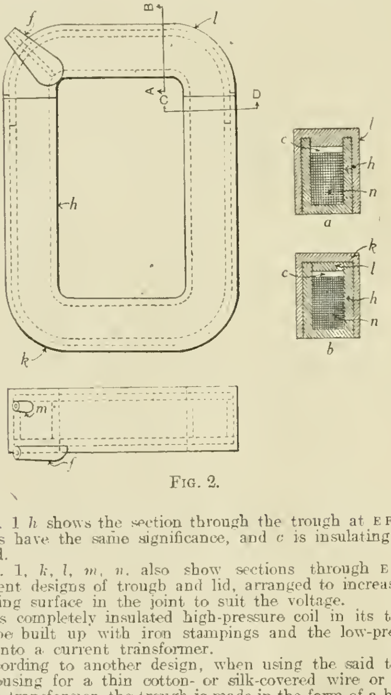


FIG. 2.

Fig. 1 *h* shows the section through the trough at E F; the letters have the same significance, and *c* is insulating compound.

Fig. 1, *k*, *l*, *m*, *n*, also show sections through E F for different designs of trough and lid, arranged to increase the creeping surface in the joint to suit the voltage.

This completely insulated high-pressure coil in its trough can be built up with iron stampings and the low-pressure coil into a current transformer.

According to another design, when using the said trough or housing for a thin cotton- or silk-covered wire or for a shunt transformer, the trough is made in the form of a bobbin of porcelain, or other hard insulating material, and the wire is wound straight into the said bobbin, with the usual paper insulation between the layers. The end of the bottom layer should be brought out through the knob or terminal of suitable shape as shown at *f*, fig. 2, thus leaving no chance of breakage of the lead. The bobbin, with the coil in place, can be impregnated with insulation in vacuum, as usual; then two lids or covers are put on (one at the bottom and the other at the top, with a knob to bring the top end of the coil out) after pouring hot insulating compound over the bobbin, so that the compound will fill the joints between the bobbin and its lids; thus making a solid job without leaving an air-space anywhere. The bottom lid overlaps the top lid for some distance at their joint, thus completely covering the coil. String hinders may be used at different places to keep the bobbin and its lids in position. Different designs of bobbins and lids may be used as shown in the case of the current transformer, increasing the length of the creeping surface through the joint, to suit the voltage.

In fig. 2 is shown the completely insulated high-pressure coil of a shunt transformer.

Fig. 2 *a* shows a section through the coil and bobbin at A B, and fig. 2 *b* shows a similar section at C D.

In fig. 2 *f* is the knob or terminal to bring the bottom end of the coil out, and is made in one piece with the bobbin *h*; *m* is the knob to bring the top end of the coil out, and is made in one piece with the top lid *l*; *l* is the top lid or cover with knob *m*, and is arranged to be overlapped by the bottom lid *k*, as shown; *n* is the high-pressure coil of cotton-covered wire with the usual insulation between the layers; *c* is insulating compound.

The above method of insulation may be easily adapted to electric circuit protective gear, both for current and pressure coils. The same size of trough may be used for instrument transformers of different capacities as the ampere-turns of the different transformers are approximately the same.

WIRELESS DIRECTION-FINDING APPARATUS.

An interesting article is contributed by Capt. A. S. Blatterman, U.S.A. Signal Corps, to the *Electrical World*, on the uses of wireless direction-finding apparatus. A listening station may intercept enemy communications, and determine by measurements their origin. This is known as goniometry. Again, a flying machine may determine by wireless measurements the direction of fixed ground transmitting stations, and thereby the pilot is able to navigate his ship in a manner analogous to methods involving the readings of a magnetic compass.

The loop, as commonly used for directional receiving, consists of a vertical closed coil of several turns of wire which can be tuned to incoming waves by means of a variable condenser connected across its terminals. A detector is connected either directly or inductively to the oscillating circuit so formed, the most common arrangement being that shown in fig. 1. Such a system, when properly designed and used in connection with a sensitive multi-stage vacuum-tube amplifier detector device, may be effectively employed for receiving wireless signals over very long distances. For instance, it is easily possible to hear the high-power stations of Europe in America by using a loop frame 5 ft. or 6 ft. (1·5 m. or 1·8 m.) square with 20 or 30 turns of wire on it.

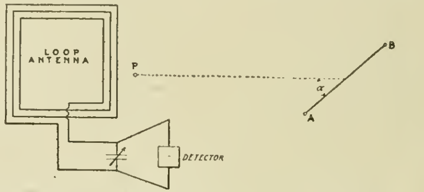


Fig. 1.—Common Arrangement. Fig. 2.—Plan of Loop of Loop Receiver and Detector. Receiving from P.

The use of this type of antenna as an apparatus for locating the direction of a transmitting station depends on the fact that a vertically placed coil such as that described receives electromagnetic wave energy best when its plane coincides with the direction from which the waves are arriving, and practically not at all when placed at right angles to the direction of wave travel. Thus, in the practical use of the apparatus it is only necessary to be able to orient the loop about a vertical axis, noting the strength of signals at different settings, in order to locate the direction of the source of any wireless message that may be picked up. If two receivers equipped with this kind of apparatus are set up a known distance apart and both determine from their respective locations the direction of a certain transmitting station with respect to the geographic north and south meridian, it becomes a simple matter of triangulation on the known base line joining the receivers to fix definitely the exact position of the transmitter.

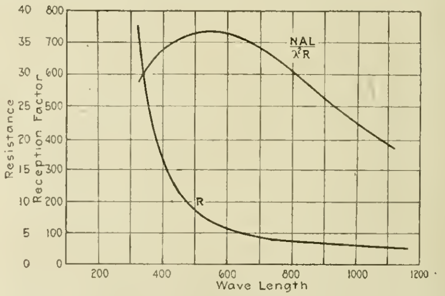


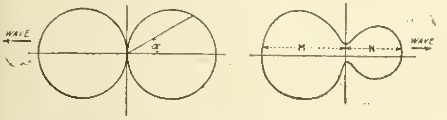
Fig. 3.—Variation of Resistance and Reception Factor of Loop with Wave Length.

In order to get the best results from the loop receiver it is necessary to proportion the size of loop properly, the number of turns, their spacing, the size and kind of wire, &c., to the wave lengths to be employed. Charts have been worked out from which it is possible to design these coils quickly for any desired wave length, so as to get maximum receiving efficiency.

The effective value of E.M.F. induced in a loop of N turns and threaded by a harmonic flux ϕ, such as produced by sustained oscillations in a distant radio antenna, $E = \sqrt{2}\,\pi f N A H$, where f = frequency, A = area enclosed by loop, H = field intensity.

If the loop is tuned to the frequency of the field in which it is placed by means of a condenser across its terminals, the impedance of the circuit so formed becomes equal to the resistance of the circuit, and the R.M.S. current flowing will be $I = \sqrt{2}\, f N A H \pi / R$.

This current produces a voltage across the tuning condenser, which is used to actuate the detector of the radio receiving set (fig. 1). The value of this voltage is given by the expression $E_c = k N A L / \lambda^2 R$, where k = a constant, L = inductance of loop, λ = wave length, R = effective resistance of loop circuit.



Figs. 4 and 5.—Theoretical and Actual Directional Characteristic of Loop Obtained in Practice.

It is found that none of the factors N, A, L or λ can be varied without affecting the value of R. and most important of all is the very marked effect of changing wave length on the effective resistance. In fact, this circumstance gives rise to the existence of a critical optimum wave length for any given loop at which signals have their maximum strength, as indicated in fig. 3.

As has been stated above, the loop antenna has very pronounced directional characteristics. If A B (fig. 2) represents the plan view of the loop, which is receiving waves sent out from P, the flux threading the loop is proportional to cos α. Hence the received current will vary for different angular displacements in a manner which can be represented by a polar curve characteristic, consisting of two tangent circles (fig. 4). This would indicate that when the plane of the loop is at right angles to the direction of propagation no energy will be received, while strongest signals will occur when the plane of the loop coincides with the direction of wave travel. For direction finding the loop would be oriented until no sound was heard in the receiving telephones. In practice, conclusions based on the general theory must be somewhat modified.

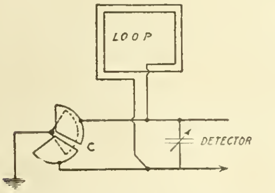


Fig. 6.—Condenser Compensator for Improving Directional Accuracy.

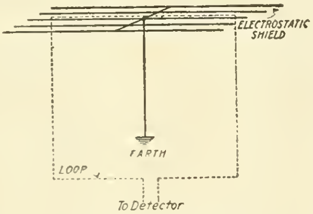


Fig. 7.—Electrostatic Shield above Loop.

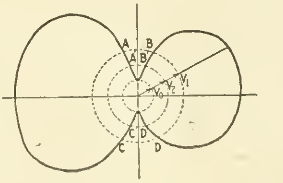


Fig. 8.—Effect of Detector Sensitiveness on Directional Accuracy.

In general, the polar curves are not circles, but are changed according to the shape and dimensions of the loop, the manner of winding, proximity to the earth's surface or near-by conductors, the nature of the ground, and the arrangement and disposition of the receiving apparatus. Thus a typical characteristic obtained by measurement of received signal at different angular positions of the loop is similar to that shown in fig. 5. The two maxima and the two minima are unequal, and the curve is distorted. Investigation of this distortion effect led to the development of methods for controlling it, either increasing it principally to augment the asymmetry of the maxima, and thus secure a device which would indicate not only the line of the transmitting station, but its sense or absolute direction, or else decreasing the dissymmetry in such a way that a very sharp minimum is secured, thus gaining directional accuracy.

There are several ways of increasing the sharpness and symmetry of the minima of the polar curve. The solenoidal type of winding is better in this respect than the flat pancake loop. A small condenser C (fig. 6), by means of which the capacity to earth of the two loop terminals may be equalised is helpful. Another method is to use an electrostatic shield, consisting of a harp of parallel wires placed horizontally just above the loop, and earthed (fig. 7).

Flat pancake loops, with unequal maxima and minima, have been used for finding absolute direction, since, after finding the line by means of right-angle settings, it is only necessary to swing the loop into the position for maximum signals, and compare the strengths M and N (fig. 5), by reversing the loop 180°, or by interchanging the condenser connections. When a loop is placed with its winding plane parallel to earth it becomes non-directional, and receives signals equally well from all directions. This arrangement is therefore valuable for intercept work.

The accuracy of the direction finder, and the speed with which settings can be made, depend on the sharpness of the minimum points in the directional polar characteristic. If the sensitiveness is great, it is often difficult to find an absolute zero as the loop is rotated. Nevertheless, it is generally desirable to have the direction sensitiveness as great as possible, for the following reasons. If the polar curve is as shown in fig. 8, and the sensitiveness of the detecting apparatus is such that it just responds to potentials of value V_1 and voltages less than this cannot be detected, then as the loop is rotated zero response will be obtained throughout the regions A B and C D. If, however, the detector sensitiveness is greater, so that smaller voltages down to the value V_2 can be detected, the zero regions are narrowed down to A′ B′ and C′ D′, and the apparatus becomes more accurate. By further increasing the sensitiveness still greater accuracy is obtained as the zero regions are further narrowed, and, in the case shown, an increase in sensitiveness to correspond to the potenial V_0 would give a single point or position where there would be zero response.

It is very desirable to produce this condition, but to do so requires extremely sensitive detecting apparatus as well as a very sharp antenna (loop) characteristic. If the zero regions are wider than a few degrees, so that they cannot be accurately and quickly bisected experimentally, the average of the four readings A, B, C, D, where the signal becomes inaudible, must be taken as an indication of the true minimum. This requires time. It has, however, been found to give good accuracy provided the regions of silence do not exceed about 30°.

With the uncompensated loop the mid-points of the regions A B and C D are not 180° apart, which makes it necessary to average all four readings as just described. The electrostatic shield effectively removes this dissymmetry.

In working out a small portable outfit for field use the size was limited to 5 ft. (1·5 m.) on a side in order to meet the requirement of portability. The stipulated wave-length range was 300 m. to 800 m. Extreme directional sensitiveness was required, together with the highest efficiency obtainable, in order to permit setting up as far as possible back from the battle front and shelled area.

The equipment furnished comprises a vertical collapsible loop surmounted by an electrostatic shield consisting of a harp of wires 5 ft. long by 2 ft. wide (1·5 m. by 0·6 m.). The loop itself contains five turns of No. 18 wire sewed in a canvas strip. A collapsible table, measuring 5 ft. by 3 ft. (1·5 m. by 0·9 m.) on top and approximately 30 in. (0·75 m.) high, is furnished and supports the loop and its shield. Electrical connections to the loop are permanently made with the necessary lead wires fastened to the table top. A wheel with shaft and gear arrangement is provided and permanently fixed to the table for rotating the loop, and the whole structure folds together, forming a comparatively flat package for transit. A multi-stage combination radio-frequency and audio-frequency amplifier is used.

The coupling between both the frequency stages is provided by iron-core transformers whose impedances are adjusted to match the internal output tube impedance and whose turn ratios are approximately one to ten.

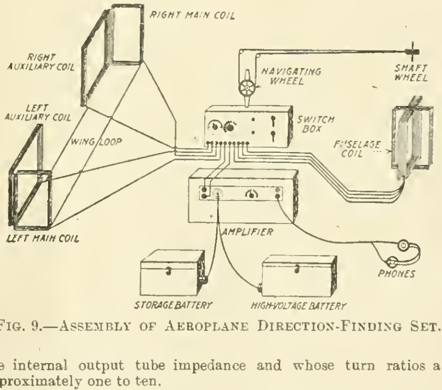


Fig. 9.—Assembly of Aeroplane Direction-Finding Set.

The requirements for aeroplane use are rather different from those for use on the ground. In an aeroplane the noise of the engine and rush of air drown out all save the very strongest signals, and the ordinary direction-finder methods are therefore of no use at all. Setting must be made "on the signal" rather than on the zero. This involves the use of a new method, credit for the application of which is due to the British. The method used allows of setting to the required direction with maximum strength of signal, while, at the same time, it retains the directional sensitiveness.

Two distinct sets of loops are provided. One is mounted rigidly on the struts and wings of the plane, a main coil fore and aft and an auxiliary coil athwart-ships. These coils have their turns sewed into a canvas band or strip about 6 in. (15 cm.) wide, which is cemented on to the struts and the entering edges of the planes. They are used for straight homing flying. Another smaller set, about 3 ft. (0·9 m.) square, is mounted inside the fuselage of the aeroplane and arranged so that it can be rotated about a vertical axis by the navigator by means of a disk, cords, and pulley device. By means of this second set of coils and a graduated dial the line of one of the beacon stations can be set, and if two such readings are taken quickly on different beacon stations the location of the plane may be determined. When the fixed wing coils are used it is necessary to alter the course of the ship in order to make the direction setting. The accuracy obtainable is about plus or minus 1° in making the setting. The general arrangement of the apparatus is shown in fig. 9.

The principles worked out relating to this type of apparatus and the methods evolved for their application will, without doubt, find application in the near future to numerous fields. Already ships at sea have been equipped with directional apparatus, and the Post Office Department at Washington has now begun investigating the question of using direction-finding compasses on planes in the aerial mail service.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

9,934. "Switches for electric lamps." Clifford Bros. & J. Riddell. April 22nd.

9,966. "Magneto-electric machines for engines ignition." A. Sheppard. April 22nd.

9,967. "Electric generators and motors for working under water, &c." C. H. Hall. April 22nd.

10,018. "Electric lighting systems." D. E. Westcott. April 22nd.

10,020. "Ignition magneto advance and retard gear." S. O. Crossley. April 22nd.

10,038. "Spark-plug indicators." C. F. Pinneo. April 22nd.

10,042. "Connectors for electrical conductors." J. de Frece. April 22nd.

10,045. "Commutators for dynamo-electric machines." H. Chitty. April 22nd.

10,048. "Electric switches." R. Norton. April 22nd.

10,053. "Polyphase electric heating furnace." E. C. R. Marks (Armour Fertiliser Works, U.S.A.). April 22nd.

10,063. "Current-connecting devices for dynamo-electric machines." A. A. Pollock & W. H. Scott. April 22nd.

10,065. "Sparking plug." W. G. Clayton. April 22nd.

10,066. "Battery cells." P. D. Ivey & A. J. Salisbury. April 22nd.

10,067. "Battery cell hydrometers." P. D. Ivey & A. J. Salisbury. April 22nd.

10,096. "Regenerative braking system for electrically-driven vehicles." K. H. O. Lubeck. April 22nd. (Sweden, April 20th, 1918.)

10,116. "Electrolytic cells." C. W. Marsh. April 23rd.

10,128. "Contact-breakers for magnetos." G. G. Dawson. April 23rd.

10,130. "Electric furnaces." A M. Texeira. April 23rd.

10,155. "Process of electrolysis." N. H. M. Dekker. April 23rd.

10,158. "Electrical connector for engine sparking plugs, &c." V. Bardin. April 23rd. (France, January 16th.)

10,159. "Sparking plugs." V. Bardin. April 23rd. (France, February 4th.)

10,179. "Apparatus for electrolysing liquids." J. S. Withers (National Electro-Products, Ltd., U.S.A.). April 23rd.

10,193. "Carbon-holder and feeding mechanism for arc lamps for kinematograph projectors, &c." A. W. Newland. April 23rd.

10,197/10,198. "Machines for making bobbins for electric batteries." National Carbon Co. April 23rd. (U.S.A., January 10th, 1918.)

10,202. "Automatic telephone system." T. Lenaghan. April 24th.

10,209. "Automatic time-switch for electric lighting, &c." M. Volk. April 24th.

10,214. "Automatically-controlled make-and-break for internal-combustion engines." H. Duran. April 24th.

10,217. "Reducing lagging current on alternating-current systems supplying induction motors, &c." H. A. L. Barry. April 24th.

10,219. "Sparking plugs." H. Singleton-Griesbach. April 24th.

10,220. "Means for ventilating dynamo-electric machines." Brolt, Ltd. April 24th.

10,241. "Incandescent electric lamps." J. Bilefeld. April 24th.

10,268. "Galvanic batteries." G. Oldham & J. Oldham. April 24th.

10,273. "Automatic apparatus driven by electric motor for winding spring-driven clocks." H. Ramseyer, F. Guye & L. H. Borel. April 24th.

10,306. "Friction contact ratchet mechanism." T. Quick. April 25th.

10,314. "Electrolytic process for coating iron or steel with lead or antimony or alloy of lead and antimony." C. Bowen & Q. Marino. April 25th.

10,336. "High-tension magnetos." J. H. Runraken. April 25th.

10,344. "High-voltage current-distributing apparatus for electric ignition apparatus of internal-combustion engines." Scintilla. April 25th. (Switzerland, September 18th, 1918.)

10,357. "Control of power absorbed in electric furnace." W. S. Gifford, Campbell, Gifford & Waite, and D. F. Campbell. April 25th.

10,378. "Electric contrivance for greeting persons in the dark" L. Canaro. April 26th.

10,390. "Electric conduit tubes and fittings." M. J. Railing & T. Taylor. April 26th.

10,393. "Device for demonstrating difference between true pole and magnetic pole, &c." E. K. Brown. April 26th.

10,413. "Electric flashlamps for photographic, &c., purposes." H. M. Batten. April 26th.

10,414. "Electrically-operated camera shutters." H. M. Batten. April 26th.

10,418. "Protective gear for turbo-alternators." British Thomson-Houston Co. & H. W. Walker. April 26th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

3,543. Apparatus for recording and reproducing sounds and electric signals. E. Russell Clarke. March 9th, 1916. (124,764.)

3,769. Electric indicators and like apparatus. J. G. Hooper & F. R. Hobley. March 14th, 1916. (124,766.)

4,295. Inductances for wireless telegraphy and allied uses and the manufacture thereof. E. Russell Clarke. March 23rd, 1916. (124,776.)

4,518. Receiving instruments for wireless signalling. A. Artom. March 27th, 1916. (124,786.)

5,331. Sound transmission by light rays actuating photo-electric cells. W. H. Bragg & A. O. Rankine. April 11th, 1916. (124,805.)

5,631. Sound detecting systems and apparatus therefor. H. R. Wilding and R. F. Bossini. April 17th, 1916. (214,812.)

5,634. Sound detectors or transmitters. H. R. Wilding & R. F. Bossini. April 17th, 1916. (124,814.)

6,056. Submarine sound signalling apparatus. S. M. Davison. April 27th, 1916. (124,825.)

6,256. Aerial conductors for wireless signalling and other purposes. J. Hettinger. May 2nd, 1916. (124,833.)

1917.

1,929. Dynamo-electric machines for use with internal-combustion engines and vehicles propelled thereby. Bijur Motor Lighting Co. April 30th, 1917. (115,414.)

1918.

1,773. Variable-speed dynamo-electric machines. Fuller Accumulator Co. and A. P. Welch. July 31st, 1918. (124,855.)

4,680. Ignition systems for internal-combustion engines. C. F. Kettering. August 30th, 1915. (Divided application on 6,406/16.) (115,812.)

5,585. Portable stand for electric lamps. W. J. Furse & Co. & H. J. Furse. April 2nd, 1918. (124,874.)

5,779. Lanterns for gas-filled electric lamps. British Thomson-Houston Co. & H. C. Wheat. April 4th, 1918. (124,889.)

6,090. Automatic electric cut-outs. A. Fernandez. April 10th, 1918. (124,906.)

6,698. Electrically-driven hoists. Veritys, Ltd., & A. Lanz. April 20th, 1918. (124,922.)

16,408. Apparatus for the attachment of electric wires to terminals. H. Windibank. October 9th, 1918. (125,014.)

16,995. Electric ignition apparatus for internal-combustion engines. G. E. Turnbull. April 17th, 1918. (Divided application on 13,318/17.) (125,022.)

18,396. Methods of and apparatus for electrical welding. T. E. Murray. November 9th, 1917. (120,906.)

20,899. Truck-type electric switchboards. Johnson & Phillips & W. A. Walker. December 14th, 1918. (125,042.)

1919.

2,644. Electrical phase converting systems. British Westinghouse Electric & Manufacturing Co. March 13th, 1918. (124,190.)

The Electric Welding of Ships.—At a meeting of the Liverpool Engineering Society on April 16th, a paper on "Some Aspects and Developments of Mercantile Shipbuilding under War Conditions" was read by Prof. T. B. Abell, R.C.N.C., ret., M.I.N.A., in the course of which the author dealt with the subject of electric welding, on which he had been called upon to report. He said that the ultimate aim must be to secure butt joints of all plating, whatever the direction of the joint; first, because that joint appeared from tests to be the most efficient when good workmanship could be assured; secondly, because weight was thereby saved, and also because in a lap joint, where great pressure could not be exerted to bring the two plates together, corrosion of a serious character was likely to result. At present, butt joints on the flat or in a vertical plane could be made without difficulty if a metal backing strip of thin material forming a strap to the joint were provided on which the weld might be built up. The horizontal butt joint between two vertical plates—the joint which would result in the greatest saving of riveting and weight—was very difficult to make satisfactorily. The difficulty was great, and would not be overcome until much further experience in the construction of large structures had been obtained. The butt weld was more efficient though more expensive, partly on account of the extra metal required in the weld.

Attention, too, was required in arranging material properly, particularly in bringing the various parts into contact, as in lap joints or faying surfaces, or into proximity for welding, and in arranging the spacing of seams to allow for contraction of the weld on cooling. This was particularly the case with butt welding, and perhaps it would be found, ultimately, that the elimination of severe cooling stresses would render butt jointing throughout quite practicable.

The angle bar attachment, so expensive in weight, was still necessary for bringing plates in planes at right angles into correct position, though here again endeavour must be made to reduce the use of the angle bar as much as possible, particularly in watertight work, where it was necessary to use four lines of welding—two continuous and two tack welds—to secure watertightness and strength. The principal difficulty in reaching this ideal lay in the fact that erection of the structure must be always very much in advance of the jointing of the parts by welding, so that angle bars would always be very much used. There was, however, no reason why angle-iron lugs should not be made to suffice.

Whether the slag-covered electrode or the bare electrode, or that protected by a volatile covering, would prove the most suitable for ship work, was still unsettled. But it would seem that efforts must be continually directed to discovering an electrode which would avoid the use of a slag covering without sacrificing the high quality in the material of the weld. Inspection would always be difficult and would require to be very close.

THE

ELECTRICAL REVIEW.

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Published every FRIDAY, Price 4d.

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OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 6d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

THE ELECTRICITY SUPPLY BILL.

THE long-awaited Bill of the Board of Trade has at last been issued, and can be obtained from the usual sources (Bill 72; price 3d. net). For full details we must refer readers to the original text; we give a summary of its contents elsewhere in this issue.

Broadly speaking, the Bill follows the lines laid down by the Committee appointed by the Board of Trade on Electricity Supply, but there are many evidences that the draftsmen have profited by the criticism which has been levelled at the Bill, and by the suggestions which have been put forward from so many sources. We are very pleased to see that no countenance has been given to the egregious proposal that companies which are authorised undertakers shall be deprived of all representation on the electricity boards of their respective districts; that officials who suffer damage through the operation of the Act are guaranteed compensation, though the terms of the clause are capable of improvement; and that the enlarged powers for obtaining compulsory wayleaves without delays, running lines overhead, and using water from rivers and canals, appear to provide the facilities which have so long been needed by the industry.

The Electricity Commissioners are endowed with ample powers, and are entrusted with the discharge of the duties at present fulfilled by the Board of Trade, but their decisions are subject at all times to the approval of the Board, and in many cases they can act only through the medium of a "special order," which, if opposed, involves the holding of a local inquiry, with the consequent delay and expense. As in some cases the Commissioners have to hold local inquiries before issuing the special order, the procedure may be drawn out to considerable length, and affords abundant opportunity for obstruction.

The District Electricity Boards are given very large powers and important duties, with remuneration for their services; the mode of their election is not specified, but their constitution is outlined, and their members will include representatives of all the principal interests concerned, not excepting labour, as well as local authorities which are not supply undertakers, but which agree to afford financial assistance to the Board (with the permission of the L.G.B.)—a new feature in municipal enterprise in this country, though common enough abroad. The function of an Electricity Board is simply stated as the provision of a cheap and abundant supply of electricity within the district, and for that purpose it will be empowered to acquire all generating stations and main transmission lines, to construct new works and lines, and to take over existing undertakings, always subject to the control of the Commissioners. In fact, by the constitution of a district board, all generating stations and main lines *ipso facto* become vested in the board, subject to payment to the owners therefor. In defining the "standard price" provision is made in the case of municipalities, not only for taking over the capital charges in respect of outstanding loans, but also for compensating the owners for capital construction paid for out of revenue, a point upon which the municipal authorities have insisted; in the case of private ownership, the cost of construction and of the site, less depreciation, will determine the amount, subject to arbitration in case of disagreement. What a vista for the Parliamentary Bar! Another municipal point is met by a clause requiring the board to supply electricity to the original owner of a station compulsorily acquired as cheaply as he could have generated it himself.

New stations and extensions of existing stations are made subject to the will of the Commissioners. The rights of existing distributors are expressly protected, provided that their refusal to allow an Electricity Board to distribute in their areas is not held to be unreasonable. The rights of local authorities to purchase undertakings are transferred to the District Boards—even in the case of County Councils; this clause has a direct bearing upon the future of electricity supply in the London area. District Boards are empowered to delegate or lease their powers to authorised undertakers or to "a company established for the purpose"—a provision at which some municipal authorities, notably in the North-East, will look askance. Pending the establishment of a District Board, the Board of Trade itself may execute the functions of the Board.

The financial provision is of special interest; the Treasury is authorised to provide 20 million pounds out of the Consolidated Fund for the use of the Board of Trade, and may issue Exchequer Bonds for the purpose.

The Commissioners are also authorised to raise an "electricity loans fund" not exceeding 25 millions, out of which to make loans to district boards, the interest being guaranteed by the Treasury. Further, during the first five years, Parliament is to advance money to cover the deficit in the accounts of the Commissioners, other than the loans account, such moneys to be repaid during the three succeeding years.

The principle upon which the Board of Trade is to fix prices for electricity is simple in theory—namely, at such amounts as will cover the capital charges and leave a margin. There is no sanction given to making profits. On the other hand, there is no attempt to impose uniform prices on the whole country—an impracticable scheme. Power is given to suppliers to let for hire and maintain electrical apparatus of all kinds, but not to manufacture or sell them.

The section of the Conspiracy Act of 1875, which deals with breaches of contract by persons employed in the supply of gas or water, is extended to the supply of electricity.

Provision is made, in the event of a Ministry of Ways and Communications being established during the present Session of Parliament, for the transfer of the whole of the powers and duties of the Board of Trade in respect of electricity supply to the new Minister. We have no doubt that the Minister will be as able as the President of the Board of Trade, and as well-disposed towards electricity supply, but it is impossible to suppose that in the stress of organising a new department with enormous responsibilities, he will be able to devote attention to the subject, which must not wait, but is pressing for immediate action.

The Resettlement Problem.

A correspondent in this issue raises again the question of re-employment of demobilised officers and men, and asks whether preference is given to officers by the Appointments Board. We believe that no such discrimination is exercised; officers and men are dealt with on exactly the same basis, and we know of cases where officers have waited for many weeks before receiving a reply to their application. The fact is that the machinery of the Appointments Board was not ready when hostilities ceased, and it is only now getting into working order. The delay is most regrettable, as there is a great number of men who are unable to obtain either employment or training. The case of men who went straight from school into the Army or Navy is particularly unfortunate and difficult to deal with; some of them, to our knowledge, have been with the Colours practically from the outbreak of war, and are now released at the age of 22 or 23 without any preparation for the battle of life except such as they received at school—we know only too well how much that is worth—and that which they have gained in service. The latter is by no means to be underrated: men who have occupied responsible positions in H.M. Forces have of necessity acquired a more or less sound knowledge of human nature, and many have learnt to handle men; but while this valuable experience will tell in after life, it must be admitted that between handling men under the bonds of military discipline and handling free men under civilian conditions there is a vast difference. Others of less capacity may have gone through the mill without deriving much benefit from the process. We trust that every effort will be made to provide training for those who require it at the earliest possible moment. In the meantime, we wish to draw attention to the remark of our correspondent: "I am too proud to draw the O.W.D. of 29s. per week. How am I expected to live?"

We respect the writer's spirit of independence, but we think he is making a fundamental mistake. He seems to regard the out-of-work donation as savouring of "charity;" it is nothing of the sort. It is an allowance for maintenance to which he is fully entitled, just as if he were still on active service, and is intended to answer his question—"How am I expected to live?" True, it is a meagre allowance in these days of high prices, but that has nothing to do with the fact that, such as it is, it belongs to him and he incurs no dishonour in claiming it.

With the suggestion that employers should make a point of giving demobilised men a chance to prove their worth we cordially agree. At present, in view of the unsettled conditions in the industrial world, we admit that the problem is exceedingly difficult; we are all waiting for the declaration of Peace and the return of stable conditions under which industry can go ahead at full speed. But we hope the moment will not be long deferred, and that our ex-fighting men will speedily come into their own.

Recent French and American Activities in Spain.

The French Minister of Commerce and the Minister of Foreign Affairs have just opened a French commercial bureau at 19, Calle del Principe, Madrid. The object of this new centre is to develop and improve commercial relations between France and Spain. Periodical exhibitions of samples and models will be organised, each exhibition being devoted to the products of a distinct group of manufacturers, or occasionally to the products of a single manufacturer. The bureau will furnish information to French and Spanish manufacturers and buyers on such subjects as tariffs and Customs, transport, conditions of sale, credit, &c.

The *Liberal* newspaper makes the following comment on American activities in Spain:—

> The war is hardly finished and already the Yankees are fixing their attention on Spanish affairs. A representative of the National Bank is now in Madrid studying the question of opening a branch. There is also in Gibraltar a representative of the International Transport Co., who is deeply interested in the proposed new railway from the French frontier to Algeciras. The Americans are studying our railways, our tramways, water-power, mines, &c., and there is no doubt the near future will see a much better commercial understanding between this country and the United States.

The Spanish technical periodicals now show quite a number of advertisements from French and American houses. The American method of propaganda is to advertise well and to open branch establishments, whereas the French system is to advertise well while conducting business from the central office in France. Our special correspondent in Spain, writing on this subject, says:—"It is possible that British manufacturers are preparing to secure a share of the Spanish market, but up to the present their activities are not mirrored in the technical Press."

Electricity Supply Regulations.

That the "informal meetings" of the Institution of Electrical Engineers have filled a real want, and proved a successful venture, is, we think, beyond question; their main object is to promote discussion amongst the more retiring members, and this has certainly been achieved, the discussions being both interesting and well sustained. Our compliments are due to the chairmen—Messrs. Rankin and Pooley—for their able and genial conduct of the meetings, which has greatly conduced to their success. The falling-off in the attendance since the first meeting is largely due, we believe, to the inconvenient hour at which the meetings are held; as we stated in our issue of March 21st, several members informed us that they would prefer an earlier start, and on Monday this feeling was voiced by others during the discussion.

Mr. Bradshaw, in opening the debate, devoted most of his emarks to the article by Mr. C. A. Baker, which we pubished a few weeks ago, and to our comments on the subject. As the article and leader dealt mainly with the legal and commercial aspects of the question, we did not anticipate that they would in any way affect the discussion at the approaching informal meeting, which we expected to turn on technical points. However, they were evidently a godsend to Mr. Bradshaw, whose breezy humour enlivened a subject which in other hands might have proved somewhat dull. The chief points of importance which cropped up in the discussion were the desirability of adopting one uniform set of rules—namely, the Wiring Rules of the I.E.E.—and giving them the sanction of legal authority; and the necessity of introducing the registration of wiremen, in order to put an end to jerry wiring, and to checkmate the incompetent wireman-contractor. With both of these proposals we cordially agree, and we feel sure that everyone who has the interests of the industry and the public welfare at heart will give them his energetic support.

The I.E.E. Elections.

In our recent comments on the nominations for the new Council, we anticipated that additional nominations from outside would be submitted; these did not, however, appear on the balloting list. As will be seen from a letter in our "Correspondence" columns, such nominations were sent in, but owing to a technical defect they were invalid.

Our correspondent, who, we believe, represents a considerable body of members, assumes an attitude decidedly hostile to the Council, and evidently feels very much aggrieved. It is certainly very much to be regretted that the nominations were disqualified, but is it quite fair to blame the Council for the mishap? We have in past times had occasion ourselves to criticise various actions and omissions of the Council, but in this case we see no reason to attribute to it any unworthy motive or to jump to the conclusion that the incident has any sinister significance.

It is not many years since the Articles of Association were altered after mature discussion, one of the chief reasons for alteration being the desire of the Council to satisfy the demands of the members for a reformed system of election. Apparently, in spite of the best intentions, a loop-hole for mishap still remains, but evidently it would be easy to avoid a repetition of the trouble on future occasions. That the Council would deliberately flout the wishes of the Associate Members, who constitute the mainstay and more than half the membership of the Institution, is hardly credible, and the record of progressive action and successful work that the Council has to show for the past few years affords no support to the theory. We trust that steps will be taken to convince the writer of the letter and his friends of the *bona fides* of the Council, which we believe would be an easy matter if a personal interview were arranged.

Labour in the German Cable Industry.

The chairman of the Deutsche Kabelwerke of Lichtenberg (Berlin), speaking at the recent general meeting, stated that the wages paid in 1918 had experienced a terrible increase. It was a question, in his opinion, whether foreign competitors would not be able to secure the business in the German home market. It was, therefore, necessary for wages and the length of the working day to be fixed by international agreement, whilst syndicates were needed for the inland market. The apprehension that the latter formed the bridge towards socialisation was without any foundation, as undertakings which required the work of individuals were not suitable for socialisation. It would be possible, however, to meet the democratic idea by modifying the German company laws in the direction of reducing the value of the share from 1,000 marks (£50), so as to afford an opportunity to the workmen to acquire shares. If this were done, it would offer the best solution of the question of joint or co-decision, in so far that the possibility for electing workmen as directors would arise. On the other hand, the right of joint control without any participation in the capital could not be conceded. The feeling of responsibility on the part of the workman would be stimulated by his having a financial interest in the undertaking.

SEVEN YEARS IN EAST ASIA: SOME IMPRESSIONS AND REFLECTIONS.

By Prof. C. A. Middleton Smith.

During the next 10 years there will be rapid changes in China. Despite the war, there has been extraordinary progress in engineering work in the Far East during the seven years that the writer has been living in that part of the world. Electric light installations are being fixed up, or have been fixed up, in nearly all the towns in China, and even little villages near the treaty ports have 10 and 15-kw. plants. In a tiny little fishing hamlet near Hong-Kong, where law and order is maintained by one British police-sergeant, about a dozen Indians, and a few Chinese constables, where there is hardly a two-storied house, and where about one-half of the people seem to live in structures made out of bamboo poles and matting, electric light is installed. In the matsheds are 5-c.p. lamps, and the charge is 50 cents (say 6d.) a month for such a light, including maintenance. That is just an example, and there are many other signs of the onrush of the engineer in East Asia.

But the purpose of this article is not to give details of recent engineering progress in China, but simply to relate a few general impressions by an engineer. After nearly seven years of work with the Chinese, among whom he is glad to know that he has many personal friends, the writer is shortly coming "home" on leave. That is the custom of the Far East, especially of South China, where the climate is that of a vapour bath, certain to affect the insulation of electrical gear and the livers of the non-Asiatic. And it is hoped just now to record a few impressions in the setting in which they were formed.

The Genius of Kipling.

When Sir Alfred Ewing, who is now Vice-Chancellor of the University of Edinburgh, wished me "Good luck" on the eve of my departure from London to the Far East, he made two remarks which have frequently come back to my mind since that day. He had been very kindly telling me of his own experiences in Japan, and I had replied that the one thing that worried me was a feeling that in the Far East there would be intellectual isolation in scientific matters. "That is true," he said in effect, "but you will have ever so much more leisure, and so more opportunity for research work." That was an optimistic forecast which was made without any knowledge of the peculiar difficulties in the way of the newly-created University of Hong-Kong. It also, of course, ignored the demands made by the Great War. He added some words like these: "You will have one great advantage in Hong-Kong that I did not have in Japan—you will be under the British flag." That was in 1912; and in my enthusiastic admiration for the Islanders of the Far East, an admiration created by English newspapers and magazine articles about the Anglo-Japanese alliance, I replied that surely there would be very little difference in the conditions which obtain in the countries which fly the flags known as the Rising Sun and the Union Jack. But experience has taught me that there was a great deal of truth in those words of one who had lived in the Far East, for my travels, during the two years before August, 1914, taught me two things. The first is that Kipling was inspired when he wrote "What do they know of England who only England know?" The other is that Japan was not only the land of cherry-blossom and people who are delightful company when met socially, but that it was, perhaps still is, the home of a military party which has made nearly all of the Europeans, and practically all the British merchants in China, anxious about the future. It may not be correct to say that, before August, 1914, the Japanese were anti-British; but they impressed one impartial observer as being definitely anti-American. It is correct to say that they are not popular to-day in China.

The war aroused national feelings in Great Britain which were so intense that they saved the world from disaster. But before the war these feelings existed, and were very much in evidence, in the places where Europeans congregate in China. They exist to-day: a thing that has impressed me very much is the growth of this feeling among the Chinese. They bitterly resent what they think is the interference, even the aggression, of the Japanese in the affairs of their own country.

The mass of the vast population of China live on the soil, and are very poor, and thus interested only in local affairs. But a new generation in the treaty ports are demanding the development of the natural resources of the country, and they will win. They welcome engineering appliances and scientific knowledge, and they distrust Japan, especially when they think of Korea.

The Workers and the Drones.

Another thing that has impressed me greatly, is the utter failure in China of an entirely classical education. For many centuries the Chinese clung only to the classics for their learning. "First comes the scholar," says the Chinese sage, as he lists the various types of men, putting the farmer second, the mechanic third, the merchant fourth, and the soldier last of all. It is not for one engaged in academic work to be-little scholarship. But it is important to insist that true scholarship is not the scholarship which was the ideal of the old-time Chinese scholars. Life would be a hopeless sort of a business without the inspiration of good literature; many a man of science has turned from his experiments and his mathematics to be refreshed by the great thoughts to which we, of this generation, have become heirs. But the Chinese scholars learnt classical platitudes, and most of them failed to act according to the precepts about which they prattled. It is useless reading good literature unless it produces good results, and also we must remember that science without the ideals of life, is prostituted and becomes brute materialism. The Germans have made us understand the horrible results of that creed. Therefore, let us insist that we must have developed in our Universities the subjects which we call Arts and Science. The lamp of knowledge must be held aloft—not only must we have it fed by the scientists, but also by the men of letters, the historians, those who think about law, and even the poets. You are not a real Briton if you know nothing about Shakespeare or Drake or Magna Charta. But, also, you are not a true Briton if you are ignorant of the work of James Watt, Faraday, Darwin, and those others of whom some of the clever ignorant people in Britain know nothing. You are like the old mandarins of China, if you have a lofty contempt for the work of the scientist and the engineer. Before the war the writer experienced that sort of contempt—University colleagues and Oxford-trained administrators spoke of an engineer as did the old Admiral of years ago, who called the engineer of the Royal Navy "A lascar with an oil can." But the war has produced a change. There is rather less patronage towards engineers from men of the "learned professions." But, even now, the engineer has not obtained for his profession the status that it deserves.

When a man in his outlook ignores entirely the arts, he is working for the German ideal; when a man ignores entirely in his outlook the sciences, he is working for the Chinese ideal. And, speaking of them collectively, the scholars of China during the last few centuries have been the drones. They had to become classical scholars to become officials; and the officials have been the curse of the country. Conceited, and contemptuous of manual work, a contempt advertised by long finger nails, they have tried to stem the tide of scientific knowledge with a wall of classical learning; and now that the tide is bursting through these artificial barriers, they are bartering their country and its vast natural resources with anyone who will stoop to bribery and corruption. Not all of the Chinese officials—perhaps you can name exceptions. But the spirit expressed by finger nails inches long must be swept away if the rich stores of minerals are to be unearthed, the methods of communication improved, the workers lifted out of beggary and freed from rapine, murder, flood and famine. There are influential Chinese who still advocate only a classical education for the youth of the country; and the answer to their tirades is—China; China, the land of the most industrious people, the land of vast natural resources, the land of chaotic government, flood, famine, and poverty. On the other hand, there are influential men in Europe who sneer at anything that is not "business," and the answer to them is—Germany; Germany the outcast amongst nations, the clever, ignorant rulers of which country have sent a whole people into the Abyss. It is a good thing for Anglo-Saxon engineers to keep in mind the results of two extreme ideals in two countries so far apart. "Virtue is the extreme between two vices," says a Chinese proverb. Engineers should study good literature and the Arts; people certainly should know something of the laws of Nature and Science.

Early Impressions.

It is nearly a quarter of a century ago that the writer first saw and read the Electrical Review, and over all that long vista of years he has never failed to glance through its pages and to read the articles the ideas of which have appealed to him. The most important portion of any journal is, or should be, what is called "the editorial" or "the leading article." For twenty-five years there has been in the editorial articles of the Review a note which always has rung true; which has often stimulated one reader to take a deeper interest in his work, to be proud of his profession, to take a closer note of those problems which are not entirely technical in their nature. It would be wrong to suggest that the writer regards the Review as infallible; it is far too human for that. But, without in any way losing its value as a technical journal, it has always opened its columns to ideas that do not involve the integral calculus or even a knowledge of workshop practice. It seems to have tried to keep in mind the true purpose of all literature, which is to inspire the reader to accomplish some worthy object. It has always advocated educational development, and it has been invariably sympathetic with the "under dog." Nearly twenty years ago it published an article by "A University Lecturer," entitled "Some Difficulties which Lecturers in Engineering Meet," or words to that effect, for it is impossible to refer to the files of the Review just now. It was written in reply to an article by a student in engineering, who described some of his own difficulties, and a rather weary lecturer who read the student's contribution wanted to put before the Review readers the story of his own trials. To be quite frank, he never expected that the Editors of the Review would "accept" his effort. It was completed, he remembers, after an "all-night sitting"; and for a week he wondered at his own audacity in troubling the Gods of Olympus. But on the following Friday, there it was in print. And now that the editors of the Review are 10,000 miles remote from that writer, and after 20 years, he finds a reversion of that early anxiety. For only a mixture of coercion, by the writer, and an appeal to sentiment, will overcome their modesty and persuade them to publish words of praise for the Review. But the words are well deserved.

A Friend in Need.

In the year 1912 the writer came to Hong-Kong to a University that had no laboratories, no money, no students, and practically no staff. There were just four of us for that first year. The Principal was Sir Charles Eliot, C.B., K.C.M.G., scholar and administrator, and intellectual giant. He is now on leave, and is acting as British High Commissioner in Siberia. Mr. Matthewman was lecturer in physics, Mr. Hinton was Registrar, and the writer occupied the only chair—the Taikoo chair of engineering. Amateurs had planned the University, and like all amateurs they had under-estimated the cost. There was only one of two things to be done—either to appeal to the sentiment of the British manufacturer and shipowner, or acknowledge failure. We appealed to the technical journals, and in some cases the response was immediate and generous. The Review was true to its traditions. It had the necessary vision. In the days before the war, the writer explained the aggression of the Germans in China, which had been another revelation to him in 1912. Thus did the Review help us. After two years, success became certain. The first batch of graduates went out into the Far East, to carry British ideas and ideals into the arid desert of intellectual China, in 1916. The total roll of graduates (other than honorary graduates) of the University is 71; of these 42 are engineers. The Chinese now believe firmly n the University of Hong-Kong; but in the beginning hey adopted the typically-Chinese tactics of "wait and ee." Those of us who believe that only by demonstration nd training of young Chinese in engineering work can the ast natural resources of the country be properly developed, annot forget the splendid support of our friends in the lays of doubt and difficulties. Time after time has it een possible to trace new schemes involving the use of nachinery in China to a chance visit of the friends of students nd others to the laboratories and workshops of the University. f Great Britain were really properly organised for scientific urposes, we should have still further examples of British nachinery to show our Oriental students and visitors in the 'niversity of Hong-Kong. To paraphrase a well-known roverb, we can almost say that an ounce of machinery at vork is worth a ton of text-books in China.

Our engineering students have come from Peking, from Iupeh, Shanghai, Yunan, Singapore, Bangkok, and many ther places in the Far East. Those of us who have earnt to know the Chinese well like them very much ndeed. They have an immense respect for learning, and hey are beginning to see that all knowledge is not bounded y the classics of China. After nearly seven years of work, lmost entirely in co-operation with the Chinese, the writer s coming "home" on six months' leave. He wants to ersuade British engineers to take an interest in China. He opes to see that vast country criss-crossed with railways, enetrated by roads, stimulated by everything electrical. Ie trusts that the British engineer in China will be as espected by the Chinese as those others from "the old country," such as General Gordon, Sir Robert Hart, and Sir Richard Dane. It is time that the British engineering profession and trade should have big ideas about China. In the years that are past, some of our politicians made big bungles; the British policy was feeble and haphazard. There is a rich soil in China; if we sow the seeds with scientific knowledge, and show courage and enterprise, we can do in that country what has been done in India, Egypt, and Mesopotamia. It will never be done unless scientific people give the subject more than a passing thought. They must act. They must even be prepared to sow the seeds, and to wait patiently for the harvest. China is a name that has been too often associated only with the ideas of opium and missionaries. In the engineering profession in Great Britain you have the real missionaries; the men of vision with a practical outlook; the men who, by their work, are transforming the earth, making the desert and jungle fruitful, and utilising the Forces of Nature for the good of man. If they assist in this vast work in China, they will also provide work for the factories of Great Britain. The Chinese have, in the last few years, completely changed their outlook. They now welcome machinery, but they do not know of its uses. The British must show them and help them. My outstanding impression, after seven years in China, is that the opportunity for the British engineer to do splendid work on behalf of humanity was never so great as it is to-day in China. "There is a tide . . ." Shall we let it flow past us? It seems impossible, when we remember the history of engineering in Britain during the last 50 years.

THE STEVENS PETROL-ELECTRIC VEHICLE.

'he Stevens petrol-electric drive has been referred to on everal occasions in these pages. We give below a brief ccount of the capabilities of the 3-ton War Office subsidy tevens petrol-electric lorry. In this vehicle, fig. 1, as is generally known, the place of the gear box and clutch is taken y a very flexible electric transmission. Its speed and elecrical generating capacity especially adapt it for trailing and upplying D.C. for searchlights, for which purpose it has een largely employed both at home and overseas. In addition, the car has special uses in providing an electrical supply for arc welding, electric lighting, heating, and battery charging. In fact, besides being a transport lorry pure and simple, the car is able to provide a supply of electricity wherever it is able to go and without the use of any auxiliary apparatus.

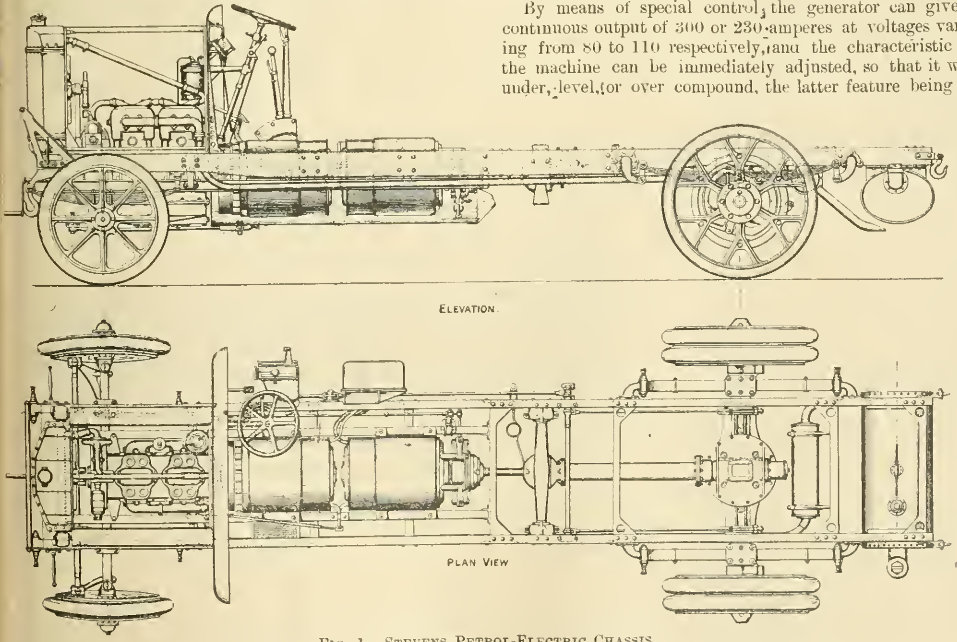

Fig. 1.—Stevens Petrol-Electric Chassis.

By means of special control, the generator can give a continuous output of 300 or 230 amperes at voltages varying from 80 to 110 respectively, and the characteristic of the machine can be immediately adjusted, so that it will under, level, or over compound, the latter feature being of value when a varying supply at constant pressure at the end of a long cable is required. For battery charging the generator may be used as a shunt machine.

The electrical generator, of the four-pole interpolar type, is compound-wound and provided with commutating poles. It is direct coupled by means of a flexible coupling to the petrol engine, which is fitted with a centrifugal governor, adjustable as to speed by a hand-wheel on the middle of the dashboard.

The shunt winding, of high resistance, in series with a multiple contact resistance, is connected directly across the brushes of the generator for lighting purposes, and across the brushes of the motor for driving purposes, the change over being effected by the switch L D (see fig. 2), and is capable of exciting the field to produce the required E.M.F. when no current is being supplied to the outer circuit.

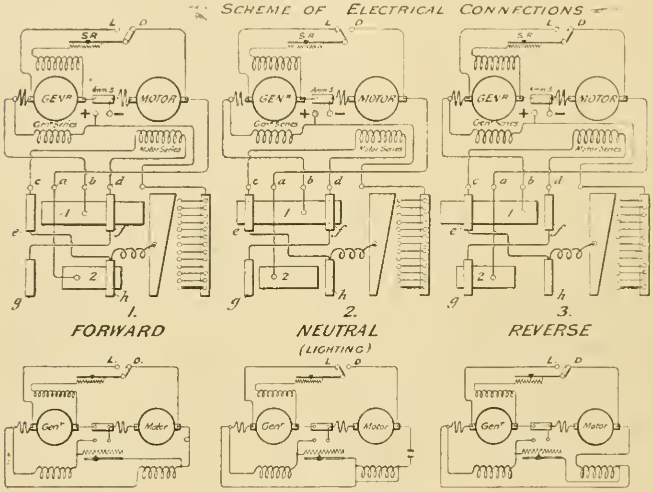

Fig. 2.—Electrical Connections.

From the positive brush of the generator the circuit, after passing through the interpole windings, divides, one circuit being through the series field winding of the generator. This circuit is continued through a variable resistance to the movable contact of the resistance device, which in turn is connected to one terminal of the motor field winding. The other circuit is taken to one, say, *b* of two intermediate terminals *a* and *b* of the reversing controller.

The electrical connections of the reversing controller are as follows:—Carried by, but insulated from, the controller spindle, and from each other, are two plain conducting movable segments, numbered 1 and 2, fig. 2. These are arranged concentrically with, and symmetrically to, either side of the spindle when the latter is in its mid position. The segment 1 extends through an angular width of about 210°, and segment 2 through an angular width of about 150°. Mounted on an insulating base or carrier are four stationary contacts *e*, *f*, *g*, and *h*, of which *e* is connected to terminal *c* and *f* to terminal *d*. Contact *e* is so arranged that it can make contact with the left-hand-side portion of segment 1, and contact *f* is so arranged that it can make contact with the right-hand-side portion of the same segment, and contact *g* can make contact with the left-hand-side portion of segment 2, and contact *h* can make contact with the right-hand-side portion of the said segment 2 by suitable rotation of the segments. The contacts *e* and *g* are arranged in line, and at an angular distance of about 180° from contacts *f* and *h*, which are also arranged in line with each other, the contacts being cross-connected, so that contacts *e* and *h* are electrically connected, as also are contacts *f* and *g*. Segment 1 is flexibly connected to terminal *b*, and segment 2 is flexibly connected to terminal *a*, which is connected to the negative brush of the motor. Terminal *d* is connected to one end of the motor field series winding, and terminal *c* is connected to the other end of such winding and to the movable contact of the resistance device. This device comprises a number of resistances adapted to be successively connected in parallel with one another by movement of the said movable contact in one direction, and a short-circuiting contact.

When the spindle of the controller is in its mid or neutral position, as shown in diagram 2 (fig. 2), segment 1 electrically connects contacts *e* and *f*, but segment 2 does not connect *e* and *d*, as there is an interval of about 15° between its ends and the centre lines of the contacts.

By means of this controller it will be seen that the series field winding of the electric motor is connected across the terminals of the reversing controller, the negative brush of the motor being connected to the intermediate terminal *a*. The circuit from the positive brush of the motor to the negative brush of the generator is made by a low-resistance conductor.

The switch connections are such that in the "forward" position of the controller, diagram 1 (fig. 2), the series winding of the generator with its series resistance forms a variable shunt to the series field of the motor and the direction of current through the motor series field winding and armature causes the vehicle to be driven in a forward direction. The generator series field winding is connected through the variable resistance to the terminal *c* of the motor series field winding.

The generator series field winding and the motor series field winding are thus connected in parallel, and when the variable resistance is short circuited, the current through the generator field winding is approximately equal to the current through the motor-field winding. By moving the contact of the variable-resistance device in a direction to cut out successive parallel resistances in circuit with the generator series field winding, and thus increasing the effective resistance, the current through this winding will be reduced, and the current through the motor field winding will be correspondingly increased.

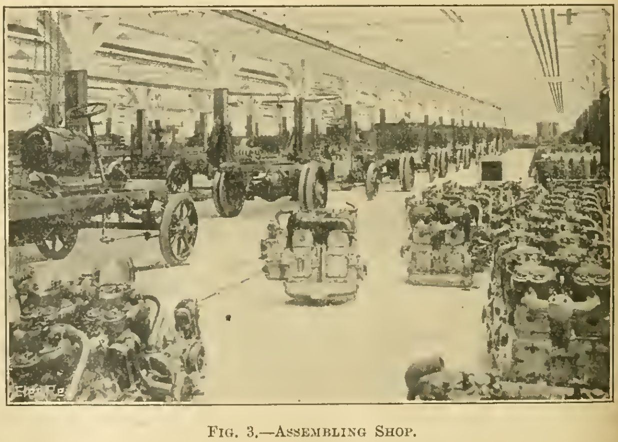

Fig. 3.—Assembling Shop.

When the last fixed contact of the variable-resistance device has been reached and passed, and the circuit of the generator finally broken, all the current from the generator will pass through the motor series field winding. By the arrangement described, a large speed variation between the generator and motor is obtained.

When the controller is put into the reverse position, diagram 3 (fig. 2), the generator series field winding is connected in series with the motor series field winding, and can also be shunted by a circuit of low resistance in the controller. As the resistance of the generator field winding is also low, sufficient current will then pass through the latter winding to well excite the generator, the shunt field winding of the generator also assisting. The vehicle will then run in a reverse direction.

To use the electric generator for lighting or welding purposes, it is necessary to put the reversing controller into the middle or neutral position, diagram 2 (fig. 2). The connection between the motor armature and its series field winding will then be broken, and the motor series field winding and the generator series field winding, with the variable resistance, will be short-circuited.

As one of the lighting terminals is connected to the junction of the generator and motor armatures, and the other to the junction of the generator series field winding and the variable resistance, this resistance can be made to act as a variable shunt to the generator series winding, so that any desired excitation can be attained, and the machine can be used either as an under, level, or over-compounded generator at any voltage between 80 and 110.

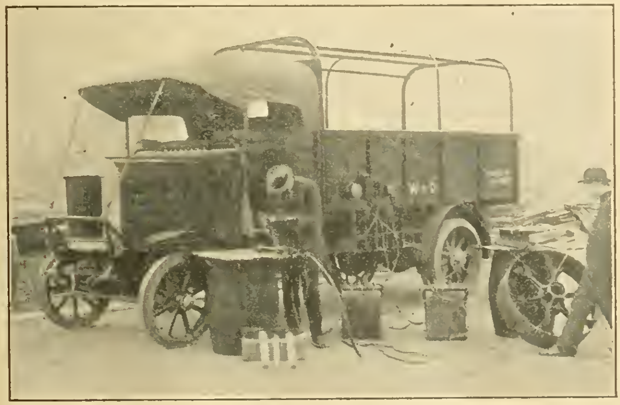

Fig. 4.—Stevens Lorry used for Arc Welding.

Last week we had the pleasure of being present at the works of Messrs. Dennis Bros., Ltd., Guildford, and witnessed a most interesting demonstration of the capabilities of a 3-ton lorry in supplying electricity for arc welding. The equipment used was that supplied by the Quasi-Arc Welding Co., Ltd., and the only requisites beyond the lorry itself were electrodes, a holder for them, and a patent reactance coil in each welding circuit. A 3-ton wagon is capable of dealing with three welding equipments at 60 volts, or two at 105 volts, fig. 4, and the results achieved are certainly very satisfactory.

The running capabilities of the vehicle were also demonstrated in the hilly district surrounding Guildford, and we were able to see the manufacture of the vehicles, which is carried out on the lines of the Ford system. As will be seen from fig. 3, the frames are moved along from point to point as they are assembled, and finally emerge under their own power. Each frame is moved along about once every 1¾ hours, and a vehicle is completed in about two days.

These vehicles appear to be capable of very creditable performances, and their ability to serve more than one purpose deserves emphasis.

In conclusion, we have to thank Mr. W. A. Stevens for supplying the particulars set out above, and for the courteous manner in which we were received by Messrs. Dennis at the time of our visit.

NATIONAL ELECTRICITY SUPPLY.

The following is a summary of the "Electricity (Supply) Bill" that was introduced into the House of Commons by the Home Secretary on Thursday, May 8th:—

The Bill provides that for promoting, regulating, and supervising the supply of electricity there shall be established as soon as may be after the passing of this Act, a body to be called the Electricity Commissioners, who shall have such powers and duties as are conferred on them by or under this Act, and shall act under the directions of the Board of Trade. The Commissioners, not exceeding five in number, of whom one shall be chairman, shall be appointed by the Board of Trade; in the case of two of the Commissioners the term of office shall be fixed by the Board of Trade at the time when the appointment is made; the other Commissioners shall hold office during His Majesty's pleasure.

The Electricity Commissioners may appoint a secretary and a staff of inspectors, officers, and servants; a fund will be established out of which they and their staff will be paid and on retirement awarded pensions at rates determined by the Board of Trade, and any expenses incurred by the Commissioners will be defrayed.

The Board of Trade may exercise through the Electricity Commissioners any of their powers and duties under the Electric Lighting Acts or the orders made thereunder, or under any local Acts relating to the supply of electricity.

The Commissioners may, subject to the approval of the Board of Trade, conduct experiments for the improvement of the methods of electric supply and incur the necessary expenditure, and may appoint an advisory committee to assist them.

The Electricity Commissioners may, after holding local inquiries, by special orders create districts for the purposes of the Act, and constitute and incorporate for each such district a district electricity board, including representatives of local authorities, companies, and authorised undertakers within the district, large consumers of electricity, and labour.

Any such order may provide for the appointment by the Commissioners of a person experienced in the control of large industrial undertakings as chairman of the board, and for the remuneration of the members.

It shall be the duty of every district electricity board to provide a cheap and abundant supply of electricity within its district, and for that purpose every such board shall have such powers with respect to the acquisition and construction of generating stations and main transmission lines, the supply of electricity, and the acquisition of the undertakings of authorised contributors and power companies as are hereinafter mentioned, and every board shall comply with any directions given to them by the Commissioners.

As from dates specified in the order constituting a district electricity board, all generating stations then existing within the district, other than private generating stations, and such main transmission lines as may be specified, shall vest in the district electricity board, subject to the payment to the owners thereof of the standard price.

Any particular generating station unsuitable for the purposes of the undertaking may be exempted by the Commissioners.

The standard price in the case of plant belonging to a local authority shall be annuities required to indemnity the local authority against their liabilities for interest and sinking-fund charges on outstanding loans; if a substantial part of the cost has been defrayed out of revenue, such annuity may be increased by such amount as the Commissioners think just.

In the case of plant belonging to a company or person, the price shall be the cost of construction of the plant and the acquisition of the site, less depreciation.

If in any exceptional case it is shown that the procedure would work injustice, the matter shall be determined by an arbitrator appointed by the Board of Trade.

A district electricity board may, with the consent of the Commissioners, acquire any private generating station on such terms as may be agreed.

Whenever a district electricity board acquire a generating station otherwise than by agreement they must supply the former owner with electricity at a price not greater than that at which it could have been generated, with due regard to the existing circumstances.

Where a station or line has been vested in or acquired by a district electricity board the board may, subject to the approval of the Commissioners, authorise the former owner to work it on behalf of the board.

Where a district electricity board are authorised by order to acquire or use any land for the purpose of a generating station, no person shall be entitled to restrain the use of the land for that purpose.

No person except a district electricity board may establish a new or extend an existing generating station without the consent of the Commissioners unless it be a private generating station, and the owner complies with regulations made by the Commissioners as to the type of current, frequency, and pressure to be used.

A district electricity board shall not supply electricity in any area which forms part of the area of supply of any authorised distributors without the consent of those distributors, except to lighting authorities, or for traction, or in the area of supply of a power company, without the consent of the company. If the consent is unreasonably withheld, the Board of Trade on the recommendation of the Commissioners may dispense with such consent.

The Commissioners may impose on any district electricity board an obligation to supply electricity in such circumstances, within such areas, and on such terms and conditions as to price and otherwise, as may be specified.

Any right to purchase an undertaking vested in any local authority will be transferred to and vested in the district electricity board.

The Commissioners may on the application of a district electricity board by order exclude from the area of supply of any power company any part of that area which at the time of the application is not being supplied by the company, and in consideration therefor may confer on the power company power to supply electricity for lighting purposes in other parts of their area of supply which do not at the time form part of the area of supply of any authorised distributors.

The Board of Trade, on the representation of the Commissioners, may authorise any district electricity board to abstract water from any river, stream, canal, inland navigation or other source, subject to such conditions as may be specified.

The powers and duties as to the generation and supply of electricity conferred on district electricity boards may be exercised and performed either by themselves or, if so authorised by the Commissioners, through any authorised undertakers or through a company established for the purpose. For the purposes aforesaid a district electricity board may lease their undertaking to any such undertakers or company.

If, within five years from the date of the vesting of any generating station or main transmission line in a district electricity board under this Act, any officer or servant who has been regularly employed in or about such station or line proves to the satisfaction of a referee appointed by the Minister of Labour that he has suffered loss of employment, or diminution of salary, or wages, otherwise than on grounds of misconduct, incapacity, or superannuation, and the district electricity board do not show to the satisfaction of the referee that equivalent employment on the like conditions as those obtaining with respect to him before the said date was available, the district electricity board shall pay him such compensation as the Minister of Labour shall think just, including any expenses which the officer or servant necessarily incurs in removing to another locality.

It shall be lawful for the Board of Trade after consultation with the Electricity Commissioners at any time before the establishment of a district electricity board for any area, and for two years after the establishment of any such board, to construct any works, and exercise any powers which a district electricity board can exercise under this Act.

The Treasury may issue to the Board of Trade out of the Consolidated Fund any sums not exceeding in the aggregate twenty million pounds, required for the construction of works or the acquisition of land, or required for providing working capital for such works, on such terms and conditions as to interest, repayment, and otherwise as the Treasury may think fit. The Treasury may borrow money for the purpose by means of the issue of Exchequer bonds.

At the expiration of two years after the establishment of a district electricity board, or earlier, any works and land acquired by the Board of Trade shall vest in that board, subject to the repayment to the Board of Trade of advances in respect of such works and lands.

During the period between the passing of this Act and the establishment of a district electricity board in any area, any authorised undertakers within the locality may, and if required by the Commissioners shall, enter into arrangements for mutual assistance in the supply of electricity, the management and working of the undertakings, the provision of capital required, &c.

The powers of the Local Government Board and the Secretary for Scotland and the London County Council with respect to the sanctioning of borrowing by local authorities will be transferred to the Electricity Commissioners.

Where the consent of the Board of Trade is obtained to the placing of any electric line above ground in any case, the consent of the local authority shall not be required, but the Board of Trade before giving consent shall give the local authority an opportunity of being heard.

A district electricity board or any authorised undertakers may place any electric line below ground across any land, and above ground across any land other than land laid out as building land or land so situate that the placing of lines above ground would affect the amenity of any dwelling house, in cases where the placing of such lines above ground is otherwise lawful.

Before placing any such line across any land the board or undertakers shall serve on the owner and occupier of the land notice of their intention; if, within twenty-one days, the owner and occupier fail to give their consent or attach to their consent stipulations to which the board or the undertakers object, the Board of Trade may, after giving all parties concerned an opportunity of being heard, give consent either unconditionally or subject to such terms as they think just.

A district electricity board and any local authority authorised by special Act or by order to supply electricity may provide, let for hire, and in respect thereof may connect, repair, maintain, and remove (but shall not manufacture or sell) electric lines, fittings, and appliances for all purposes for which electricity can be used.

The prices charged by a district electricity board for electricity shall be subject to the approval of the Electricity Commissioners, and shall be such that their receipts on income account will be sufficient to cover their expenditure on income account (including interest and sinking fund charges), with such margin as the Commissioners may allow.

The benefit of any reduction in the cost of electricity attributable to the provisions of this Act shall enure to consumers.

The Commissioners may require any authorised undertakers to alter the type of current, frequency, or pressure employed in their undertaking, and this shall be a purpose for which a local authority may borrow under the Electric Lighting Acts.

Anything which under the Electric Lighting Acts may be effected by a provisional order confirmed by Parliament may be effected by a special order made by the Electricity Commissioners and confirmed by the Board of Trade.

District electricity boards and authorised undertakers shall furnish to the Commissioners such accounts, statistics, and returns as they may require.

The accounts of every district electricity board and their officers shall be audited by auditors appointed by the Commissioners.

For any payment or work the cost of which ought to be spread over a term of years (including the payment of interest on money borrowed for capital expenditure whilst the expenditure remains unremunerative), and during the first three years after the establishment of the board for the purpose of providing working capital, a district electricity board may, with the consent of the Commissioners, borrow money. Where money is borrowed for the construction of works at a time when the cost of labour or materials is abnormally high, regard shall be had to that fact in fixing the period for repayment.

The Electricity Commissioners may, for the purpose of enabling a district electricity board to raise money, authorise the board to issue stock bearing interest. All such stock, and interest thereon, shall be charged on the undertaking and all the revenues of the district electricity board.

Any authorised undertakers within the district, and any consumer, or council, shall have power to give financial assistance in any form to the board, but in the case of a council not without the consent of the Local Government Board.

Money borrowed by a council for this purpose shall not be reckoned as part of the total debt of the council for the purpose of any limitation on borrowing.

The Electricity Commissioners may lend to a district electricity board or any authorised undertakers any money, not exceeding in the aggregate 25 million pounds, which the board or undertakers are authorised to borrow, if the Commissioners are satisfied that the board or undertakers cannot otherwise raise the money on reasonable terms.

Any such advances shall be issued out of a special fund to be under the charge of the Electricity Commissioners, and to be called the electricity loans fund, and to that fund shall be carried all sums received by the Commissioners on account of interest or of repayment of the loans made by them.

The Commissioners may issue stock, to be called electricity stock, bearing interest.

The Electricity Commissioners shall at the beginning of each financial year prepare an estimate of their receipts and expenditure during the year, and submit it for approval by the Board of Trade.

The Commissioners shall apportion the amount by which the estimated expenses exceed the estimated receipts amongst the several district electricity boards, in proportion to their gross receipts in the preceding year; and every such district board shall pay to them as a contribution towards their expenses the sum so apportioned: Provided that during the first five years after the passing of this Act the amount of such excess shall be paid out of moneys provided by Parliament, but such payments shall be treated as advances and shall be repaid, with interest at such rate as the Treasury may fix, by the Commissioners by equal annual instalments in the next three succeeding years.

Section four of the Conspiracy and Protection of Property Act, 1875 (which relates to breaches of contract by persons employed in the supply of gas or water), shall extend to persons employed by a district electricity board or by any authorised undertakers in like manner as it applies to persons mentioned in that section, with the substitution of references to electricity for the references to gas or water.

The Electricity Commissioners may hold such inquiries as they consider necessary or desirable for the purposes of this Act.

The Board of Trade and the Commissioners may respectively make rules in relation to applications and other proceedings before them under this Act.

A special order made under this Act by the Commissioners shall not have any effect unless and until confirmed by the Board of Trade. If objection is raised by any person, unless the order is amended, an inquiry shall be held.

Before any special order comes into force it shall be laid before each House of Parliament for a period not less than 30 days, and if either House presents an address to His Majesty against the order or any part thereof no further proceedings shall be taken thereon without prejudice to the making of any new order.

This Act shall apply to Scotland and Ireland, subject to necessary modifications.

In the event of a Ministry of Ways and Communications being established by an Act passed in the present session of Parliament, all the powers and duties of the Board of Trade under this Act, and under the Electric Lighting Acts, shall be transferred to the Minister of Ways and Communications.

The Bill is published by H.M. Stationery Office (Bill 72). Price 3d. net.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Waste.

Financial men tell us that this country is in debt, the currency is inflated, and to correct matters the native resources must be developed, inventions fostered, and all must work wisely and hard. It seems to me that this policy is the inverse of what is being followed in this country at the present time.

There is a statement in your issue of last week that the Canadian Government is going to spend $12,000,000 this year in further electric development of the water powers of Ontario. It is acknowledged here that coal resources should be conserved and water-power developed, but as yet there seems to be no practical policy in the matter. Railway electrification is coming, but the question of standardisation of system is still undecided. In the meantime, there are many good technical engineers in the country looking for work, or wasting time in trivialities—surely under a scientific Government these men would be used in investigating these problems and in standardising methods and systems.

Again, the much-debated question of the adoption of the metric system is still undecided while the country is entering the race for commercial supremacy. In a question of armaments, a matter of £2,000,000 for a battleship is nothing. Possibly the Government will wake up one day to the fact that its aforetime unnoticed technical ability has emigrated to those countries where it is appreciated.

Reader.

May 6th, 1919.

The E.P.E.A. Award.

I feel sure that there must be many chief engineers of small undertakings like my own who have from time to time received niggardly advances, not as war bonuses, quite inadequate to the now high cost of living, and yet have refrained from joining a trade or professional union such as the above, on the ground that it would be *infra dig.* Well, Mr. Editor, with your inner-circle knowledge, can you or any of our friends tell us whether this is a *bona-fide* award that is backed by the Government, or is it, in the words of the crowd, a "wash-out"? Do some of the big stations participate and the small ones not? In case it is a Government award, what steps does the Association take, or the Government, to enforce it? If it is not a Government award, would it not be better for the E.P.E.A. to amalgamate with the E.T.U. and thereby share the proportionate advances in wages that have been granted to that Union?

I can heartily endorse the remarks of Mr. Connaught Smith and "Nil Desperandum." The E.P.E.A. seems to me to take the attitude of the old "passive resisters," who gradually died out of existence.

H. A. Harding.

Bognor Electricity Works, Sussex, *May 6th*, 1919.

The Re-settlement of Officers.

For several weeks quite a number of letters were printed in the Electrical Review on the question of "preference for officers" by "Fed-Up," "Sapper," &c. The notice which is now displayed in Post Offices distinctly states "for officers and men of like standing in civil life." However, that is not what I wish to discuss. Two months ago I made application under the scheme for training in electrical engineering and maintenance towards the same. I wrote the District Director of the Appointments Department asking the reason for the delay, and, after waiting all this time, his reply states that the application is awaiting consideration by the Interviewing Board.

Now, as I served in the ranks, I was unfortunate not to get a commission. Am I having to take a back seat while officers get preference, or are officers kept waiting similarly for fresh supplies of red tape? It is three months since I was demobilised, and so far I haven't drawn a penny, and I am too proud to draw the O.W.D. of 29s. per week. How am I expected to live?

Again, are employers acting squarely towards those who have returned to civil life, officers or men? I have written to several large electrical undertakings stating my qualifications, and asking if they would give me the chance I was desiring, but I invariably received the same answer. Admitted that I want some training, but how am I to get it under such circumstances?

I suggest that employers soften their hearts towards the demobilised soldier, and give him all the help they can, and as the Excess Profits Tax has been decreased by one-half they could, at any rate, afford to use that half on training one or two who, in their opinion, would make good business men. Give them the chance for a few months; then if they have made no progress, there is only one alternative. Offer them a living wage. By that I don't mean money for nothing, as our friends the Labour Party are asking, but I believe the labourer is worthy of his hire. Would a director of a firm of electrical engineers employing several hundred hands state his views, please?

Still Trying.

May 6th, 1919.

[We refer to this subject in our leading columns to-day.—Eds. Elec. Rev.]

Telephone and Telegraph Line Construction.

With reference to your correspondent Mr. Barlow, *re* the above, in answer to my letter in a previous issue of the Electrical Review, I wish to say that Mr. Barlow is undoubtedly correct as regards the cost, and present charges to the public for usage of the wires. It is *expensive* laying telegraph and telephone wires underground.

The reason of my astonishment, however, was more, perhaps, political, seeing that the authorities *were* laying or *had* laid miles of telegraph and telephone wires inland underground. I have heard some people remark: "If you want secrecy it would be just as easy to 'tap' a buried wire as an overhead wire." This is *not* the case. The underground wires would be, in special cases, located by means of a *pocket compass* and sign posts with a *cipher or code direction* on one side of it, and on the other side the penalty for wilful removal of such direction post. The authorities or owners of the buried wires would be in possession of the "key" cipher book, faults, of course, being tested for in the usual way, as for submarine cables.

I hope in time all telegraph and telephone wires will be laid underground, and it may perhaps facilitate or reduce costs when the new electric power schemes now coming forward are brought about. The telegraph wires could be laid at the same time; not necessarily in the same trough or very near the power cables trough.

D. R. Broadbent.

London, S.W. 1, *May 9th*, 1919.

The Election of the I.E.E. Council.

Now that another election has taken place, it would be interesting to know how many of the 5,000 corporate members who are entitled to vote have exercised their right. From my own observation, about nine out of every ten dropped their voting papers into the waste-paper basket, and the reason for this indifference is not far to seek.

There are approximately 1,500 full members who have the right, if groups of ten are agreed, to nominate candidates for the Council. The Council, therefore, always nominates a few more men than there are vacancies, to give the members a choice, knowing that if it gave no choice, the members would take the matter into their own hands, and nominate an opposition. This year, the Council nominated seven members for three vacancies.

When it comes to associate member representatives, however, the Council gives them no choice at all, merely nominating three men for three vacancies, knowing that the 3,500 associate members must accept its choice, as they are barred from nominating any opposition. It is not surprising, therefore, to find that the average associate member takes no interest in the election, and that there is a general impression among them that the Council of the I.E.E. does not put itself out to study their interests at all, and it is only when it wants to get their votes, as when the subscriptions were raised, that any redress can be obtained from the Council to long-outstanding grievances.

In the past, the Council could safely ignore the opinions of the general members, for there was no cohesion among them, and they could not, therefore, take united action; but times are changing now, and electrical men especially are forming associations of their own which contain a high proportion of I.E.E. members. If action against the Council were taken by any of these groups the apathy of the average member when a ballot is being taken is likely to react very seriously against the Council, for it would not take many hundred members voting together to defeat the Council at every election, but the Council seems to be blind to the signs of the times

It is stated on good authority that four candidates, two of them associate members, with very strong backing, were nominated for the last election, but were disqualified owing to a technical error, which could have been rectified in a few hours, but they were not notified till too late, although there was sufficient time between the receipt of the nominations and the closing date. The Easter holidays may have had something to do with the delay, but the Council has committed too many tactical blunders in the past to make its victims willing to give it the benefit of the doubt.

The Council could do a great deal to arouse interest in the Institution by treating the associate members as fairly as it treats the members, by giving them a choice of representatives at elections. It could do this either by having extra Council nominees for each grade, or by giving the other corporate members the same right to nominate candidates as the present full members. I am afraid the remedy is too obvious for the Council of the I.E.E.

An Associate Member.

May 11th, 1919.

[We refer to this matter in our leading columns.—Eds. Elec. Rev.]

The Field of the Electrical Contractor.

The excellent article in your issue of May 2nd, by Mr. Donald Smeaton Munro, under the above title, of course touches only the fringe of what I venture to call the scandal to which he refers.

One of the points which it does not cover is the responsibility of the contractor for a very large portion of his wrongs, inasmuch as he, unlike the members of "nearly all other respectable trades," is perfectly content to place his orders with the Manu Factor-Contractor who is his bitterest opponent, instead of supporting the firms, and there are such, who confine themselves to the supply branch of the business as distinct from those who try "running with the hare and hunting with the hounds."

For years I fought the battle of the contractor at the council table of the British Electrical Manufacturers' Association (out of which the "B.E.A.M.A." sprang), of which I was one of the founders; *inter alia* doing my best, also, to wrest the control of the Association from the hands of the alien element who largely preponderated in it, and make it really British. Again and again I objected, sometimes successfully, to the election of firms who notoriously posed as contractors, whilst, in one case at least, also calling themselves consulting engineers, manufacturers, factors, and agents—all the lot—and resigned from the sub-committee which met the Electrical Contractors' Association, respecting a special preferential allowance of 2½ per cent., which it was suggested should be given them by the manufacturers, because a highly respected contractor then and there convicted a member of the sub-committee of being, *sub rosa*, a contractor.

But I fear my time and energy were entirely thrown away, for, although this incident occurred many years ago, the firm in question, who have not, I believe, yet mended their ways, are still largely supported by what I regard as the suicidal policy of contractors in placing orders with them and similar establishments.

If, as Mr. Munro justly says, "The electrical contractors . . . are the infantry of the line . . . there is little wisdom in turning all the heavy ordnance, tanks, and aeroplanes of the electrical army into instruments for the decimation of their own infantry," what can be said of the "infantry" who traitorously assist in doing so?

Further, the insane cry of the user for cheapness, and the equally mad competition between contractors to give it, has led to the gradual introduction of apparatus which will just, and only just, pass the tests and fulfil its desired duties, shading off into the absolute dishonesty of altering a maker's capacity plate, attached to an electric motor, for instance, to do as much as double its guaranteed H.P. (and overloading it at that), with the result that the outraged maker has been forced, for his own reputation's sake, to take a hand in the deal.

That electrical contracting would ultimately be taken up by plumbers, ironmongers, &c., was long foreseen by the pioneers of the industry, and this will continue, and grow in frequency, until it is recognised as a skilled, a technical, calling, and steps are taken, by the contractors themselves, to render it impossible for any wireman's mate, who chooses to do so, calling himself "electrical engineer and contractor."

Not that I wish to "throw bricks" at every plumber or ironmonger who does so, or tar them all with the same brush; I know many, and am glad to number them amongst my supporters, who employ good electrical men to run that branch of their business, or call in competent firms to act as sub-contractors, their methods being to my mind quite legitimate.

"In nearly all other respectable trades" business is strictly divided into three divisions—manufacturers, factors (or wholesalers), and retailers—none of which attempts to bridge the others.

But if, in the electrical trade, the contractor or retailer is hard hit, so also is the factor who has to contend with the same prices being quoted to the retailer as he can himself get from many of the manufacturers.

However, this, as Kipling says, "is another story," with which, unless you are interested in it on some future occasion, I do not propose to take up your space, although I think I could show that the attempt to suppress the factor is as greatly to the contractor's detriment as for the manufacturer to get at his customers direct.

I have a great objection to anonymity, but I have a greater, and you doubtless have also, to any attempt to obtain a free advertisement out of the technical Press, so consider myself justified in signing this,

One of the Pioneers.

May 12th, 1919.

LEGAL.

Fraser & Chalmers, Ltd.

Mr. Justice Astbury had before him in the Chancery Division, last week, a question raised by the liquidator of this company, concerning the principle that should be adopted to determine the manner of distributing the surplus assets (£150,000) that remain after payment of all liabilities. His Lordship decided that the surplus assets should be rateably distributed between the ordinary and preference shareholders.

Compensation Claim.

At Bradford County Court, last Friday, Mrs. Jane Kershaw, widow of Mr. Henry Kershaw, who was killed by electric shock last June at the works of Thwaites Bros., Ltd., engineers, Bradford, and three illegitimate children of Kershaw by another woman, claimed £300 compensation. Kershaw was a power-house attendant. In seeing that things were right before leaving on a Sunday evening, he, apparently, noticed something wrong with a switch. Whilst he had his head and shoulders in a high tension cubicle there was a flash, all the lights went out, and half the cubicle seemed to be in flames. Kershaw was dead. It was contended that even if the man did a foolish act it was clearly within the scope of his employment. If he had succeeded he would probably have been "patted on the back."

Mr. F. G. Smith (for defendants): I don't know about that. If the poor man had lived he would have been instantly dismissed.

Mr. Andrew Ryan, the engineer, said Kershaw had no right to adjust anything. He should have reported anything wrong to him (witness).

His Honour Judge Macklin said if anybody in authority had told Kershaw to do what he did, he would have been liable to a charge of manslaughter. As it was, the man took upon himself to go right outside his employment. He therefore gave judgment for defendants, but in commenting on the generosity of the firm towards the children and their mother, he hoped they would extend it to the widow.

Meharey *v.* Belfast Corporation.

The resident magistrate for Belfast delivered his considered judgment in this test case (see Elec. Rev., May 9th, p. 534) on Monday. In giving judgment for the defendants, the magistrate said the facts were admitted, and the question was one of law. The defendants only received two days' notice of the strike, and he held that it was impossible for them in that time to procure the necessary labour to carry on the work.

Prigot *v.* Electric & Ordnance Accessories Co., Ltd.

At the Birmingham County Court on the 7th inst., a Belgian mechanic named Prigot sued the defendants for damages for wrongful dismissal. He commenced to work for the company on October 15th, and after three months the contract was revised, plaintiff's engagement being fixed for the duration of the war. In December, 1918, he was told that he would be suspended. Counsel argued that as the war had not yet come to an end plaintiff was entitled to damages for wrongful dismissal. For the defendants, it was stated that the plaintiff, upon his dismissal, accepted a week's wages in lieu of notice, and said he was satisfied with the arrangement. This, said counsel, amounted to a mutual discharge of the contract whatever it was.

Judge Amphlett, in giving judgment for the plaintiff, awarding £75 damages, said that the contract was not terminated by plaintiff's acceptance of a week's wages.

Defective Tramway Track: Compensation Case.

In the Southwark County Court on Monday, £30 damages was awarded a woman omnibus conductor for personal injuries due to a collision between her omnibus and a van belonging to Hay's Wharf, Ltd., who attributed the accident to defective L.C.C. tramway lines. According to the *Times* report the Judge said that the London County Council was responsible for the proper care of the tramway lines of London, and it was its duty to prevent the possibility of accidents caused by defective rails, notwithstanding the scarcity of labour or of material. He decided that the London County Council was responsible for the accident to the plaintiff, and he awarded her the amount mentioned, and made an order that the Council must pay the costs of Hay's Wharf.

BUSINESS NOTES.

Letters from the Forces.—A Captain in the R.A.F. writes from France thanking us for the Electrical Review, which had been sent to him for some considerable time; he adds: "It is pleasant to see such an old friend come out of war times stronger than ever, both in circulation and, I think, technical and literary interest."

Stocks of Non-Ferrous Materials.—The following particulars are published of the stocks (exclusive of old metal and scrap) in this country in possession of the Minister of Munitions on May 1st, 1919:—

Copper	51,130 tons
Spelter, g.o.b.	26,912 ,,
Spelter, refined	7,057 ,,
Aluminium	11,542 ,,
Soft pig lead	109,012 ,,
Nickel	2,567 ,,
Antimony regulus	4,461 ,,

Import Restrictions Removed.—The President of the Board of Trade, after duly considering the recommendations of the Consultative Council on Imports, has given the following further directions in regard to the Prohibitions of Import:—

The restrictions on the importation of the following goods are to be removed:—

81. Malleable tube fittings.
82. Pressure regulators, lubricators, grease cups, injectors and ejectors, pump and engine governors, pressure and vacuum gauges.
83. Expansion joints, iron or brass.
84. Pressed steel union couplings.
85. Water-gauge fittings.
86. Steam traps.
87. Metallic steam packing.
88. Brass wire, copper wire, copper-clad wire, phosphor wire, coppered steel spring wire, tinned mattress wire, wire, leading-in nickelled copper, steel wire coppered and flattened.
89. Wire rope sockets, drop forged steel.
90. Copper rods and steel and iron wire rods.
91. Antimony, crude, regulus, and sulphide.
96. Mathematical instruments and screws for same.
97. Oil cans.
105. Waste or scrap rubber.

General licences have been issued for the above articles.

The importation of the following articles is to be licensed only exceptionally, as and when required:—

119. Brass rods, tape, and strip; brass-coated tubes, brass or copper tubes, and brass hose clamps.
120. Nickel wire.
122. Iron and steel valves, cocks for gas, water and steam and iron foot valves.
127. Semi-rotary pumps.
128. Steel and iron wire, wire bale ties, and galvanised wire.
133. The following kinds of glass and glassware:—
    - Scientific.
    - Machinery.
    - Optical.
    - Miners' lamp glasses and miners' electric lamps.

The importation of the following articles is to be restricted as shown:—

141. Importation of gun metal, brass or bronze valves for gas, water, and steam is to be restricted to 100 per cent. of 1916 imports.
143. Glassware (including bottles and jars), other than scientific glass and glassware, machinery glass and glassware, optical glass and manufactures thereof, miners' lamp glasses and miners' electric lamps, are to be admitted at the rate of 50 per cent. of 1913 imports.

Applications for special licences should be made, as usual, to the Department of Import Restrictions, 22, Carlisle Place, London, S.W. 1.

A list of articles indicating what is included under the heading of scientific glassware is printed in this week's issue of the *Board of Trade Journal*.

Housing by Public Utility Societies.—The Local Government Board has issued a small penny booklet with this title showing in simple terms how small groups of people, whether of workers, or of workers acting jointly with employers, or of other individuals, may band themselves together for the purpose of promoting housing schemes and obtaining financial assistance from the State. It is felt that with the facilities which the Government proposes to give, groups of people associated together in these societies may do much to supplement the work of local authorities and to help towards a solution of the housing shortage.

Exhibitions of 1920.—The British Industries Fair of March next will be held at the Crystal Palace. In the following summer the buildings will be used for an Imperial War Exhibition.

"What Licked the Kaiser?"—This is the title of a booklet issued by the aggressive Society of Electrical Development (U.S.A.). It leads off by showing that it was by means of "co-operation" that the "most efficient hell-raising organisation the world has ever seen" was smashed, and it is by "co-operation" that the bill will be paid. The Society is the means for promoting electrical co-operation: the pamphlet tells us what it has done and hopes to do in that direction. We are seriously assured that the pamphlet was not meant to be facetious.

Reconstruction Problems.—No. 23 of the series of Grey pamphlets issued by the Ministry of Reconstruction is Part 2 of the consideration of Public Health questions, and it deals with "The Present Problem and the Ministry of Health."

Patent Restoration.—Mr. W. R. Pilkington has applied for the restoration of Patent No. 2,343 of 1914, for "Improvements in air or other fluid-pressure pumps." Mr. W. B. Good & Rebesi, Ltd., have applied for restoration of Patent No. 6,887 of 1913, for "An Automatic Morse Recorder."

Demobilised Men Entertained.—About 130 employés of the Birmingham electric supply undertaking who have been serving with H.M. Forces, and have already been demobilised, were entertained by their colleagues at a dinner and concert, last week. Owing to the large number of guests and visitors, the dinner was served in two dining halls, presided over by Mr. R. A. Chattock, city electrical engineer, and Mr. E. J. Jennings, secretary, respectively. During the evening a cordial "welcome home" was extended to the men by the Lord Mayor and Mr. Councillor Burman (the chairman of the Committee). Presentations were made to Messrs. Whiting and Kirby, honorary secretaries to the War Funds and War Relief Organisation of the department.

Foreign Trade.—The April Figures.—The official returns of imports and exports during last month contain the following electrical and machinery figures:—

Imports.	*April*, 1919.	*Inc. or dec.*	*4 months*, 1919. *Inc. or dec.*
	£	£	£
Electrical goods, &c. ...	132,661	+ 68,019	+ 147,845
Machinery	1,094,368	+ 340,211	+ 2,000,943
Exports.			
Electrical goods, &c. ...	366,998	+ 221,754	+ 683,161
Machinery	2,010,858	+ 702,762	+ 2,217,654

International Competition in Aluminium.—The chairman of the Aluminium Industrie A.G., of Neuhausen, addressing the shareholders at the recent general meeting, is reported to have stated that the rumours were absolutely without foundation which had been circulated that the company's gross profits in 1918 were higher by £800,000 than was shown in the accounts for the year. Discussing the future prospects of the undertaking, he expressed the opinion that extremely severe competition was to be expected, as rivals in other countries had become considerably strengthened during the course of the war. The strength of the Neuhausen company lay in the fact that the installations had been written down very considerably, and the business policy must continue in the direction of keeping the value of the installations at such a low level that the cost of production was only affected to a slight extent by the financial charges for interest and redemption, particularly in regard to the hydro-electric works, so as to keep the cost of electrical energy as low as possible. Moreover, it was essential to develop the works and provide for a uniform utilisation of the water powers, which varied according to the time of the year, and it was also unconditionally necessary to take into account in the policy of profit distribution the totally changed political and economic conditions, and the resulting uncertainty as to the future. The chairman further stated that the principal customer was the Krupp Co.; the installations in Hungary had been socialised, but nothing was known as to the situation in Roumania.

Dispute at Rochdale.—A correspondent states that trouble has arisen at a Rochdale mill through the dismissal of two employés who are members of the Electrical Trades Union, and the members of that and other unions consider they should be reinstated. An ultimatum is to be presented to the employers to cease work if an amicable settlement is not reached.

Safeguards in the Workshop.—The British Fire Prevention Committee have decided to issue, in the form of a "folder," some useful reminders to the factory owner, manager and foreman, as to the prevention of fire. The present season has been selected for the issue, as so many works are reorganising their establishments for post-war activities. Folder No. 1, entitled "Safeguards in the Workshop," contains valuable and timely hints which should be laid to heart by those concerned. Copies are provided gratuitously to applicants who address the Registrar of the Committee in writing at 8, Waterloo Place, Pall Mall, S.W. 1, with an addressed and stamped envelope enclosed.

Catalogues Wanted.—The Imperial Trade Correspondent at Victoria, B.C., Mr. J. J. Shallcross, P.O. Drawer 730, Victoria, B.C., is getting together a complete library of catalogues and trade literature for reference by local importers. British catalogues of machinery, hardware and glassware, electrical appliances, especially including those for unit lighting systems for farmhouses and other buildings, are wanted.

The British Vice-Consul at Granada is asking for British catalogues in Spanish for distribution among Spanish firms in his district.

Birmingham Commercial Library Opened.—The Lord Mayor (Sir David Brooks) recently opened the new commercial and technical library which has been established by the Corporation in the new Council House Buildings. The library will provide all Consular and trade reports, manufacturers' catalogues, &c., and technical and industrial books. The assistants will help inquirers to obtain information, and as far as practicable questions will be answered on the telephone. The Lord Mayor stated that while the general reader should be provided for, adequate facilities should be made for the student, the research worker, the scientific man, and the man of commerce. Mr. H. C. Field, President of the Birmingham Chamber of Commerce (who is an export merchant), insisted that the fault for insufficient commercial development and knowledge lay largely with the English commercial classes themselves. We had been too apt to devote our attention to our offices and factories without taking a sufficiently wide outlook on commerce as a whole, on possibilities of development, and on our relations with different countries.

The Belgian Charleroi Works.—The report of the directors of the Ateliers de Constructions Electriques, of Charleroi, which was approved at the general meeting held towards the end of last month, stated that the company would be able at once to resume peace manufactures, excepting in the case of cables, with a reduced rate of production. The rate, however, would rapidly increase with the arrival of new machinery and the return of recovered machinery, which would not occupy very long. It was possible to foresee the return shortly of a large portion of the cable factory machinery, and it was hoped that the works would have regained the full productive capacity before the end of the present year. A number of new machines purchased in America, and the delivery of which had begun, would permit of a material expansion of the output. The company were preparing to meet the extension of markets which was in prospect. The new conditions of labour would compel industries to electrify their equipment in order to reduce the cost of labour, and the Belgian Government had under consideration the question of the conversion of some railways to electric traction. The development of the uses of electricity would be hastened on all hands, and the demand for electrical plant had become more considerable. The balance sheet at the end of 1918, resulting from the management of the German sequestration, showed a provisional deficit of £93,000, but the directors adopted an attitude of reserve as to the accuracy of the accounts, which would only become definite when the compensation for war damages had been ascertained.

Japanese Competition.—Writing in *Unity*, (May issue) Mr. Stanley de Brath, M.Inst.C.E., says: "National prosperity depends on national trade, and the vast burdens which the war has left behind can be carried only by an unprecedented volume of production and cheap transport. Already Japanese and American trade has gone up by leaps and bounds at our expense. The case of Japan is interesting. The suicidal quarrels of the white races have been pure good luck to the yellow race. Before the war Japan had overborrowed to an extent which made her solvency dependent on a continuance of good rice seasons. Now, thanks to the flood of gold which has poured over to the Far East, her credit stands higher than ever. One thing is certain—if we in Europe raise the price of living by low production, Japan and China will certainly lower it by cheap labour and transport; and the lowering will be at our expense by supplanting us in neutral markets. It needs no prophet to foretell that the exhaustion of Europe will be the opportunity of Asia; many Asiatics are thinking so. Scientific management is familiar to Japan; it will surely arise in China, whose vast coal and iron fields, *closed to Europeans* by the agreement between China and Japan, are being exploited by the cheapest and most contented labour in the world. It is rapidly becoming so in India, whose teeming population is almost as simple in its mode of life as the Chinese coolie. There is no 'labour unrest' in the East."

Exports to Europe.—The Overseas Trade Department states that the present position in regard to the control over exports to Norway, Sweden, Denmark, Holland, and Switzerland is as follows:—

1. Goods on sections A, B, and D of the list of prohibited exports can only be exported provided a licence is first obtained from the Export Licence Department, 4, Central Buildings, Westminster, S.W. 1.

2. Goods on the list of "free" exports may be exported without any formality whatever.

3. Goods on section C of prohibited exports (other than such goods as appear on section D) may be shipped (not posted) without licence provided the following conditions are observed:—

(*a*) Norway and Sweden.—Individual guarantees in respect of exports are no longer required provided the goods are consigned to the appropriate Import Association on account of the actual consignee. Should the consignee declare that the Import Association will not accept consignment, the goods should be consigned to the Inter-Allied Trade Committee at Christiania or Stockholm, as the case may be, on account of the actual consignee. This method of consignment must also be adopted in the case of goods which are not consignable to any import association. In order that the method of consignment may be checked, an arrangement has been made whereby shippers are to forward the Customs Shipping Bills or specifications (whichever are required under Customs regulations) to the Export Licence Department, 4, Central Buildings, Westminster, S.W.1 (in envelopes marked "Shipping Section") for approval. Should the exporter actually have received a guarantee against re-export in respect of the transaction, it should be forwarded with the shipping bill or specification, and if the guarantee has previously been sent to the Export Licence Department the reference number of the relative papers should be furnished. The shipping bills, or specifications will be amended if necessary and returned to the shippers stamped "approved." Upon the production of approved shipping bills or specifications, shipment will be allowed by H.M. Customs without any form of guarantee, subject to the usual Customs formalities. This procedure will not apply to any licences which have already been issued or which may hereafter be issued in special cases.

Should exporters prefer, they may forward to the Export Licence Department a duplicate of the usual advice sent to their shipping agents in lieu of a shipping bill or specification. The advice will then be stamped and returned to them (or to their shipping agents if requested) for production to the Customs with the usual shipping bill or specification. Documents addressed to the Shipping Branch of the Export Licence Department will be dealt with at once and dispatched to exporters by return post.

(*b*) Denmark.—The goods should be consigned direct to the consignee provided certificate from the Danish Chamber of Manufacturers or Danish Merchant Guild is produced to His Majesty's Customs at the time of shipment. Should the consignee declare that the Chamber or Guild refuse to issue the necessary certificate,* shipment will be allowed without certificate, if the goods are consigned to the Inter-Allied Trade Committee at Copenhagen on account of the actual consignee.

(*c*) Holland.—N.O.T. certificates are no longer required, but goods must be consigned to the Netherlands Oversea Trust on account of the actual consignee. Should the consignee declare that the N.O.T. will not accept consignment,* shipment will be allowed provided the goods are consigned to the Inter-Allied Trade Committee at The Hague on account of the actual consignee.†

(*d*) Switzerland.—S.S.S. certificates are no longer required, but goods must be consigned to the Société Suisse de Surveillance Economique on account of the actual consignee. Should the consignee declare that the S.S.S. will not accept consignment*, shipment will be allowed if the goods are consigned to the British Legation at Berne on account of the actual consignee.†

4. For consignments (*a*) for the personal use of the consignee, (*b*) for trade purposes of not more than £5 in value, or (*c*) to be exported by parcel post, it is proposed to continue to issue export licences in order to obviate consignment difficulties. These licences will be issued with the utmost expedition.

5. Where licences are already held by exporters in respect of goods which under the above regulations may now be exported without licence, the following points should be noted:—

Norway and Sweden.—Shipment will be permitted under the licences without the production of approved shipping bills. *Vide* 3 (*a*).

Denmark.—Shipment will be permitted under the licences without the production of guarantees—*Vide* 3 (*b*).

Holland and Switzerland.—Shipment will be permitted under the licences without the production of N.O.T. or S.S.S. certificates, even though the production of such certificates to H.M. Customs may be stipulated in the licences. *Vide* 3 (*c*) and (*d*).

6. N.O.T. and S.S.S. certificates which under the new regulations are not now required should be handed to H.M. Customs for disposal at the time of shipment.

* It is suggested that before any consignments are dispatched, exporters should ascertain by reference to the consignee whether the Import Association will accept consignment.

† The Inter-Allied Trade Committee or the British Legation at Berne, as the case may be, will endorse the bills of lading (without any financial liability) on receipt of satisfactory guarantees from the importer.

The Banks of the Rhine.—The Board of Trade have extended their General Licence authorising, on certain conditions, the supply of goods to the territories on the left bank of the Rhine in the occupation of the Armies of the Associated Governments, so as to cover, on the same conditions, the supply of goods to the occupied districts on the right bank. As regards both banks of the Rhine, applications should be made to the Export Licence Department, 4, Central Buildings, Westminster, S.W. 1, in respect of goods remaining on Sections "A" or "B" of the Prohibited List which it is desired to dispatch to the occupied areas (including Luxembourg). Goods on Section "C" of the Prohibited List do not now require a licence for export to the above-mentioned territory, provided, in the case of shipment *viâ* Holland, they are first consigned to the Standard Bank of South Africa, Rotterdam. Goods on the "free" list may continue to be exported free of all restrictions. No import permit from the authorities in the occupied areas is now necessary.

Export Prohibitions.—The *London Gazette* for May 9th contains a further list of alterations in export prohibitions.

Catalogues and Lists.—Messrs. George Kent, Ltd., 199-201, High Holborn, London, W.C. Twenty-four-page fully illustrated catalogue (Section 8) of steam meters. The contents include a general description of the apparatus; the two forms of orifice fittings (fixed and variable) are shown by means of excellent diagrams. Other information relates to the rate of flow indicator; the diagram steam flow recorder; the planimeter, which is described, and the counter and diagram steam flow recorders. A loose sheet of prices and shipping weights is given.

The Herbert Frood Co., Ltd., Sovereign Mills, Chapel-en-le-Frith.—An eight-sheet "Personal Message" explains the firm's business in the production of "Ferodo" friction linings for clutch, brake, and other duty. The illustrations include one showing the research laboratory and testing department.

"Easy-Fix" Fittings Co., 66, Victoria Street, London, S.W. 1.—Advance illustrated descriptive leaflet of the "Easy-Fix" conduit fittings.

Messrs. J. & E. Dalton & Co., Ltd., Albion Emery Works, New Mills, near Stockport.—Circular describing their solid woven endless polishing bands, for use on Linisher or other polishing machines.

The Mirrlees-Watson Co., Ltd., Scotland Street, Glasgow.—Illustrated descriptive circular No. C 1,000, relating to the Mirrlees tube cleaning apparatus for surface condensers.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Stock lists of shunt-wound interpole motors, 110 volts, 230 volts and 460 volts.

Messrs. Griffiths Bros. & Co., London, Ltd.—Specimens of "Shaydolite" for colouring or frosting electric large bulbs by immersion.

Book Notices.—Bureau of Standards. Radio Pamphlet No. 40. "The Principles Underlying Radio-Communication." Washington: Government Printing Office. Price 55 cents.

"Modern Electrical Engineering." In six volumes. Edited by Prof. Magnus Maclean. London: Gresham Publishing Co. Price 12s. 6d. each net.

The eighth number of the *Journal* of the British Science Guild, containing a report on Industrial Research and the Supply of Trained Scientific Workers, particulars of the British Scientific Products Exhibition, 1918, &c., may be obtained on application to the Secretary, British Science Guild, 199 Piccadilly, W. 1, price 6d. per copy.

New French Company.—A new company has lately been formed in Paris with a capital of £5,600, and the title La Société Chauffage Electrique Domestique et Industriel (C.E.D.I.), to manufacture electric heating and cooking apparatus.

Trade Announcements.—Mr. L. G. Hawkins has severed his connection with the Hotpoint Electric Heating Co., and established an electric appliance business as L. G. Hawkins & Co., at 116, Charing Cross Road, London, W.C. 2. The firm will control the business in the "Universal" electrical appliances in the British Isles and on the Continent. They have been appointed European representatives for the Geyser Electric Co. (laundry machines); the Ramey Manufacturing Co. (Inc.) "Simplex" and "New Pacific vacuum cleaners; the Empire Transformer Co. (Inc.) Bell transformers. The Oriental Tube Co., Ltd., of West Bromwich, have appointed the firm to be their sole representatives for electric conduits, &c., in the British Isles. Mr. L. G. Hawkins and Mr. E. P. Bennett will shortly be visiting Continental countries, as they announce in our advertising pages to-day, and are open to undertake business negotiations.

With reference to the negotiations that were in progress for amalgamating the interests of four battery firms, it is announced in our advertising pages that as no agreement has been arrived at the negotiations have been broken off, and the respective companies will continue to carry on their businesses independently.

Mr. W. P. Durtnall informs us that though the works at Jeumont, in France, were thoroughly smashed up by the Germans, in about six months the "Paragon" machinery, for which Capt. Lucien Failon is representative, will be available for France and the French Colonies. Arrangements had been completed just before the war for this purpose, and similar plans are pending for the United States, in connection with Mr. Durtnall's inventions for marine propulsion and railway traction.

Messrs. Ferguson & M'Lauchlane have commenced business as electrical engineers, at 94, Drygate Street, Larkhall, Hamilton.

Messrs. Dorman & Smith, Ltd., of Manchester, have appointed Messrs. Andrews & Co., 40, West Campbell Street, Glasgow, as their representatives for Scotland.

Customers of the "Z" Electric Lamp Manufacturing Co., Ltd., are asked to take note that the Bristol telephone number of the company has recently been altered to "Bristol 4273."

The Hart Accumulator Co., Ltd., has removed its Manchester branch office to larger premises at 4, Victoria Bridge, Manchester.

Mr. Geo. H. Rattle, electrician, having been released from Government inspection work with the Air Force, has reopened business at Station Road, Oxted, Surrey.

Messrs. Webb & Co., of Birmingham, have taken premises at Stourport, for the establishment of electrical engineering works.

Messrs. Speedy & Eynon have removed to 22, Essex Street, Strand, London, W.C. 2. Their telephone number is unchanged.

Mr. R. A. Giffen, electrical engineer and contractor, of Chequer Street, St. Albans, has (owing to expansion of business) taken into partnership Mr. L. G. Hosier, of the same city. The business will be carried on as heretofore at the same address, under the style of Giffen & Hosier.

Agencies in Russia.—H.M. Consul-General at Gothenburg reports that a firm of agents in that city desire to obtain agencies in Russia for United Kingdom manufacturers and exporters of electrical supplies and materials, central heating fittings, steel pens, &c. (Reference No. 877.)—*Board of Trade Journal*.

Wages of Women Cable Makers.—The *Times* states that women and girls employed in the cable-making trade, including the electrical section, are under an award of a court of arbitration to receive an advance in wages of 5s. and 2s. 6d. respectively, provided the total advances over pre-war rates shall not exceed 20s. and 10s.

Australian Copper Mines Close Down.—The *Times* learns that private advices have been received to the effect that all the copper mines and smelters of Australia, except the Mount Morgan and Mount Lyell, have been closed down as the result of the enormous stocks of metal which are held and the comparatively small consumption of the metal since the Armistice was signed. Certain proposals were made to the British Government on behalf of the producers with a view to enabling the mines to continue working, but they having been rejected the mines have suspended operations.

The *Melbourne Age* for March 14th contains an article in which it is stated that the huge accumulated war stocks of metals abroad were making the immediate sale of Australian metals a difficult matter. The Acting Prime Minister, in the course of a statement on the position, said that there was a restriction on the export of base minerals and ores, the chief reason being found in the policy of the Commonwealth Government, which was to have all minerals and ores, as far as possible, refined within the Commonwealth. There could be no two opinions regarding the soundness of this policy. Encouraged by the Government, vast development had occurred during the war, and several branches of the industry had been preserved and stabilised. Copper works had been extended and new plants installed, the capacity of which was ample to smelt and refine all copper material produced in the Commonwealth. The largest silver-lead smelting works and refinery in the world was now possessed by Australia at Port Pirie, the output being 150,000 tons of pig-lead per annum, and 5,000,000 to 6,000,000 oz. of silver. The electrolytic zinc works in Tasmania were being extended, and when complete the capital involved in the scheme would approximate £2,000,000.

Mr. Watt stated that the restrictions necessarily imposed on the export of raw copper had nothing whatever to do with the existing difficulties. If the embargo were lifted, no relief would be given in present circumstances. Until the stocks of copper and other non-ferrous metals that had accumulated during the war had been absorbed in peaceful arts and manufactures, there was no possibility of finding profitable markets. Stocks of copper material held by the British Government in various parts of the world represented in value £30,000,000 and the United States Government had also vast accumulations. America had been unloading its copper on the market for some little time, and these forced sales were the cause of the depression in price and difficulty of disposal. There were many thousands of pounds' worth of mined copper in Australia. The Imperial Government had a stock of refined copper there of approximately 20,000 tons, which had cost it about £120 a ton, including interest and other charges, and instructions were recently received to cease shipments until further advised. In addition to copper, there would be in Australia by the end of March 80,000 tons of pig-lead and 500,000 tons of zinc concentrates stored and paid for by the British Government. The total value of metals and concentrates paid for by the Imperial authorities and still in Australia represented no less a sum than £7,000,000. The Commonwealth Government was advised that this condition of affairs was transitory, and that as soon as the war stocks had been consumed, sound markets would be found. The Goverment had already gone a long way to assist the copper producers.

Dissolutions and Liquidations.—George Schultz and Co., Ltd., 10, Arthur Street, London, E.C.—The creditors interested herein met, on 9th inst., at the offices of Messrs. W. A. Scott & Co., C.A., 50, Cannon Street, E.C. The shareholders of the company had previously passed an extraordinary resolution to the effect that it had been proved to their satisfaction that the concern could not, by reason of its liabilities, continue its business, and that it was advisable to wind up voluntarily. The shareholders also passed a resolution appointing Mr. W. A. Scott to act as liquidator. The liquidator submitted a statement of affairs, which disclosed ranking liabilities of £9,203, all of which were due to unsecured creditors. The assets were set down at £4,411, from which had to be deducted £38 for preference claims, leaving net assets of £4,373, or a deficiency of £4,830. The assets included patents, £1,124, and goodwill, £3,000. The issued share capital of the company was £4,210, and as regarded the contributories there was a deficiency of £9,040. At a forced realisation it was estimated that the assets would produce £787. At a forced realisation the patents were valued at £50, while the goodwill was written off. The company was registered on July 29th, 1912, with a nominal capital of £7,000, divided into 400 ordinary shares of £5 each and 1,000 preference shares of £5 each. In all, 722 ordinary shares and 120 preference shares had been issued. In addition to the assets shown, the company had a claim against another concern in respect of loss of profits due to a contract not being carried out. There was also a claim of £6,782 against another company. That amount would form a counter-claim against a claim which might be made against the company. The liquidator stated that at the outbreak of the war the son of the managing director of the company was acting in Manchester as agent for a firm which was said to have its headquarters in Cologne. The son joined the Army and he entered into an agreement with the company to carry on the business. The company continued the business, but a loss was made, and, finally, a controller was appointed by the Board of Trade, on the ground that the Manchester business was an enemy concern. The company resisted that claim, but the assets at Manchester were disposed of. The company claimed that they were entitled to be indemnified against loss in that direction by the firm in Cologne. After some discussion, the liquidator said he would resign if it was the wish of the creditors, and it was agreed that an application should be made to the Court for the appointment of Mr. D. F. Basden, C.A., as liquidator. The creditors are as follows:—

Interlock Metal Hose Co. ..	£22	Hill, W. C.	£73
Hughes Johnson Stampings, Ltd.	57	Directors' Fees	75
Stewarts & Lloyds, Ltd.	70	Scott, D. H.	73
Board of Trade (Royalty Account)	12	Scott, G. L.	926
William Dawson & Sons, Ltd. ..	14	Manchester Corporation ..	36
Scott, W. A., & Co.	17	Board of Trade	5,446
Mackie & Watts	70	Public Trustee	2,306

Westinghouse Electric Co., Ltd. — Winding-up voluntarily. Liquidator, Mr. A. E. Scanes. Meeting of creditors, May 20th, at 2, Norfolk Street, Strand, W.C.

Cramp's Patent Reversible Turbine, Ltd.—Winding-up voluntarily. Liquidator, Mr. F. W. Steel, 5, Copthall Buildings, London, E.C. Meeting of creditors, May 22nd. Claims to be sent to the liquidator by May 21st.

Monometer Manufacturing Co., Ltd.—Meeting, June 11th, at 26, Corporation Street, Birmingham, to hear an account of the winding-up from the liquidators (Messrs. H. T. Ledsam and G. G. Poppleton).

Troughton & Young, electrical and general engineers, Park Mansions Arcade, Knightsbridge, London, S.W.—Messrs. J. A. Troughton and H. T. Young dissolved partnership in July, 1918, by effluxion of time. Mr. H. T. Young will attend to debts and continue the business under the same style and at the same address.

Surplus Government Property.—It is announced that in order to interest export houses in the sale abroad of surplus Government property and to deal readily and on the spot with inquiries from such firms a city branch of the Surplus Government Property Disposals Board has been set up under the direction of Sir Sydney Henn, K.B.E., at Holland House, 32, Bury Street, E.C.

Resumption of Trade Between Japan and Germany.—According to the Bale *Anzeiger*, a Japanese Commission, representing the foreign trade of their country, recently left Tokio for Italy, charged with the duty of making a trade compact with Austria, Hungary and Germany. Reuter's correspondent informs us that the Japanese will send finished goods and raw materials, principally copper, to Germany. Regarding copper, the question of the German contracts in America is again becoming acute. Japan expects to receive in return from Germany chemicals and electrical goods.—*Oesterreichische Chemiker-Zeitung*, March 15th, 1919.

Bankruptcy Proceedings.—W. J. McCombe, tramway manager, Berkeley House, Princes Avenue, Kingston-upon-Hull. Receiving order made May 5th, on debtor's own petition. First meeting, May 22nd; public examination, June 16th; both at Hull.

LIGHTING AND POWER NOTES.

Accrington.—Year's Working.—At the last meeting of the T.C., it was reported that there would be a loss on the year's working of the department of about £1,698, and that it would probably be necessary to increase the charges for electricity. It was intimated that there was a probability that the application for borrowing powers for electricity extensions would not be successful, and that a new super-power station would possibly be erected at Preston, on the banks of the Ribble, in the near future, and that the winter of 1921-2 might see the distribution of electricity in bulk under a national scheme, the area supplied extending from Preston to Bacup, with Accrington, as a distributing centre.

Australia.—E.L. Schemes.—Wagga (N.S.W.) has instructed Mr. Vormester, of Albury, to prepare plans and specifications for the town electric supply scheme, which, it is estimated, will cost £30,000. When approved tenders will be invited in England and Australia for the supply of plant. Blacktown (N.S.W.) Shire Council is considering the question of installing electricity in the shire.

It is proposed to supply electricity to the Goswells district (W.A.), which includes Waddington, Kenwick, and part of Cannington, from the City of Perth (W.A.) electricity supply. The Perth City Council has arranged to give a supply of electricity to the Queen's Park district, which embraces Welshpool, Cannington, and the frontage to the Canning River, a distance of about 10 miles. The initiation of the scheme was delayed owing to the war.

Bath.—Price Increase.—The E.C. recommends increased charges for lighting and power, as follows:—Private lighting, 1½d. per unit, additional to the present prices; power and heating, 2½d. per unit, subject to discount.

Loan.—The Committee is applying to the L.G.B. for powers to borrow £2,528 for new mains.

Bolton.—Loan Sanction.—The Corporation has received the sanction of the L.G.B. to the borrowing of £17,000, and £5,000 for prospective expenditure on electricity mains and sub-stations respectively.

Bournemouth.—Electricity Charges.—The Electricity Supply Co. has communicated with the Council, giving six months' notice to terminate the agreement of January, 1914.

Brandon (Durham).—E.L. Scheme.—The U.D.C. has decided to apply for borrowing powers for lighting the whole district with electricity, and also for authority to supply energy to private consumers.

Brentwood.—Proposed E.L. Scheme.—The U.D.C. has passed a resolution to the effect that an E.L. scheme would be favourably considered, and support given to an approved company, and expert advice is to be obtained and the result reported to a public meeting.

Bridlington.—Price Revision.—The T.C. has raised the charges for electricity for power as under:—First 250 units per quarter, 2½d.; 250 to 500, 2d.; 500 to 1,000, 1¾d.; beyond, 1½d.

Burnley.—Proposed New Works.—The Town Council has confirmed the action of the Electricity Committee in instructing Mr. E. M. Lacy, consulting engineer, to advise as to the advisability of proceeding with extensions to the electricity undertaking on the present site, or alternatively as to the erection of a new generating station on a more suitable site, at a fee of 200 guineas, plus expenses.

Proposed Loan.—The Committee has decided to apply to the L.G.B. for sanction to borrow £5,000 to cover expenditure in laying mains.

Coventry.—Price Revision.—The Electricity Committee recommends that, as from January 1st last, the charges for electricity for power be fixed at 20 per cent. above those in force on September 30th, 1918.

Darwen.—Year's Working.—There was a loss of £973 on the electricity undertaking last year.

Denbigh.—Water Power.—The Anglesey County Council has decided to support a joint scheme for the utilisation of the water-power available on the borders of the Denbigh Asylum Estate to generate electricity for lighting and heating. Mr. S. E. Britton, of Chester, has prepared a scheme which, at a cost of about £6,000, would supply the Asylum by next winter with three and a-half times the power now generated by steam, and save 700 tons of coal. The total estimated cost would be apportioned to the respective County Councils concerned, as follows:—Denbigh, £1,893; Flint, £1,212; Anglesey, £668; Carnarvon, £1,631; Merioneth, £593.

Dundee.—Flood-Lighting.—Electric flood-lighting projectors were recently tested by the City Fire Brigade, Police, the Lighting Committee, and Mr. H. Richardson (city electrical engineer), and it was considered that projectors would be of great use in helping to bring fires under control.

Durham.—Street Lighting.—The T.C. has asked the E.L. Co. to quote terms for public lighting in competition with the Gas Co., whose contract expires on September 30th next.

Eton.—Street Lighting.—The U.D.C. has entered into a new contract with the Windsor Installation Co. for public lighting at £10 a year for clusters of three 200-c.p. lamps, and £3 10s. each for 25-c.p. lamps.

Hereford.—Lighting of Rural Areas.—The T.C. proposes to extend the area of supply into the rural areas, and has asked for an initial loan of £13,000, and for an indemnity in respect of capital charges on plant installed during the war, to provide energy for national purposes. A conference is to be held with the rural authorities, and their co-operation in the scheme solicited.

Heywood.—Year's Working.—There was a loss of £290 on the last year's working of the Corporation electricity undertaking. The output reached 1,404,299 units, an increase on the previous year.

Kingston-upon-Thames.—Year's Working.—The report of the year's working to March 31st, 1918, states that after payment of all charges, including interest and repayment, the net deficit was £1,763, as against a deficit of £6,790 in 1917. Notwithstanding the high prices of coal and fuel oil, the cost of fuel per unit sold decreased from 1·752d. to 1·584d., partly due to increased output and partly on account of the larger proportion of units generated by the Diesel engines. During the year the steam plant generated 939,122 units at a fuel cost of £9,183, or 2·346d. per unit sold, while the Diesel plant generated 746,913 units at a fuel cost of £1,942, or 0·623d. per unit sold.

Lancaster.—Year's Working.—For the year ended March, 1918, the number of units sold totalled 936,844 and the working costs 2·50d. per unit. Gross profit was £2,516; after payment of interest and special expenditure, £1,320, and loan instalment, £1,851, there was a deficit on the year's working of £655.

Lincolnshire.—Plant Extension.—It is reported that electrical plant is to be laid down at Keadby to provide a supply of energy to the North Lincolnshire ironstone area and the South Yorkshire coalfields.

London.—Ilford.—Price Revision.—The Electricity Committee recommends the following increased charges for lighting and power:—Rateable value, 12½ + 75 per cent. + 2d.; ordinary lighting, 7d. per unit; maximum demand, 8d. and 5d. per unit; slot meters, 7½d. per unit; power, maximum demand system, 5d. and 3d.; large consumers, 5d. per unit, to 2¼d. per unit; heating, &c., 3d. per unit; special purposes, kinemas, vehicle charging, photo lamps, bulk supply, &c., addition of 25 per cent., making a total increase of 100 per cent.; minimum account, 5s. per quarter.

Hackney.—The Electricity Committee recommends that the Council grant plenary powers to the representatives of the I.M.E.A. acting on the Joint Industrial Council—Electricity Supply Industry; also that authority be granted to it to exercise such powers when negotiating outside the Industrial Council with any body of workers or association not having representation thereon, and also that a communication be addressed to the Ministry of Labour stating that in the opinion of the Council the Wages Conference of Local Authorities, Greater London, should be represented on the Joint Industrial Council in dealing with all matters in connection with the electric supply industry.

Refuse Destructor Works.—The Establishment and General Purposes Committee, recommends that the whole of the supervision and management of the refuse destructor undertaking should be transferred from the Electricity Committee to the Public Health Committee.

Flooding of Works.—The borough electrical engineer has reported to the Electricity Committee on the recent flooding of the works due to the overflow of the River Lea. On February 18th the river rose rapidly, and for the first time in the history of the works, threatened to innundate the engine room basements, which contain the whole of the condensing plant. A total shut down of the works was narrowly averted on February 19th by the help of the fire brigade. The L.C.C. account for services rendered for pumping was £259.

Loughborough.—Price Revision.—In reply to the protests against the increased electricity rates, it was explained that the works costs had increased by £4,050, and the additional charges of 20 per cent. for lighting, and 25 per cent. for power, making 65 per cent. for lighting, and 80 per cent. for power, would only bring in £4,109.

Manchester.—Housing Schemes.—The Corporation Housing Committee has asked the City architect to consider the report upon the use of electricity for illuminating purposes in the houses to be erected in connection with housing schemes.

Morley.—Year's Working.—There was a deficit of £1,758 on the electricity department for the year 1918.

Motherwell.—Price Revision.—The T.C. has adopted the following increases in the charges for electricity for power and lighting :—Cooking and heating, ⅜d. per unit ; kinemas, ¼d. ; collieries, ·05d. ; public lighting, 50 per cent. in place of 15 per cent. ; works lighting, 2d., instead of 1¾d. ; power consumers, up to 2.500 units per term, 2d. instead of 1½d. ; hire of motors, 50 per cent. increase.

Rathmines.—Loan Application.—The U.D.C. has decided to apply to the L.G.B. (Ireland) for sanction to a loan of £10.000 for the extension of mains and other purposes in connection with the electric lighting of the township.

Rothwell.—Street Lighting.—The U.D.C. has decided to ask the Yorkshire Electric Power Co., Ltd., for terms for the supply of electricity for the street lamps in the districts where mains are already laid.

Runcorn.—Town Hall Lighting.—The U.D.C. has decided to have E.L. installed at the library and Town Hall, at a cost of £158.

St. Helens.—Loan Application.—The Electricity Committee has decided to apply to the L.G.B. for sanction to borrow £2.650 for electrical purposes.

Stroud (Glos.).—Proposed Generating Station.—The Electric Supply Co. has applied to the B. of T. for consent to erect a generating station at Cainscross.

Sunderland.—New Plant.—At the Corporation's power station at Hylton Road a 7,500-kw. Willans-G.E.C. turbo-generator is being installed, together with two large water-tube boilers, with chain-grate mechanical stokers, superheaters and economisers. A new cooling tower also is being built. The cost of the new plant will be approximately £90,000.

Walsall.—Bill.—The T.C. has confirmed the decision to promote a Bill in Parliament for obtaining additional powers with regard to the supply of electricity.

Walthamstow.—Loan Application.—The E.C. has recommended that application be made to the L.G.B. for sanction to borrow £32,975, the estimated cost of installing one 3,000-3,500-kw., three-phase turbo-alternator, complete with condensing plant, circulating pipes, switchgear, and the necessary machine and auxiliary-plant cables, and of one 20-ton engine-room crane.

Workington.—E.L. Bill.—A public meeting has approved the Corporation's application in the present session of Parliament, for an Act giving powers with regard to the supply of electricity.

Worthing.—Loan Sanction.—The T.C. has received the sanction of the L.G.B. to borrow £8,896 for a Diesel engine and dynamo, £496 for a balancing transformer with foundations, switchgear, &c., £3,550 for mains, and £3,500 for services.

TRAMWAY AND RAILWAY NOTES.

Australia.—Railway Workshops Electrification.—Mr. O. J. Rankin, works manager of the South Australian Railway workshops at Islington, has reported that the cost of equipping the shops with electrical drive would be £26,400, using the existing main shafting for the grouped machines, and independent motors for the larger machines, power to be obtained from the Adelaide Tramways Trust at 11,000 volts and transformed at Islington. The report has been submitted to Mr. P. A. Anthony, who recently made investigations as to the management of the railways.—*Tenders.*

Bradford.—New Tramway Cars.—The Tramways Committee has decided to order 26 additional sets of car motors for immediate delivery, and it is directed that these new cars be fitted with Spencer-Dawson patent oil-power brakes.

Canada.—Wages.—The employés of the Toronto tramways are demanding 55 cents (2s. 3½d.) an hour, an eight-hour day, and overtime pay. The increases would cost £400,000 annually.

According to the daily Press, the Montreal harbour railway system is being electrified.

Chesterfield.—The B. of T. has extended the time till August, 1920, for the completion of the overhead equipment, &c., for working trolley vehicles authorised under the Chesterfield Corporation Railless Traction Act, 1913, and until July, 1920, for the completion of certain sections of the tramways authorised in 1914.

Colne.—Year's Working.—The annual report on the working of the Corporation tramway department shows a loss on the past year of £3,004, compared with an estimated loss of £1.825. The manager attributes the excess deficit to increased costs of wages and electricity, amounting to £2,070.

Darwen.—Year's Working.—There was a loss of £75 on the tramway undertaking for the past year.

Doncaster.—The Electricity and Tramways Committee has decided to postpone the application to the Light Railways Commissioners for sanction to construct a line to Rossington.

Ealing.—Reconstruction.—The L.U.T. track is to be entirely reconstructed ; the centre standards are to be removed and placed at the side of the road, and the rails are to be laid nearer the centre, so as to leave a wider carriage-way on either side. The cost of the removal of the centre standards is estimated at £4.200 and the rearrangement of the electric lighting at £2.500 ; the alteration of the track is estimated at £35.000.

Hastings.—Overhead System.—The Tramway Co. has applied to the T.C. for support to a scheme for replacing the surface contact system on the sea front by overhead lines, and a Committee has been appointed to go into the matter.

Heywood.—Year's Working.—The profit on the Corporation tramways for the past year amounted to £944. Before the war the working costs totalled £7,936 ; last year they amounted to £14,440. It is estimated that the reduction of hours will add an extra £1,400 to £1,500 to the working expenses.

Jamaica.—Railway Electrification.—The improvement of the State Railways is under consideration and investigations are being carried out with a view to the transport of market produce. The Government is also considering a scheme of electrification, and a sum of £1,000 has been set apart for inquiry in this direction. Recently a gentleman connected with a large electric supply plant on the Clyde, while on a visit to Jamaica, went into the scheme. It is proposed to utilise water power, of which there is an abundance in the island, for the generation of electricity.

Lincoln.—Loan Sanction.—The Electricity and Tramways Committee has received sanction to borrow £6,000 for the purchase of additional tramway-cars.

London.—Hornsey.—Electric Vehicles.—The T.C. is to spend £11,500 on six electric vehicles for the collection of house and trade refuse.

A Highways Committee report states that 1,500 men are now repairing L.C.C. tramway track. The supply of materials is not yet satisfactory.

Mansfield.—Light Railway Extensions.—The Light Railway Commissioners on May 7th held an inquiry into the application of the Light Railway Co. to extend the lines to Forest Town, Clipstone, and Rainworth, a total of 6½ miles. The T.C. supported the application, which was opposed by the local railway companies.

Northampton.—Bulk Supply.—The T.C. has accepted the recommendation of the Tramways Committee to cease generating electricity for the tramways, and, instead, to purchase a bulk supply for five years from the electric light company at 1·4d. per unit. Energy purchased by the Corporation of late has cost over 2d. per unit. A saving of nearly £3,000 per year is estimated to result from the change.

Plymouth.—Year's Working.—The annual report on the Corporation tramways to March 31st last shows that the total number of passengers carried was 28,438.343, compared with 26,187,549 in the previous year. The total income amounted to £121,017 ; after deducting working expenses the gross profit totalled £33.024, and, after payment of capital charges, the net surplus remaining was £10,679, from which the Committee has decided to apply £6.000 to working capital and place the balance (£4.679) to the reserve fund. The receipts per car-mile averaged 20·34d., against 16·34d. To meet the additional expenditure involved by the adoption of the 48-hours week, the Tramways Committee has decided to double the fares on the longer routes.

Portsmouth.—Extensions.—The Corporation proposes laying a further 3 miles of tramway at a cost of £65.000.

Sandgate.—Resumed Service.—The Sandgate-Hythe tramway service is to be resumed at Whitsuntide.

Shipley.—Increased Rental.—The U.D.C. recently applied to the Bradford Corporation for an increased rental for the tramway tracks owned by the Council and leased to the Bradford Corporation. The Corporation suggested that the Council should consider selling the tracks. The Council, last week, declined to entertain this idea, and decided to press for increased rental.

St. Helens.—Purchase of Cars.—The Tramways Committee has decided, on behalf of the Corporation, which is taking over the local tramway service in September, to purchase 36 tramcars from the existing company.

Loan Application.—The Tramways Committee has also decided to make application to the B. of T. for sanction to borrow £25,000 for tramway purposes.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—After the Commonwealth Naval Department, the Defence Department, and the Postmaster-General's Department had considered an offer made by the Marconi Co. to establish wireless telegraph stations in Australia for international messages, the Commonwealth Government decided to give no rights to private companies. Experts are to report on the technical and financial sides of the proposition.

Automatic Telephones.—Contracts for buildings for an automatic telephone exchange at Sheffield are to be placed immediately.

British Submarine Cable Work during the War.—The full story cannot yet be told of the remarkable achievements of submarine telegraph cable-laying and repairing authorities during the past five years. The Telegraph Construction and Maintenance Co., in addition to manufacturing 20,000 miles of trench telephone cable, mostly with several conductors, made 19,000 miles of submarine cable, and its ships were actively engaged, generally on most dangerous work, laying, repairing, and diverting cables. The cable steamer *Telconia* made 75 repairs to cables and laid 24 new ones around the English and Irish coasts.

Cable Delays.—The P.M.G. announces that, in future, commercial cables are not to be delayed in favour of Government messages, unless the latter are really urgent.

Certain important cables which were interrupted have lately been repaired; but the American Pacific Cable is still interrupted, and this throws extra work on the British cables in that region. It is expected that the cable will be repaired in a few days' time.

Some months ago the War Office invited the Chambers of Commerce to suggest what codes might be added to the list of those already authorised. The Posts and Telegraphs Committee of the London Chamber advocated complete freedom in the use of codes, and submitted a list of codes which it suggested should be authorised. The Army Council last month regretted that the proposals involved difficulties which precluded their adoption at the present stage of the cable censorship.

China.—Communication between Peking and the outside world is broken, except to Siberia. There is severe rioting at Peking, and all wires have been cut.

Post Office Deficit.—In the House of Commons, on May 7th, Mr. Illingworth said the deficit of £274,000 upon P.O. services was due principally to the war bonus and the general rise in costs. The sum of £3,430,000 to be raised by borrowing was capital expenditure upon new telephone works and upon the Post Office (London) Railway, and was authorised by Acts of Parliament. The war bonus was estimated at £14,000,000 per annum, and so long as it continued at its present figure he feared the Post Office must be regarded as a non-revenue-producing department.—*The Times.*

P.O. Employés.—At the annual conference of the Postal and Telegraph Clerks' Association, at Blackpool, last week, the president stated that the Association was now ready to use the strike weapon, and that amalgamation with other organisations of P.O. workers was the subject of a ballot. The Association had obtained a 60 per cent. war bonus on the average, but that was not enough. On a proposition to confer rights on wireless operators, the Executive announced that the Government was about to nationalise wireless systems.

Wireless Stations Arbitration.—Mr. Justice A. T. Lawrence was to sit yesterday to assess the damages payable by the Crown to the Marconi Co., for breach of agreement for the construction by the company of a chain of six Empire wireless stations.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Brisbane.—June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.). Offices of the company at Brisbane.—*Tenders.*

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

June 23rd.—Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.*

Bury.—June 6th. Electricity Department. One 6,000-kw. steam turbo-alternator and exciter, with surface condenser and air circulating pumps. (See this issue.)

Ilkley.—May 20th. U.D.C. Supply of one 3½-ton electric hand-tipping wagon. Mr. G. A. Waite, Engineer and Surveyor, Town Hall.

London.—L.C.C. May 27th. Tramways Department. 2,000 tons of standard steel girder tramway track rails with fastenings, and alternatively, about 4,000 tons of standard track rails, lipless track rails and renewable guard rails. Specification (£2) from the Chief Engineer, County Hall, Spring Gardens.

Maidstone.—May 19th. Electricity Committee. 1,050 yd. ·15 sq. in. and 1,260 yd. ·05 sq. in. E.H.T. cable. Mr. E. E. Hoadley, Engineer and Manager, Electricity Works.

Manchester.—May 28th. Electricity Committee. Two 4,000-K.V.A., three-phase static transformers for Stuart Street generating station. Mr. F. K. Hughes, Secretary, Electricity Department, Town Hall.

June 4th. Electricity Committee. Supply of cable for 12 months. (See this issue.)

Natal.—May 20th. Corporation. 12 miles steel girder rails (95 lb. per yd.) with fishplates, bolts and nuts, and 4,300 tie bars, and 1,500 copper rail bonds and 300 cross bonds. Webster, Steel & Co., Agents to the Durban Corporation, 5, East India Avenue, E.C.

Oldham.—May 27th. Tramways Department. 12 double-deck top-covered tramcars, with or without vestibules, complete with trucks; also 12 complete 40-H.P. electrical equipments for the above. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Bolton.—Electricity Committee:—

Supply of cable during the next 12 months.—B. I. & Helsby Cables, Ltd.; I. Frankenburg & Sons, Ltd.; W. T. Henley's Telegraph Works Co., Limited.

Tramways Committee:—

Supply of a 36-in. plain horizontal milling machine, complete with motor and starter.—Smith & Coventry, Ltd.

Dartford.—U.D.C. Cables, feeder control units and meters for the supply of Vickers, Ltd., Joyce Green. Johnson and Phillips, Ltd., £3,152.

Dublin.—Corporation. One 5,000-kw. turbo-alternator and condensing plant:—

General Electric Co., Ltd.	£42,212
Ateliers de Construction Oerlikon (accepted)	**42,680**
Brown, Boveri & Co.	42,697
Richardsons, Westgarth & Co.	43,216
British Westinghouse Co.	43,342
Dick, Kerr & Co.	43,460
Belliss & Morcom	43,533
C. A. Parsons & Co.	43,575
British Thomson-Houston Co.	43,646

This is the third order for turbo-alternating plant placed with the Oerlikon Co. by the Dublin Corporation.

Eastbourne.—Corporation Electricity Department:—

John Thompson Water-Tube Boilers, Ltd.—One boiler, having an evaporative capacity of 26,000 lb. of steam per hour from and at 212° F., fitted with underfeed travelling-grate stokers and Ferguson superheaters, £7,400.

Leeds.—Tramways Committee. Recommended:—

Rotary converter, £2,586.—British Westinghouse E. & M. Co., Ltd.

London.—L.C.C. Highways Committee. Tenders accepted during the three months ended March 31st, 1919:—

Metallic filament traction lamps (schedule 17a).—B.T.H. Co., Ltd.; Siemens Bros. Dynamo Works, Ltd.

Winchester.—T.C.:—

Material for converting existing stoker on the large boiler at the electricity works into a mechanical stoker.—Babcock & Wilcox, Ltd., £200.

FORTHCOMING EVENTS.

Junior Institution of Engineers.—Friday, May 16th. At 7.30 p.m. At 39, Victoria Street, S.W. Paper on "Notched Bar Tests," by Major P. Philpot, R.A.F.

(North-Eastern Section).—Tuesday, May 20th. At 7.15 p.m. At the Mining Institute, Newcastle-on-Tyne. Paper on "Gas and Oil Engines," by Mr. Tree.

Institute of Metals.—Monday, May 19th. At 8 p.m. At Caxton Hall, Westminster, S.W. Ninth annual May lecture on "Radio-Activity," by Prof. F. Soddy, F.R.S.

Industrial Reconstruction Council.—Tuesday, May 20th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Industrial Life of the Coal Miner," to be opened by Mr. J. Walton, M.P.

Labour Co-partnership Association.—Thursday, May 22nd. At 3 p.m. At the Hoare Memorial Hall of the Church House, Gt. Smith Street, Westminster. Annual meeting. Address by the Rt. Hon. J. R. Clynes, M.P.

Institution of Electrical Engineers.—Thursday, May 22nd. At 6 p.m. At the Institution of Civil Engineers, Great George Street, S.W. Paper on "Electrical Phenomena Occurring at High Atmospheric Levels," by Dr. S. Chapman.

(South-Midland Centre).—Wednesday, May 21st. At the University, Edmund Street, Birmingham. Ordinary meeting.

NOTES.

Stealing Electric Lamps.—At Haslingden, last week, a 17-year-old youth was fined £1 for stealing six electric lamps from the Weavers' Institute, and three from the Free Library. There had been complaints of thefts of lamps from public buildings in the town. In this case the youth sold three of the lamps for 6s.

The Protection of Oil Tanks from Lightning.—A pamphlet issued by the Petroleum Executive states that experience proves that lightning conductors should not be provided for the protection of oil tanks; the tanks, being metal structures, efficiently protect the contents, and the addition of lightning conductors might in some cases increase the risk of ignition of the vapours from the oil.

A City Electrified.—Contractors and central stations in more than 400 cities in the United States have signified their willingness to co-operate with the Society for Electrical Development in a nation-wide house-wiring campaign, "Electrify Your Home." Of all the 11,000 contractors and central stations to whom the story of the campaign was sent, only one flatly said, "You can't do anything for us"—namely, Pasadena, California. The Municipal Electric Lighting Department stated that every house in Pasadena was wired and connected; population, 42,000; electric meters connected, 15,600. Here is the ideal for our Electrical Development Association to focus its attention upon.

The Food Ministry Interested in Electrical Development.—In view of the recent formation of the Electrical Development Association, it is interesting to learn that, in addition to the Board of Trade, the Ministry of Ways and Communications, the Prime Minister, the Home Secretary, and other eminent authorities, the Ministry of Food has taken notice of electricity supply.

We learn that Mr. George W. Greenwood, British Minister of Food, has written to Mr. J. M. Wakeman, general manager of U.S. Society for Electrical Development, commending the Society's campaigns for broader applications of electric service and requesting, for official purposes, copies of all material used. Mr. Greenwood's letter states that "in the reconstruction period following upon the war, the Ministry of Health and the Ministry of Reconstruction are both advocating a wide extension of the use of electricity in all forms of industry and also in the home for domestic purposes, such as cooking, heating, and lighting."

He understands that the Society has been established primarily with the object of popularising the uses of electricity in the United States, and has conducted some very efficient campaigns in this direction. He therefore asks to be favoured with copies of pamphlets, literature, newspaper articles, advertisements, and any other material—such as photographs, &c.—in order that he may submit them to the proper official quarter.

Mr. Greenwood's action is highly commendable, though we are somewhat perplexed by the conclusion of his letter. Which is the "proper official quarter"?

Gibraltar Straits Tunnel.—A Committee of leading Spanish financiers has been formed in Barcelona to further a scheme for a tunnel under the Straits of Gibraltar, drawn up by Colonel Rubio y Bellve, who has obtained from the Government the necessary authorisation for carrying out soundings and other preliminary work. The tunnel would be over 20 miles long.

German Nitrogen Syndicate.—In view of the opposition of the Reichstag to a commercial monopoly of nitrogen, the Treasury has proceeded to create a syndicate which is to deal with all the nitrogen produced in Germany. The Government has not only already invested enormous sums in the industry, but has now also secured a controlling interest in the management of the syndicate and the fixing of the price. It is proposed later on to unite all the consumers in a single group. The whole scheme has been laid before the National Assembly for approval.

The I.M.E.A. Annual Convention: Alteration of Dates.—Owing to difficulties concerned with catering when the Association visits Ipswich on the first day of the Convention, it has been necessary to alter the dates for the Convention to Wednesday, Thursday, and Friday, June 18th, 19th, and 20th, instead of the dates previously announced. The Felixstowe hotels have been notified of the altered dates. A revised programme will shortly be issued to members.

Irish Water-Power.—At the Dublin Rotary Club, Mr. Marshall Harriss, general manager, Dublin United Electric Tramways, read a paper on Irish rivers as aids to the distribution of cheap electrical power, and alluded to the important water-power development now being considered by the directors of the Dublin and Lucan Electric Railway. It was proposed, he said, to utilise the fall on the River Liffey, available above Leixlip, acquiring the site, including the water rights on both sides of the river.

Electricity for Farmers.—Dr. J. F. Crowley, M.I.E.E., lectured to the Tunbridge Wells Farmers' Club recently on "The Uses of Electricity in Agriculture." Dr. Crowley said electricity was used in the production of artificial fertilisers, more particularly through the fixation of atmospheric nitrogen, and its direct application to growing crops was being investigated by a special scientific Committee. The use of machinery reduced labour cost, and enabled more work to be done in a given time, and, in addition, the elimination of animal power from farm work enabled millions of acres at present devoted to the raising of food for fodder to be devoted to more directly productive purposes.

The Inns of Court Regimental Association.—The task of finding employment for ex-officers looms large in the public mind to-day. With the revival of industry which is now taking place, opportunities should be many, and, for the fully qualified men, the problem depends for its solution on the provision of an efficient medium by means of which employers can get in touch with candidates of the requisite qualifications. The Inns of Court Regimental Association, which has a large register of ex-officers, provides such a medium, and employers and others, who have vacancies or openings for men of the officer type, should notify this Association of their requirements. The Association has already been successful in placing many of its members in appointments ranging from mere clerical posts to partnerships and directorships where capital is brought in. No fees are charged, and the increasing co-operation which is now being obtained by it from employers is, no doubt, due to the personal methods which it employs, and its capacity for fitting the right man for the opportunity.

Communications should be sent to the Secretary, Inns of Court Regimental Association, 10, Stone Buildings, Lincoln's Inn, London, W.C. 2.

London Electrical Engineers, R.E. (T.F.)—The officers of the London Electrical Engineers, R.E. (T.F.), will hold a dinner at the Restaurant Frascati, on Thursday, June 12th, at 7.15 for 7.30 p.m. Any officer able to attend should communicate with Captain F. Masters, at 46, Regency Street, London, S.W. 1, as soon as possible, the accommodation being limited.

Patents in War-time.—With a view to concerted action for the extension of the life of patents, Messrs. Briggs & Son, 16, John Street, W.C. 1, invite patentees to communicate with them.

Fuel Control.—The Controller of Coal Mines announces that until further notice the supply and consumption of any form of anthracite coal is free from restriction under the Household Fuel and Lighting Order, 1918, and need not be recorded against the allowances of consumers. The price remains under control. Otherwise the provisions of the Order in respect of coal, coke, gas, and electricity still apply, and will continue to do so until the coming into operation of the Order proposed for July 1st.

American Electric Furnace Association.—Important steps were taken to promote the use of electric furnace products at a meeting held at Niagara Falls, N.Y., on March 21st. It was asserted that all interested in the matter could join together on a common basis to extend the use of electric furnaces and their quality products. A start was made in an organised way to carry out these plans. A permanent organisation, to be called the Electric Furnace Association, was created, with Mr. Acheson Smith (Acheson Graphite Co., Niagara Falls) as president, and M. C. G. Schluederberg (Westinghouse Electric Manufacturing Co., Pittsburg) as secretary. The president was authorised to get in touch with all companies and persons who should be interested in joining the organisation, and to arrange an early meeting when completed publicity plans could be discussed. The different Committees were instructed to perfect reports which could serve as a basis for constructive work.

Eliminating Telephone Line Interference.—The Seattle Municipal Lighting Department has developed a satisfactory means of protecting telephones from inductive interference on the city's 40-mile transmission line. The telephone wires are strung 15 ft. (4·5 m.) below the power wires, which consist of a 60,000-volt star-connected circuit with earthed neutral. The plan which has succeeded after the failure of several other attempts, says the *Electrical World*, has been to install on all telephone services a special closed-core transformer, in which a heavy brass sheath separates primary and secondary coils. The edges of the sheath are overlapped, but insulated, to prevent its becoming a secondary of one turn. The sheath is earthed, as is also the secondary of the transformer. This design is the same as that used on small power transformers, which step down from 60,000 to 125 and 250 volts for the accommodation of patrolmen along the right-of-way. With this arrangement no static impulse can pass to the telephone, and the operator is protected in case a H.T. conductor should break and fall over the telephone line. No insulated stool is used for H.T. telephone operators. A telephone was manufactured, in which two contacts are used, one on each side of the diaphragm. The two paths of the current being wound differentially in the repeating coil, a constant current is not obstructed, but is shifted from one wire to the other with the vibrations of the diaphragm, thus permitting the use of high currents. The transmitter at the power house is being successfully operated from the current of one of the 125-volt exciters through a variable resistance, which allows a larger current to be maintained when the telephone lines are disturbed. In this way there can be maintained a much larger talking current in proportion to the induced current from the power wires. If the talking is too loud in the receiver, a variable-capacity reactor or resister between the telephone lines can be used to reduce the volume. This reduces the talking current and the interfering currents in a virtually proportional degree. On account of the number of telephones on the line, a stronger ringer was necessary, and this requirement has been met by gearing together two ordinary magnetos connected in series.

The A.S.E. Secretaryship.—A Manchester paper reports that Mr. James Kaylor, of Manchester, has been nominated for the position of general secretary of the Amalgamated Society of Engineers, rendered vacant by the election of Mr. R. Young to Parliament as the Member for Newton-le-Willows.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Monday last the third "informal meeting" took place, Mr. F. Pooley presiding. The attendance was much less than on the previous occasions, and several members drew attention to the desirability of opening the meetings earlier in the evening. Mr. W. E. Bradshaw opened the discussion on "The Regulations Issued by Electricity Supply Undertakings," referring, first, to the early days of electricity supply, and to the development of the Wiring Rules of the I.E.E. He then proceeded to discuss the article by Mr. C. A. Baker which appeared in the Electrical Review of April 18th and 25th, and the leader in the latter issue, maintaining that the formulation and enforcement of regulations by the supply authorities was very necessary to the safety of the public. As examples of rules backed by legal authority, he cited the Home Office Rules for Factories and Workshops, and the regulations for the use of electricity in kinematograph theatres and other places of entertainment; he also gave instances showing that bad wiring was still met with, and stated that, far from being deterred from applying for a supply of electricity by the regulations of the supply authorities, the public were eager to obtain it.

A spirited discussion followed, in which both sides of the question were well represented. Amongst the points that were raised were the desirability of obtaining for the I.E.E. Wiring Rules the force of legal sanction; the need for the registration of wiremen; the question whether kinematograph motor-generators should be supplied at power or lighting rates; and the frequent disregard of some of the Home Office Rules.

Referring to the failure of the projected visits to works for want of support, the chairman announced that the Committee had under consideration a visit to the National Physical Laboratory on a Saturday morning in the summer, followed by a trip up the Thames, in which ladies could take part.

The Committee of the Western Centre has had under consideration the advisability of holding meetings outside of Bristol and Cardiff, so that members not conveniently placed with regard to these Centres may have an opportunity of enjoying the privileges of the Institution. Inquiries are being made to ascertain whether sufficient support would be forthcoming to justify the inclusion in the programme for the Session 1919-20 of a meeting at either Exeter or Plymouth, and one at Swansea.

The Committee of the Scottish Centre states that the special meeting which will be held at Aberdeen on Friday, June 6th, is intended to take the place of the summer outing. Ladies and other friends will be welcomed, and visitors have been invited by the Electricity Committee of the Aberdeen Corporation to luncheon at the Art Gallery. After a visit to the Fish Market, at 8 a.m., there will be a general meeting at the Town Hall, and a welcome to the Institution by the Lord Provost, followed by a lecture by Prof. Magnus Maclean. The President of the Institution is expected to be present, and to deliver an address. After lunch there will be visits to works and places of interest, including the Donside Paper Works, the Rubislaw Quarries, and the electricity works, where tea will be served. Mr. Alex. Gardner, of the Corporation Electricity Department, Aberdeen, will act as honorary secretary for this meeting.

A complimentary dinner was given at Princes Restaurant, on Monday, May 12th, to General Ferrié, C.M.G., LL.D., Technical Director of the French Wireless Service, by members of the Council and of the Wireless Committee of the Institution of Electrical Engineers. Mr. C. H. Wordingham, C.B.E., President of the Institution, was in the chair. After the healths of the King and the President of the French Republic had been drunk, Mr. Wordingham proposed the health of the guest of the evening, and was followed by Dr. W. H. Eccles. In replying, General Ferrié gave an interesting account of the great part which wireless telegraphy had played in the war.

Society of Engineers (Incorporated).—In compliance with a suggestion made by the Ministry of Labour (Appointments Department), the library and reading room of the Society, 17, Victoria Street, Westminster, S.W. 1, have been placed at the disposal of officers who are looking out for appointments in the engineering and allied professions. All such officers are also cordially invited to attend the ordinary meetings of the Society, particulars of which may be obtained on application to the Secretary.

North-East Coast Institution of Engineers and Shipbuilders.—The Institution has arranged to hold a summer meeting at Newcastle-on-Tyne on July 9th-11th, when diplomas of honorary fellowship will be presented to Marshal Foch, Sir David Beatty, Sir Douglas Haig, Lord Weir, Sir Joseph Maclay, and Lady Parsons. The papers to be read include: "Limits of Thermal Efficiency in Diesel and other Internal-Combustion Engines," by Sir Dugald Clerk; "Ship Repairing during the War," by Messrs. M. C. James and Launcelot E. Smith; and "Transmission of Power," by Mr. G. Constantinesco.

London Association of Foremen Engineers.—On May 3rd the Association held its Sixty-Sixth Anniversary Festival at Cannon Street Hotel. Mr. Douglas Vickers, M.P., presided, and the guests numbered between 500 and 600.

After the usual loyal toasts, Sir Hamar Greenwood, M.P., proposed the health of "The Imperial Forces."

The Right Hon. T. J. Macnamara, M.P., in responding, said that the hand of the engineer was shown in every feature affecting the prosecution of the war. In no previous war had the knowledge and skill of the engineer been so vital an element of victory.

The Chairman, proposing "Prosperity to the Association," said he was sorry, looking to the future, he could not promise engineers a very easy time. He was afraid they would have to face very nearly the same conditions that they had four or five years ago, when they were constructing for the war; now they would have to construct for the works of peace, and that would be no easy task. Employers would have to take the men very much more into their confidence than they had done. He had, however, every confidence in the future, for he felt that employers could appeal to the men and get them to understand that their interests were identical. An increased output was most essential if the country was to hold its own, and he looked to that with the greatest hope, because he had confidence in the race to which he was proud to belong.

Mr. James Harrington (Secretary and Past-President) responding, said the care which was always taken as to the qualifications of applicants for membership was now being fully justified: they had only 5 per cent. of their members unemployed, and only one man was receiving assistance on account of unemployment. A sum of £510 had been contributed to the Association's superannuation fund.

Institution of Municipal and County Engineers.—The Institution visited Bournemouth on Friday and Saturday last. In the course of the proceedings, Mr. Ignatius Bulfin, tramway general manager, read a paper on "The Corporation Tramways," and on Saturday he conducted several demonstrations at the depôt. The first was concerned with the Sandberg sorbitic treatment of rails *in situ*, which is being tried over a mile of track in Bournemouth. A second demonstration was the cutting of a piece of manganese steel rail by the oxy-acetylene flame; and a third, the electric welding of joints. The demonstrations were followed with great interest.

Gas *v.* Electricity.—Lecturing at King's College, London, on May 3rd, Dr. W. T. Gordon said there was much talk about using our coal supply for electric power purposes, but there was a great loss in energy when coal was used in that way. A much more economical way was to use gas. On the other hand, gas was much more dangerous in certain industries than electric power, and it might be that electrical power for certain definite purposes was better.

Educational.—Edinburgh University.—A site of 115 acres has been purchased by the University, to provide for the erection of chemical and other science laboratories.

University of London.—The hon. treasurers of the Ramsay Memorial Fund have now received promises and donations amounting to £42,625.

Cambridge University.—The British Oil Companies have combined in a scheme for endowing a chemical school at Cambridge, with a donation of 200,000 guineas; Prof. Pope will probably be at the head of the school.

Engineers Object to Female Labour.—The Burnley and District Allied Engineering Trades have decided that there shall be no female labour in local engineering shops. Two electrical engineering firms, which employed 30 women, had asked to be allowed to retain this female labour, but the men have refused permission, and have fixed May 24th as the date when all female labour must be withdrawn. The men state that they are proceeding on the lines of the Government guarantee, and they add that there are about 200 engineers idle in the district. Females were not employed before the war.—*Manchester Guardian.*

Committee on Miners' Lamps.—The Home Secretary has appointed a Committee to inquire and report what improvements are possible in miners' lamps as regards safety and illumination, and what alterations are desirable in the present methods of testing and approving such lamps for the purposes of Section 33 of the Coal Mines Act, 1911. The members of the Committee are:—Mr. W. Walker, Acting Chief Inspector of Mines (chairman); Prof. F. E. Armstrong, Mr. T. G. Davies (H.M. Inspector of Mines), Mr. Vernon Hartshorn, Mr. G. A. Mitcheson, Mr. S. Roebuck, Mr. J. Wallwork, and Dr. R. V. Wheeler, of Eskmeals. The Secretary of the Committee is Mr. K. G. Fudge, Home Office, Whitehall, S.W. 1.

James Watt Centenary.—At a large public meeting in Birmingham, on May 8th, attended by representatives of all the leading engineering societies and scientific institutions, a provisional scheme for the celebration of the James Watt centenary was adopted. No permanent memorial has yet been erected to the inventor of the steam engine. The scheme provides for the endowment of a Chair of Engineering at Birmingham University and the erection of a Memorial Hall and Museum.

The South Kensington Science Museum will hold a Watt Commemorative Exhibition in London.

Electrical War Inventions for Sale.—*The Times* states that the Electrical Section of the Disposal Board is about to place on the market a number of interesting articles little known outside naval and military circles.

The daylight signalling lamp, which was invented to replace the heliograph—an article dependent for its effectiveness on sunlight—is one example. Several hundreds of these lamps are for disposal. The apparatus consists of a cylindrical lamp resembling in shape a motor-car side-light or bicycle lamp equipped with a powerful reflector, strong 12-volt dry battery, and a Morse tapper, the whole enclosed in a teak wood box and carried by strong leather straps.

There is also the electric mine exploder, a delicate relay. Sound waves produced by the propeller of an approaching submarine actuate a diaphragm, which operates the relay and causes the mine to explode. Some two to three thousand of these await disposal. Their adaptability to peace-time purposes is a matter left to the enterprising manufacturer.

Specimens of the above apparatus may be seen at the offices of the Board, Room 61, Caxton House, Westminster, S.W. 1.

The Electricity (Supply) Bill.—On Wednesday the Bill passed the second reading in the House of Commons without a division.

The Controller of the Miscellaneous Stores Section of the Disposal Board, Caxton House, wants suggestions for the adaptation of heavy guns to industrial uses, as well as the utilisation of cordite, fuses, cartridge cases, mica coated with shellac, and a mixture of alum and soda used for water softening.

Fatality.—While playing on the steep railway embankment adjoining the golf club near North Ealing Station, on Sunday last, an eight-year-old boy started to run down the slope. Unable to stop himself, he fell over the wires at the bottom and on to the live rail. Owing to a curve in the line, the driver of an electric train was unable to see what had happened, and his train dragged the boy several yards before he was able to pull up. The boy was dead when lifted from the rails.

Appointments Vacant.—Electrical engineer (£500) for the Dartford U.D.C. ; head of the Physics and Electrical Engineering Department (£400, rising to £600) for the Borough Polytechnic Institute ; head of Electrical Engineering Department (£350) for the Brighton Municipal Technical College ; engineer and manager (£350) for the Leek U.D.C. electricity works. See our advertisements pages to-day.

Inqniries.—A correspondent wishes to get into touch with a maker of tumbler switches, with the cover and knob made of non-metallic material that will stand a hot damp atmosphere.

Makers of miniature 250-volt, 2-amp., and 110-volt, 4-amp. switches, for use on small motors, and makers of bowls of native alabaster, are asked for.

Delayed Training Facilities.—The Durham County War Pensions Committee reports that as regards the proposed training classes in electricity, the situation is the same as last quarter. The commencement of the class is still being delayed owing to the fact that the Local Technical Advisory Committee set up by the Ministry of Labour has not yet approved of the appointment of the instructor (who was appointed in September last), although the Pensions Committee bas called attention to the matter on several occasions. This scheme was submitted over 12 months ago, and was approved by the Minister of Pensions. The prolonged delay in the commencement of this class is much to be regretted.

Last month *The Times* quoted the Surrey War Pensions Committee as stating that for a class for electrical work about to be established there were more candidates than it could find room for ; much more could be done for the disabled men if the War Office and the Office of Works would help instead of hindering the work. At Guildford the Committee obtained the use of a schoolroom for a class in watch and clock repairing : the Ministry of Pensions approved the scheme, and referred it to the Office of Works to equip the premises ; but it took three months to get the electric light installed and the necessary henches provided, and all that time tbe men were waiting for training. The Committee now had 90 men waiting for training.

B.T.H. Tungsten Patents.—In the Court of Appeal, before the Master of the Rolls and Lords Justices Warrington and Duke, on Monday and Tuesday, an appeal was heard by the British Thomson-Houston Co., Ltd., from the judgment of Mr. Justice Sargant, in the Chancery Division, dismissing their application for leave to amend a claim in their specification in Letters Patent relating to an invention regarding a process for the treatment of metallic tungsten and for the manufacture of electric filament lamps therefrom. The case was proceeding when we went to press.

Wireless in the Air Service.—In a "Synopsis of British Air Effort during the War," issued recently as a Parliamentary paper (Cmd. 100), and abstracted in the *Times*, some idea is given of the remarkable progress and war record of this branch of the service. With regard to wireless, it is said that only one of the machines which left with the original Expeditionary Force was fitted with apparatus, which was not employed until some stable condition was reached on the Aisne, when work in conjunction with the artillery was started. From this time onwards wireless grew very rapidly, and every battery was gradually equipped with a wireless receiving station; at the end of 1916 there were about 2,000 Air Service wireless operators and mechanics, and by the end of 1917 this number had increased to approximately 3,760. The earliest experiments in wireless telegraphy were carried out between Farnborough and Brooklands, but it was not till 1917 that an efficient set was designed and demonstrated in the air. About this time night bombing machines in France were fitted with C.W. transmitters, with a range of about 75 miles, and proved of great service in reporting suitable targets. At the present time there are about 80 C.W. wireless stations maintained by the R.A.F. in France alone. There are also several hundred battery stations. To meet the demands for trained officers and operators, a training school was started in 1916, with about 30 officer pupils and 500 other ranks. This school has now 152 officers and 2,400 other ranks under instruction. The wireless branch now consists of approximately 520 officers and 6,200 other ranks.

The Electrical Stimulation of Rainfall.—Judging from the following extract from the *Sydney Daily Telegraph*, the artificial production of rainfall in Australia has fallen into disrepute :—

A cable published in yesterday's issue informed us that "the Meteorological Office experts discredit the report that an Australian department is able to 'materially stimulate the rainfall by scientific means.' One official declares that the statement must be mis-reported, as such claims have hitherto been made only by humbugs." Such information as has been made available entirely supports the British experts' assumption of a mis-report. No Australian department is known to have supported these wonderful rain-making claims. On tho contrary, the Federal department's own officer reported against them. Furthermore, when Mr. Balsillie made overtures to the Government of New South Wales the latter appointed a board of inquiry, including a number of the best-known scientific men, who reported unanimously discrediting the claims, which were not further considered by this State. Mr. Watt, however, publicly expressed his contempt for expert views; and some thousands of pounds have accordingly been paid away in connection with the matter. It is high time the Federal Government gave some assurance that a stop had been put to this inexcusable waste of public money, which is bringing world-wide discredit on Australian common sense.

Wireless and the Solar Eclipse.—In connection with the forthcoming solar eclipse on May 29th, 1919, invisible at Greenwich, the British Association Committee for Radio-telegraphic Investigation (of which Sir Oliver Lodge is the chairman) has arranged for the carrying out of experiments on the effect of the eclipse on wireless signals transmitted across the zone.

The umbra intersects the earth's surface in an approximate circle of diameter about 234 km. (126 sea miles), and it moves at the slowest at a speed of about 0.57 km. (0.31 sea mile) per second. Between 11.30 and 12 noon G.M.T. it travels across Bolivia and Brazil, and crosses the Atlantic close to the equator between 12 noon and 14.20. It then crosses the African continent from the French Congo to Mozambique. During the eclipse various wireless telegraph stations will emit signals consisting of letters of the alphabet changed according to a definite plan at the end of each minute; the programme of letters is so arranged that no two come together in the same order more than once. They will be accurately timed at selected receiving stations. By this arrangement the transmitting stations are relieved of tho responsibility of timing the signals accurately, and the receiving operators have nothing to do but write down each letter as they receive it and the number denoting its strength. On the day before the eclipse the stations will send practice signals for a short time near noon G.M.T The British Admiralty stations at Ascension and the Azores will send continuously during the transit of the umbra across the Atlantic Ocean. Observing stations north of the equator will be asked to listen to Ascension for at least an hour about the time when the umbra passes between themselves and Ascension. Similarly observers south of the equator will be asked to listen to the Azores. Certain selected stations north of the equator will be asked to listen to the Azores, so as to afford check observations upon variations that may be observed in signals passing across the central line of the eclipse, and similarly selected stations south of the central line will be asked to listen to Ascension. The American station at Annapolis will also transmit a programme during a portion of the period of the eclipse, and it is hoped that arrangements may be made for special experiments between a few pairs of stations, such as Darien and the Falkland Islands, and an Egyptian station and a South African station.

The main portion of the experiment hinges upon Ascension. The umbral cone passes from west to east, and may be expected to affect in succession the strength in which signals are received at such stations as Demerara, Jamaica, the stations on the cost of the United States and Canada, stations in Ireland, England, France, Italy, in the Mediterranean and Egypt.

The British Admiralty has provided many of the receiving stations both on land and sea, and other receiving stations are being put to work by the American, French, and Italian Governments, by the British Army and Air Force, and also by the Marconi Co. in several parts of the globe. Anyone desirous of obtaining further information should communicate with Dr. W. Eccles, Hon. Secretary of the Committee, City and Guilds Technical College, Leonard Street, London, E.C. 2.

Piezo Electricity.—Investigations made recently by Mr. A. McL. Nicolson, in America, have resulted in applying the principles of piezo electricity in a number of ingenious ways to transmit sound vibrations. The possibilities, however, have perhaps only been dimly viewed. Mr. Nicolson built up crystal cells of greatly improved efficiency. Cells weighing but a few ounces were designed which produced hundreds of volts, the wattage, of course, being very low. Rochelle salt crystals were found to be the best for the purpose. One demonstration which is suggestive of other useful applications of piezo cells was to attach to a cell a phonograph needle, mounting the cell on a phonograph in place of the regulation reproducer. The terminals of the cell were then connected with telephone receivers through many miles of wire. As the phonograph was started and the needle placed in contact with the revolving record no sound was heard in the immediate neighbourhood of the phonograph, but miles away in the connected receivers the voice was heard as through an open window across the street.

Coal Output.—In 1918, according to a Home Office return, the output of coal in the United Kingdom, which fell from 287,411,869 tons in 1913 to 248,473,119 tons in 1917, decreased still further to 227,714,579 tons, a decline of 20,758,540 tons in comparison with 1917, and of 59,697,290 tons when compared with 1913. The average output per person employed underground fell from 325 tons in 1913 to 294 tons in 1918, and the average output per person employed under and above ground from 262 tons to 232 tons.

Colloidal Fuel.—Under the direction of the Submarine Defence Association, a considerable amount of work has been done during the war on the problem of combining coal with petroleum fuel oils. It is now possible to combine in a stable liquid fuel about 45 per cent. oil, 20 per cent. tar, and 35 per cent. pulverised coal, thereby replacing over one-half of the oil, securing equal or greater heat values per barrel, and saving considerable cost.—*Electrical World.*

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Accrington T.C. has deferred for three months the recommendation of the Electricity Committee to increase the salary of Mr. A. W. CLEGG, electrical engineer, by £100.

Mr. S. C. TRANTER, at present relief charge engineer in the London County Council tramways department, has been appointed charge shift engineer at £250 a year, rising to £300.

The salary of Mr. J. B. HORNER, tramways traffic superintendent to the Wigan Corporation, has been increased from £200 to £250 a year.

The Bradford Tramways Committee has accepted the resignation of Mr. A. F. KELLETT, assistant permanent way engineer, who has been appointed permanent way superintendent to the Sheffield tramways department.

The Canterbury T.C. has, by 11 votes to 5, deleted a recommendation that the salary of the electrical engineer, Mr. BLASCHECK, be increased by £99 a year to £566, in accordance with the scale submitted by the Associated Municipal Electrical Engineers.

Clacton-on-Sea U.D.C. has appointed Mr. G. BROADHURST, of Basingstoke, as the electrical engineer.

Nelson T.C. has decided to increase the salaries of the electrical engineer and the tramways manager by £100.

In our last week's reference to Mr. BELLAMY, the new tramways manager and engineer at St. Helens, there were some inaccuracies. His initials are L. C., *not* W. His four years with the Forces were spent on the Gallipoli Peninsula and on the Somme—not in Rangoon. Previous to his appointment as assistant to the St. Helens Tramways Co. he was the manager of the Rangoon tramways for four years, and before joining the Army he was tramway manager and borough electrical engineer at Ilkeston.

On May 8th a presentation was made to Mr. C. J. ELLIOTT, A.M.I.E.E., by the staff of the Lancashire Electric Power Co., on his leaving to join a distribution company in the south.

General.—The Chair of Experimental Philosophy at Oxford, vacated by Professor Clifton at the beginning of the war, has been filled by the appointment of Dr. F. A. LINDEMANN.

Second Lieutenant J. P. MONSON, City of Dundee Fortress Engineers (Electric Lights Company), has been confirmed in his rank. He was gazetted to the corps in October, 1917.

Lieutenant F. W. BOND, Tyne Electrical Engineers, who was a supernumerary officer whilst attached for duty to another corps, has been restored to the establishment of his regiment. Lieutenant Bond was commissioned in 1915 and promoted lieutenant in 1918.

Messrs. R. T. NORTON & Co., consulting engineers, Temple Courts, Temple Row, Birmingham, and J. L. H. COOPER, B.A., A.M.I.E.E., A.M.I.Mech.E., Royal Dock Chambers, Grimsby, consulting engineer, have entered into a provisional working agreement.

Mr. WALTER LEAF, chairman of the St. James' & Pall Mall Electric Light Co., Ltd., and of the London County and Westminster and Parrs Bank, Ltd., is nominated by the Council of the Institute of Bankers for election as president.

Mr. F. C. RAPHAEL, M.I.E.E., has been appointed manager of the cable and wire department of the Edison Swan Electric Co., Ltd. (Ponders End). Soon after the outbreak of the war he joined the R.N. Anti-Aircraft Corps, but in February, 1916, obtained a transfer and a commission to the London Electrical Engineers R.E. (T.). On his return from France last August, Mr. Raphael was appointed an assistant inspector under the C.I.R.E.S., and was in charge of cable inspection up to the date of his demobilisation. He will be remembered as being successively editor of *The Electrician* and *Electrical Engineering*; previously he had been on the staff of cable manufacturing companies in this country and abroad.

Capt. H. G. WHITE, R.E., who has now been demobilised, has severed his pre-war connection with Messrs. Gent & Co., Ltd., Leicester, and rejoined the staff of the Sterling Telephone & Electric Co., Ltd., with whom he was previously associated for many years. Capt. White was employed during the war as instructor at the Anti-Aircraft, Searchlight and Sound Locator School, and has received a special mention for valuable services rendered in connection with search light operations.

Captain F. B. C. SUTHERY, A.M.I.E.E., Tyne Electrical Engineers, has been restored to the establishment of the Territorial Force. Capt. Suthery was employed as a captain of the Royal Marines for some time, and has been connected with the corps since the beginning of the war.

Lieutenant and Acting-Captain W. F. BALDERSTON, Renfrew Fortress (Electric Lights) Engineers, has vacated the adjutancy of the 62nd Divisional Royal Engineers, and relinquished the acting rank of captain on ceasing to be employed.

Roll of Honour.—Lord Onslow, chairman of the North Staffordshire Railway Co., recently presented the Military Medal to Sergt. GEORGE BOSLEY, electric light engineman, who served in France with the R.E. (Signals). His lordship stated that the Earl of Dartmouth had informed him that the work of the men from the electrical department of the North Stafford Railway on the signals at the front was most commendable.

Private C. L. FOREST, M.G.C., is now presumed killed after being missing since March last year. He was formerly an employé of Messrs. Dick, Kerr & Co., Ltd.

Obituary.—MR. W. E. BLAKE.—We regret to record the death at the age of 55 years, of Mr. W. E. Blake, superintendent of the line of the Underground Electric Railways Co. It appears that while engaged directing certain operations on the railway he slipped and injured his leg. Septic poisoning subsequently necessitated amputation of the leg. He died after an operation on May 8th at St. George's Hospital.

SIR J. H. A. MACDONALD.—We regret to record the death, at the age of 83 years, of the Rt. Hon. Sir John H. A. MacDonald, P.C., G.C.B., LL.D., F.R.S., F.R.S.E., M.I.E.E., late Lord Justice Clerk of Scotland. The funeral took place at Edinburgh on the 13th inst. Sir John became an Associate of the Institution of Electrical Engineers in 1882, and a Member in 1886. He was an inventor of electrical appliances, military telegraphs, &c., and a writer on various automobile, electrical, and general matters.

Will.—The late Mr. H. P. J. NEGRETTI, of Negretti and Zambra, left £99,520 gross.

NEW COMPANIES REGISTERED.

Craymer Unloaders, Ltd. (154,749.)—Private company. Registered May 1st. Capital, £300 in £1 shares. To acquire Patent No. 116,416 of 1918, for improvements in an unloading or discharging device, in the name of H. J. Craymer, and to carry on the business of mechanical and electrical engineers, &c. The subscribers (each with one share) are:—H. J. Craymer, 5, Clifton Square, Peckham, S.E., engineer; R. F. Smith, 8, Hanover Street, Peckham, S.E., ironmonger. Registered office: 97, High Street, Peckham, S.E.

Henry J. Monson, Ltd. (154,720).—Private company. Registered April 30th. Capital, £7,000 in £1 shares. To take over the business of a radiologist and electric medical and therapeutic operator carried on by H. J. Monson at 26, Manchester Street, W. The subscribers (each with one share) are:—B. Baines and T. Baines, both solicitors, of 6, New Burlington Street, W. 1. The first directors are to be appointed by the subscribers. Registered office: 26, Manchester Street, W.

H. T. Boothroyd, Port Glasgow, Ltd. (10,355.)—Private company. Registered in Edinburgh April 26th. Capital, £10,000 in £1 shares. To take over that part of the business of H. T. Boothroyd, Ltd., of Akenside Street, Bootle, Lancs., electrical engineers, which comprise the general electrical contracting business carried on in Scotland and the installing of electrical equipment on ships. The subscribers (each with one ordinary share) are:—H. Thomas Boothroyd, Woodthorpe, Great Crosby, Liverpool, electrical engineer; W. H. Thomson, 67, Worcester Road, Bootle, Liverpool, electrical engineer. First directors: H. Thomas Boothroyd and J. Whitehead. Registered office Bank Buildings, 24, Princes Street, Port Glasgow.

Eural Patents, Ltd. (154,750.)—Private company. Registered May 1st. Capital, £1,000 in £1 shares. Inventors and exporters of patents, and to enter into agreements with Sir Evelyn de la Rue and J. Lindsay Scott for certain inventions relating to pocket lighters, to electrical contact-makers, and to name indexes for telephones. The subscribers (each with one share) are:—Sir A. de la Rue, Bart., Lockleys, Welwyn, Herts.; J. Lindsay Scott, 9, Harrington Court, S.W. 7. First directors: Sir E. de la Rue, Bart., J. Lindsay Scott, and Miss C. Hume, 14, Somers Place, W. Registered office: 19-20, Premier House, Dover Street, W. 1.

R. F. Fuggle, Ltd. (154,512).—Private company. Registered April 19th. Capital, £4,000 in £1 shares. To take over the business carried on at Edgware and Elstree as F. F. Fuggle, and to carry on the business of manufacturers, repairers, and sellers of electric, steam, gas, oil, and other engines for motor vehicles, aircraft, boats, ships, railways and tramways, &c. The subscribers (each with one share) are:—R. E. F. Sneath, Gloucester Lodge, Hendon, business manager; E. H. Pool, Hazelmere, Montgomery Road, Edgware, works manager. First directors: R. F. Fuggle and R. E. F. Sneath. Solicitor: E. C. Harrison, 1, New Court, Lincoln's Inn, W.C.

Trafford Park Traders' Association, Ltd. (154,689.)—Registered April 29th, as a company limited by guarantee, without share capital, with 200 members, each liable for £1 in the event of winding up, to promote and protect the trade, commercial, or other interests of owners, lessees, and occupiers of land or buildings in Trafford Park, Lancs., to promote the consideration of all questions affecting the interests of such persons, or of any persons carrying on any trade or occupation in Trafford Park, to promote or oppose legislation, to collect and circulate information, to promote, support, oppose, or defend legal or other proceedings which may affect such interests, or relating to facilities afforded, or rates or conditions imposed by any railway, tramway, canal, or shipping company, or by any carriers or warehousemen, or by any lighting, traction, telephone, dock, harbour, or other public utility corporation or undertaking, &c. The first members of the council are:—J. E. Davenport, 15, Derby Road, Urmston, near Manchester, traffic manager; W. Kenyon, Westwood, Sale, Ches., secretary of Royce, Ltd.; E. A. Pochin, Rosthwaite, Lightwood Road, Buxton, engineer employer; F. J. Warren, 10, Clifton Road, Chorlton-cum-Hardy, Manchester, secretary; W. T. Glover & Co., Ltd.; Howard Asohaite & Troughing Co., Ltd., Trafford Park Power & Light Supply Co.; and Ashover Mines, Ltd.; J. O. Cheetham, Ivanhoe, Richmond Road, Altrincham, secretary, Lancashire Dynamo & Motor Co., Ltd.; R. Gravelley, Rowanhurst, Ashton-on-Mersey, director of Illingworth, Ingham & Co., Ltd., sawmill owners, Leeds; J. Mastin, Glossop Road, Marple Bridge, near Stockport, buyer for Co-operative Wholesale Society. The memorandum of association is signed also by A. Chandler, of the British Westinghouse Electrical & Manufacturing Co., Ltd. Hon. Secretary: W. Kenyon. Solicitors: Claremont, Haynes & Co., Vernon House, Bloomsbury Square, W.C.

Penrose Lifts, Ltd. (154,755.)—Private company. Registered May 1st. Capital, £15,000 in £1 shares. To acquire that portion of the business of A. W. Penrose & Co., Ltd., relating to the manufacture of electric lifts and cranes, &c. The subscribers (each with one share) are:—M. Owen, 2, Hilton Avenue, North Finchley, N.; F. W. Tompson, The Towers, Limpsfield, Surrey, brewer; F. E. Searles, Lindley, Godstone Place, Godstone, Surrey, engineer; F. J. Tompson, The Bowers, Limpsfield, Surrey, engineer. Directors: M. Owen, F. E. Searles, F. J. Tompson and F. W. Tompson, also director of Frank Jones Brewing Co., Ltd., Russell's Gravesend Brewery, Ltd., Writtle Brewery Co., Ltd., British Photographic Industries, Ltd., Houghtons, Ltd., W. Butcher & Sons, Ltd., &c. Office: 239, Southwark Bridge Road, S.E. 1.

Wellman Smithowen Engineering Corporation, Ltd. (154,585).—Private company. Registered April 24th. Capital, £160,000 in £1 shares. To take over and amalgamate all or part of the businesses of Wellman, Seaver & Head, Ltd., the James Smith Hoisting Machinery Co., Ltd., and Rubery Owen & Co., and to carry on the business of manufacturers of and dealers in engineering machinery, machine tools and instruments, electrical engineers, &c. The subscribers (each with one share) are:—A. E. Owen, Koyama, Sutton Coldfield, manufacturer; F. I. Sanderson, King's House, Kingsway, W.C. 2, managing director of Wellman, Seaver & Head, Ltd. First directors: A. E. Owen (permanent), F. I. Sanderson (commercial manager), T. Smith (managing director), and F. G. Smith (chief engineer). Registered office: King's House, Kingsway, W.C.

A. C. Cutting & Welding Co., Ltd. (154,941).—Private company. Registered May 8th. Capital, £20,000 in £1 shares. To enter into an agreement with J. F. Alvord, A. D. T. Libby, C. W. Curtiss, Sarah F. Curtiss, and C. Marion Smith, manufacturers of and dealers in cutting and welding devices. The subscribers (each with one share) are:—C. F. Roraback, 6, City Road, E.C., managing director, American Supplies Co., Ltd.; F. Farquhar, 162, Great Portland Street, W., business manager (electrical). First directors: C. E. Koraback and F. Farquhar. Solicitor: W. R. J. Hickman, 11, Ironmonger Lane, E.C.

Bolton Chemical Plant Manufacturing Co., Ltd. (154,944).—Private company. Registered May 8th. Capital, £5,000 in £1 shares. Manufacturers of chemical plant, lead workers and burners, plumbers, manufacturers of electrical accumulators and apparatus, &c. First directors:—J. Chadwick, 12, Nuttal Terrace, Bolton; J. N. Chadwick, 39, Sutherland Road, Bolton; A. Parkinson, 13, Wellington Terrace, Morecambe; T. Willetts, 114, Tonge Moor Road, Bolton. Solicitors: Balshaws, 22, Acresfield, Bolton.

British Glass Blowers, Ltd. (154,945.)—Private company. Registered May 8th. Capital, £2,000 in £1 shares. To acquire certain premises at Tollington Park, N., to construct and carry on glass works, there, &c. The subscribers (each with one share) are:—H. W. Sullivan and J. Joseph, both electrical engineers, of Winchester House, E.C. 2. First directors: H. W. Sullivan, J. Joseph, and E. G. Foley. Solicitor: E. P. Landon, 53, New Broad Street, E.C.

Electrical Utilities, Ltd. (154,805.)—Private company. Registered May 2nd. Capital, £5,300 in 5,000 cum. part. pref. shares of £1 and 6,000 ord. shares of 1s. Manufacturers of and dealers in electrical devices, appliances and materials, &c. The subscribers (each with one ord. share) are:—Capt. E. A. Godson, The Court, Tenbury, Worcs.; E. Schattner, 117, Corringham Road, Golders Green, electrical engineer. First directors: E. Schattner (chairman), P. H. S. Gibbs (managing director), and E. A. Godson. So long as the said E. Schattner remains a director of the Electrical Apparatus Co. (1913), Ltd., the company shall not manufacture, sell, purchase, or deal in any electrical motor control gear or electricity meters, or any inventions or patents relating thereto. Secretary: P. H. F. Gibbs. Registered office: 35, Copthall Avenue, E.C.

Central Electric (Handsworth), Ltd. (154,851.)—Private company. Registered May 5th. Capital, £100 in £1 shares. Manufacturers of electric plant and fittings, contractors for electric power, telephones and bells. First directors: H. Bowker, 63, Church Hill Road, Handsworth, electrician; R. A. Hudson, 14, Kingscote Road, Edgbaston, electrician. Registered office: 112, Hamsted Road, Handsworth, Birmingham.

Ignitions, Ltd. (154,722.)—Registered April 30th. Capital, £30,000 in 20,000 shares of £1 each and 20,000 shares of 10s. each. To enter into an agreement with the C.C. Sparking Plug Co., Ltd., to acquire and turn to account patents, &c. First directors:—C. L. Simpson, 13, Montagu Place, W., engineer; and T. Charlton, 187, Inderwick Road, N., financial agent. Registered office: 10, Throgmorton Avenue, E.C.

Gwalia, Ltd. (154,842.)—Registered May 3rd. Capital £1,000 in £1 shares. To carry on the business of an electric light and power company, electricians, electrical engineers, &c. First directors:—K. M. Clark, Lyde House, Sion Hill, Bath, chairman of Unity Investment Trust Co.; J. W. Cassells, The Lodge, Orford, Suffolk, private secretary, director of above trust; and H. J. Jack, Maenan Manor, Llanrwst, director of said trust. Registered office: 4, Broad Street Place, E.C. 2.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Corona Lamp Works, Ltd.—Particulars of £30,000 first prior lien debs. created March 31st, 1919, of which £22,000 are now issued, charged on the company's undertaking and property, present and future, including uncalled capital, ranking in priority to the prior lien debs. and the ordinary debs. Trustee: G. N. Ogilvie and A. Ogilvie.

F. A. Jennings, Ltd.—Particulars of £10,000 debentures, created April 11th, and all issued April 15th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Robinson & Hands Electrical Co., Ltd.—Satisfaction in full on March 1st, 1919, (*a*) of mortgage debenture dated 1909, securing £400, and (*b*) of mortgage debentures dated 1910, securing £300.

Landaulet Co., Ltd. (formerly Electric Landaulet Co., Ltd.).—R. G. Sidford, of 20, John Street, W.C. 2, ceased to act as receiver or manager on April 16th, 1919.

Tramways, Light & Power Co., Ltd.—Second supplemental trust deed dated April 14th, 1919, securing a further £75,000 5 per cent. debenture stock (making a total of £375,000 secured by principal deed of 1914 and two supplemental deeds).

Durell, Walker & Co., Ltd.—H. Dennis, of 84, Boundary Road, N.W. 8, ceased to act as receiver or manager on March 26th, 1919. H. M. Gower, 51-2, Chancery Lane, W.C. 2, was appointed receiver or manager on same date.

Smith & Mortimer, Ltd.—Particulars of £2,000 debs., created and all issued March 31st, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

S. Bornett & Co., Ltd. (89,565.—Capital £2,000 in £1 shares (1,000 pref. and 1,000 ord.). Return dated April 1st, 1919. 757 pref. and 950 ord. shares taken up; £1 per share called up on 757 pref. and 200 ord.; £957 paid; £750 considered as paid on the remaining ord. Mortgages and charges: Nil.

Cosmos Engineering Co., Ltd. (formerly Brazil, Straker and Co., Ltd.).—Satisfaction in full on April 8th, 1919, of charge dated April 13th, 1918, securing £25,000 already advanced, and further advances up to £50,000.

David Powis & Sons, Ltd.—Particulars £16,000 debs. created and all issued April 24th, 1919, charged on the company's undertaking and property, present and future, including uncalled capital and up paid calls.

Tilling-Stevens, Ltd.—Supplemental trust deed dated April 15th, 1919, to secure a further £160,000 first mortgage debenture stock ranking *pari passu* with £50,000 issued on the security of the trust deed dated November 11th, 1912.

A. W. Richardson & Son, Ltd.—Mortgage on land and premises at Ashton-under-Lyne dated April 9th, 1919, to secure all moneys due or to become due from the company to Manchester & Liverpool District Bank.

Thompson & Gingell, Ltd.—Particulars of £2,000 debs., created April 9th, 1919, of which £1,000 were issued on same date. Property charged: The company's undertaking and property, present and future, including uncalled capital. Commission, allowance, or discount, 150 £1 ord. shares for each £100 debs.

Cosmos Consolidated, Ltd.—Particulars of £500,000 debs. created February 11th, 1919, of which £6,000 are now issued, charged on the company's undertaking and property, present and future, including uncalled capital.

White, Jacoby & Co., Ltd.—Issue on May 1st, 1919, of £120 debs., part of a series already registered.

Rawlings Bros., Ltd.—Satisfaction to the extent of £1,550 on December 4th, 1918, of charge dated December 4th, 1918, securing £8,750.

Dargue, Griffiths & Co., Ltd.—Satisfaction in full on June 30th, 1918, of charge dated 1909, securing £3,000.

Wycombe (Borough) Electric Light & Power Co., Ltd. (53,133).—Capital, £50,000 in £5 shares. Return dated April 15th, 1919. 8,000 shares taken up; £40,000 paid. Mortgages and charges, £40,000.

Direct Spanish Telegraph Co., Ltd. (6,732.)—Capital £95,000 in 13,000 ord. and 6,000 pref. shares of £5 each. Return dated April 9th, 1919. 12,831 ord. and 6,000 pref. shares taken up; £94,655 paid. Mortgages and charges: Nil.

Erskine, Heap & Co., Ltd. (formerly Eckstein, Heap and Co., Ltd.) (126,262).—Capital, £30,000 in £1 shares. Return dated April 10th, 1919. 30,000 shares taken up; £7,500 paid; £22,500 considered as paid. Mortgages and charges: Nil.

CITY NOTES.

Indian Electric Supply and Traction Co., Ltd.

Mr. J. G. B. Stone presiding at the annual meeting in London, on May 6th, said that they had sold 4,105,126 units, an increase of 112,827. There were increases of 72,395 units for lighting and fans, 85,106 for power, and 11,907 for public lighting, but special contracts were less by 62,856. Lighting and fan units realised about a halfpenny more per unit than for 1917, power a fraction more, and public lighting a fraction less. Practically everything on the expenditure side had increased. The prospects for gradual development of the ordinary business and its earning capacity were favourable, but they had also under consideration the question of establishing a bulk supply station for generating power at a sufficiently low cost to secure the power loads of large consumers, mills, &c., and at the same time draw supplies at a very much lower price than it was possible to generate it at in the present station. If they could secure a site within a reasonable distance of Cawnpore, where there would be a permanent and ample supply of condensing water, they would be able to generate at a considerably lower rate, and secure a big power load for which they could not as at present offer a sufficiently attractive rate. They were paying an increase of ½ per cent. in dividend.

Metropolitan Electric Tramways, Ltd.

The revenue for 1918 amounted to £639,021. After deducting all expenses chargeable to revenue, including debenture and loan interest, but without making any provision for future renewals, there is a surplus of £7,664, plus £3,036 brought forward. £10,174 is to be placed to reserve, and £526 carried forward. The traffic receipts were £627,334, an increase of £84,803, which is due in part to the larger number of passengers, and in part to the higher rate of fare intro duced in the autumn of 1917. Owing, however, to the enhanced cost of labour and materials, working expenditure, which, exclusive of the payments to the County Councils, amounted to £491,044, shows an increase of £83,886. With a view to enabling the company to meet the continual rise in working costs, and to make the necessary provision for future renewals, a further increase of faro was, with the consent of the County Councils concerned, brought into effect early this year. High cost of fuel and increased labour charges have caused a diminution of the profits of the North Metropolitan Electric Power Supply Co., in which this company holds all the ordinary share capital. No dividend will be paid by the Power Co. on its ordinary shares for the year (as against 10 per cent. paid for 1917). The directors are, therefore, unable to recommend any dividend on the preference shares.

Urban Electric Supply Co., Ltd.

The gross profits for 1918 were £63,890, against £67,732 for 1917. After deducting expenses in profit and loss account, and paying interest, debenture stock redemption, and income tax, absorbing £44,452, the available balance, including £4,498 brought forward, is £19,966. There is put to reserve for depreciation £10,000, 2½ per cent. for the year is paid on the preference shares, £6,250, and £3,716 is to be carried forward. The following table shows the load and profits of each of the various undertakings:—

	Kilowatts.		Profits.	
	1917.	1918.	1917.	1918.
Hawick	3,363	3,545	£5,863	£6,509
Stamford	1,720	1,756	2,208	2,287
Weybridge and Walton	3,634	3,913	5,438	4,590
Godalming	1,800	1,986	2,247	2,332
Twickenham and District ..	9,191	10,171	15,175	14,716
Dartmouth	1,038	1,070	1,116	607
Camborne and Redruth ("A") and Cornwall ("B")	8,052	8,396	"A" 8,030 "B" 7,224	"A" 8,409 "B" 7,200
Newton Abbot	1,337	1,602	2,723	2,932
Grantham	1,983	2,070	8,703	8,074
Glossop	1,423	1,433	3,370	3,470
Berwick	1,138	1,161	1,066	179
Caterham	991	1,080	1.166	1.056
Newbury	1,232	1,320	3,386	905
Totals	36,902	39,503	£67,717	£63,766

London and Suburban Traction Co., Ltd.

The report for 1918 states that the continuance of war conditions has intensified the difficulties of the tramway, omnibus, and electric supply undertakings of the company. In all cases operating expenses have further increased as a result of the additional war wages awarded and the higher cost of fuel and other materials. Shortage of labour and the difficulty of obtaining material have caused a reduction of the number of tramcars in service. The tramways and motor omnibuses all show an expansion of gross revenue due partly to increased traffic and partly to increased fares, but the additional receipts have not been more than sufficient to balance the increased cost of operation. In consequence of the decrease in the dividends receivable from the subsidiary companies, due in part to the decrease in profits of the North Metropolitan Electric Power Supply Co., whose ordinary shares are all held by the Metropolitan Electric Tramways, Ltd., and in part to the Tramways (M.E.T.) Omnibus Co., Ltd., finding it necessary to make provision for the early renewal of its fleet, the directors are unable to recommend the payment this year of any dividend upon the preference shares of the company. The gross revenue for the year amounted to £46,294, as compared with £81,519 for 1917. After deducting all expenses chargeable to revenue, including debenture and loan interest, and providing for the sinking fund charges upon the 5 per cent. debenture stock, there remains a balance of £3,458, making, with £3,635 brought forward, a total of £7,092, which is to be carried forward. During 1918 £13,237 five per cent. debenture stock was purchased and cancelled.

The scheme referred to in the previous report for the reorganisation of the capital of the London United Tramways, Ltd., has received the sanction of the Court, and is now being carried into effect. By its Act of 1918, the London United Co. has secured an extension of the tenure of its tramways in Middlesex and Surrey until 1950, and will also have power at the expiration of six months after the termination of the war to make substantial increases in its existing statutory fares. In the meanwhile it has put into operation increases of fares which have recently been authorised by the Board of Trade under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918. The L.U.T. Act above referred to imposes an obligation upon the L.U. Co. to provide, for the purpose of renewals, the sum of £400,000, towards which the purchase price payable by the L.C.C. for the Hammersmith tramways, amounting to £235,000, will be available.

British Westinghouse Electric and Manufacturing Co., Ltd.

The profit for 1918, including £51,234 brought forward, is £198,152. Out of this £42,315 has been put to special depreciation of plant, machinery, &c. A dividend of 8 per cent., less tax, on the cumulative preference shares absorbs £78,090, and £77,747 is to be carried forward. Mr Lincoln Chandler has resigned the position of managing director, but retains his seat on the board. Captain R. S. Hilton has been appointed managing director. In accordance with the undertaking given by the Metropolitan Carriage, Wagon & Finance Co., Ltd., at the meeting last November, £1,000,000 of ordinary shares of the company have been applied for, and they were allotted for cash at par on April 14th. The attention of preference shareholders has already been drawn by circular to their option to convert any or all of their preference shares into ordinary shares within two years from April 14th, 1919.

Meeting, to-day, at Connaught Rooms, London, W.C.

The profit shown in the previous report was £177,859, including £89,735 brought forward. The amount then put to depreciation was £48,000 and £10,000 was put to reserve for employers' liability. The dividend at 7½ per cent. on the preference shares absorbed £68,625.

London United Tramways, Ltd.

The operation of the undertaking during 1918 resulted in gross receipts of £362,127, an increase of £7,954, but owing to continued advances in cost of material and labour the expenses increased by £81,970 to £373,831, showing an adverse balance of £11,405. After charging debenture and loan interest for the year, and bringing in the deficiency of the two preceding years, the total deficiency to be carried forward to 1919 was £94,050. The scheme for the reorganisation of the capital has been sanctioned by the Court. It provides (*inter alia*) for the cancellation of the arrears of interest on the issued first mortgage debenture stock for the year 1917, and for the reduction of such stock by 48 per cent. as from January 1st, 1918, so the whole of the deficiency of £94,050 mentioned above, is extinguished. The arrears of dividend on the preference shares to December, 1918, which amounted to £621,875, and the dividend accrued to April 8th, 1919, are also cancelled. The Company's Act of 1918 which has received the Royal Assent authorises an extension of the company's tenure of the tramways in Middlesex and Surrey until 1950, and empowers the company, at the expiration of six months from the termination of the war, to raise its fares to a maximum of 1d. per mile for ordinary passengers, and 1d. for three miles for workmen. Pending the date on which the powers to increase the fares under this Act take effect, the company has put into operation increases of fares authorised by the Board of Trade under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918. Viscount Knutsford and Capt. F. V. Schuster have resigned their seats on the board, and Sir Lewis Coward, K.C., Mr. G. Balfour, M.P., and Mr. C. G. Tegetmeier, have been appointed directors, the first two of these representing the interests of the first mortgage debenture stockholders. The board as now constituted is as provided by the scheme for the reorganisation of capital.

Swiss Companies.

The accounts of the *Motor, A.G. fur Angewandte Elektrizitat, of Baden*, show net profits of £90,000 for 1918, as contrasted with £91,000 in the preceding year. It is proposed to pay a dividend of 7 per cent., as in 1917.

The *A.G. Columbus fur Elektrische Unternehmungen, of Glarus*, which is an investment company specially interested in the Stats-Argentine Electricity Co., of Buenos Ayres, reports net profits of £72,000 for 1917-18. The dividends on the "B" shares is at the rate of 7 per cent., and that on the "A" shares 5½ per cent.

The report of the *Aluminium Industrie A.G., of Neuhausen*, states that notwithstanding increased difficulties in obtaining supplies of raw materials in 1918, it was possible to keep the works in operation until October in that year. A stoppage took place in the final quarter owing to the political events in Germany and Austria. The directors hoped in the near future to regain possession of the installations in the South of France which had been under sequestration since 1914, and to receive full payment for their having been utilised for years. The political events, and the lack of willing workers had led to restrictions in working. The accounts record net profits of £501,000, as compared with £792,000 in 1917, and the dividend is at the rate of 20 per cent., being the same as in the previous year, when, however, profits of £280,000 were also transferred to the fund for fully paying up the partly-paid shares.

French Companies.

The Société Francaise des Electrodes reports net profits of £41,000 for 1917-18. A dividend at the rate of £1 8s. per share has been declared on the old capital and 18s. 9d. on the new shares.

The Société Gramme proposes to pay a dividend of £1 18s. 5d. for 1917-18, as compared with £1 16s. in the preceding year. The share capital is now to be increased from £92,000 to £140,000.

The directors of the *Société d'Electro-Chimic, of Gifre*, recommends the payment for 1917-18 of a dividend of £2 1s. 7d. per share on the old capital and £1 0s. 9d. on the new shares. A rate of £2 16s. per share was declared in 1916-17 on a lesser amount of share capital.

The Société Centrale pour l'Industrie Electrique intends to distribute 5 per cent., or £1 per share, for 1918, this comparing with no dividend in 1917. It is stated that the installations of the company's branch at Baku have not suffered any damage from recent events and continue in operation.

German Companies.

The directors of *Felten & Guilleaume Carlswerk A.G., of Cologne and Mulheim*, recommend the payment of a dividend of 10 per cent. for 1918, as contrasted with 15 per cent. in the previous year.

The accounts of the *Deutsche Kabelwerke A.G., of Berlin-Lichtenberg*, show gross profits of £128,000 for 1918, as compared with £101,000 in the preceding year, and net profits of £41,000 and £45,000 in the two years respectively. It is proposed to pay a dividend of 10 per cent., being the same rate as in 1917.

The accounts of the *Faradit Isolier Rohr Werke Max Haas A.G., of Reichenhain, Chemnitz*, after placing £8,000 to depreciation in 1918, as compared with £16,000 in 1917, indicate net profits of £45,000 and £97,000 in the two years respectively. The directors recommend a dividend of 30 per cent., as in the preceding year.

The Lloyd Dynamo Werke A.G., of Bremen, after allocating £6,000 to depreciation account in 1918, as against £11,000 in 1917, reports net profits of £10,000, as contrasted with £7,000 in the previous year. The directors propose the payment of a dividend of 7 per cent. on the share capital of £125,000, being the same rate as in 1917.

The Elektro Salpeter Werke A.G., of Berlin, which is associated with the A.E.G. and the Griesheim-Elektron Chemical Works, and which was affected by a serious explosion in 1917, reports an increase in the debit balance of £10,000 in the latter year to £70,000 in 1918 on a share capital of £150,000.

The Elektrochemische Werke G.m.b.H., of Berlin, whose share capital of £350,000 is held by the Zurich Bank for Electrical Undertakings, reports net profits of £96,000 for 1918, after writing off £45,000 for depreciation of war plant, as compared with profits of £109,000 in the preceding year. It is proposed to pay a dividend of 12 per cent., as against 15 per cent. in 1917.

The Elektro-Nitrum A.G., of Berlin, which was formed in 1915 by the A.E.G. and the Griesheim-Elektron Chemical Works, reports gross profits of £131,000 in 1918, as contrasted with £104,000 in the previous year. Interest charges, a large loss on exchange, and the allocation of £64,000 to depreciation, as compared with £71,000 in 1917, bring the final result to net profits of £7,000, which reduce the existing debit balance to £20,000 on share capital of £150,000.

The report of the *Hochfrequenz Maschinen A.G. fur Drahtlose Telegraphie, of Berlin*, states that the company's transmarine wireless traffic in 1918 again answered the purpose. The net profits amounted to £29,400, as against £29,500 in 1917, and the "A" shares are to receive a dividend and bonus of 21½ per cent., and the "B" shares 49.6 per cent. The Eilvese and Tuckerton stations are entered as being of the value of £92,000 and £90,000 respectively, as in the previous year.

The report of the *Ges. fur Elektrische Hoch und Untergrundbahnen, of Berlin*, states that the number of passengers carried increased from 108,400,000 in 1917 to 113,000,000 last year, and overcrowding continued to prevail. The average wages, which previous to the war amounted to 52 pfennigs (6.11d.) per hour, rose to 1.20 marks (1s. 2¼d.) in 1918, and was now (April, 1919) about 2.15 marks (2s. 1½d.) per hour. A similar movement had taken place in the prices for coal. It was possible, however, to obtain compensating advantages through the two increases in passenger fares, which were introduced in April, 1918, and in January, 1919. The receipts advanced from £735,000 in 1917 to £991,000 last year, and the net profits from £139,000 to £202,000 in the two years respectively. The dividend on the ordinary capital of £2,625,000 is at the rate of 5½ per cent., this contrasting with 3½ per cent. in 1917.

River Plate Electricity Co., Ltd.—The net revenue, after providing for administration expenses, bad debts, and depreciations, amounts to £26,901; £25,961 was brought forward, making £52,862. After paying the 5 per cent. debenture interest, and 7 per cent. on the ordinary stock, £4,000 is put to income tax reserve and £17,612 is to be carried forward. As regards current supplied in bulk to customers under long-date contracts the situation was met by an increase in charge corresponding to the enhanced market price of fuel, and it was only this fact, combined with the utmost economy, which prevented an actual serious loss upon the sale of current to private consumers at La Plata and Ensenada. The earnings do not justify the dividend on the ordinary stock, but in view of the better outlook the board think they may properly use some part of the profits from former years to maintain the dividend. Default has continued on the 5 per cent. obligations of the German Trans-Oceanic Electric Co., but it is assumed that the Peace Treaty shortly to be signed will regularise relations with enemy countries, and, it is hoped, permit of a settlement of the large outstanding indebtedness due to this company. Interest has been paid on the £66,667 5 per cent. debentures of the Tucuman Tramways, Light & Power Co., and a dividend has also been paid on the company's shareholding in the Argentine Electricity Co.—*Financial Times.*

Johnson & Phillips, Ltd.—The profit on trading accounts, &c., for the year ended December, 1918, after providing for bad and doubtful debts, and charging to revenue upwards of £13,000 for maintenance of buildings, plant, &c., amounts to £80,491, plus £25,815 brought forward, less dividend paid in April, 1918, £12,250, making £94,056. This is dealt with as follows: Directors' and other fees, £1,679; debenture interest, £4,540; debenture sinking fund reserve, £8,355; second debenture interest, £2,500; depreciation on machinery, plant, &c., £14,423; interest on loans, £1,100; reserve account, £10,000; income tax and excess profits duty, £10,127; written off patents, £2,500; dividend of 10 per cent. on ordinary shares, £17,500; carried forward, £21,332. The annual meeting was held yesterday.

Shawinigan Water & Power Co.—Year 1918. Gross earnings, $3,621,074, an increase of $718,864. Net revenue $1,410,093, an increase of $59,229. Operating costs affected seriously through increased cost of labour and material, insulators, copper coils for generators and many similar items having trebled or quadrupled in price. Output of the carbide factory largest in the history of the company. The growth of the power business has continued, not only due to war conditions, but also to permanent industries. Total KW. hours generated for the Shawinigan system 1,058,127,769, an increase of 12 per cent. All the remaining power under option from the Laurentide plant will be used within the next two or three years. The next step is the development of the power at Gres Falls, a property owned by this company. This development will have a capacity of about 100,000 H.P., and will take about two years to construct. The directors feel that the present is not a suitable time to proceed with this development. Engineering information is being obtained, and plans are being made which will be available when the proper time arrives to commence this construction work.—*Financial Times.*

Brush Electrical Engineering Co., Ltd.—Including £12,700 brought forward, £103,798 is available for 1918, subject to excess profits duty in respect of 1917 and 1918. The change-over from war to peace manufacturing conditions is being made as rapidly as possible. During the war period the company has distributed a dividend of 6 per cent. per annum on the ordinary stock for the years 1916 and 1917. The directors now recommend a further distribution of 6 per cent. per annum in respect of the years 1914, 1915, and 1918, which will absorb £18,944. It is also proposed to place to depreciation of buildings and plant £9,400; further 4 per cent. interest on the prior lien participating second debenture stock, £2,045; to general reserve £13,095, and to carry forward £34,714.

British Ever-Ready Co., Ltd.—The report for the year ended March, 1919, states that the amount available for appropriation after writing off depreciation, and after making reserve for the purpose of providing for depreciation in value of stock-in-trade, excess profits duties, income tax, and contingencies, is £39,152. Dividend of 10 per cent. for the year on the preference shares, £8,500; 17½ per cent. for the year on the ordinary shares, £20,125; carried forward, £10,527. The excess profits taxation for 1918 has been settled and paid. Including the company's subsidiary undertakings this taxation amounted to £38,525 for the year. Meeting at Holloway, May 30th.

South Metropolitan Electric Tramways & Lighting Co., Ltd.—Total revenue £102,092, against £86,139 for 1917. After deducting expenses £7,500 is put to renewals, £5,000 to reserve, the balance of preference dividend for 1917, at the rate of 3 per cent. per annum, also the preference dividend for 1918 at 6 per cent. per annum, are paid, and £1,917 is to be carried forward. The gross receipts from the working of the tramways and light railways increased by £13,665. Motor-'bus receipts, £1,605 net. Gross receipts of the electricity supply section were £22,783, against £21,232 for 1917. Consumers increased by 3 per cent. to 2,522.

North Metropolitan Electric Power Supply Co.—Net revenue for 1918 £53,725, plus interest and dividends, making £69,455. After meeting interest charges, putting £2,000 to debenture reserve fund, placing £15,000 to renewals reserve, and paying 6 per cent. cumulative preference dividend, £2,321 remains to carry forward. Revenue from all sources increased by £32,612, but expenses increased by £55,020, of which £50,041 was for increased wages and cost of coal, leaving a decreased net revenue of £22,408.

The Vickers Issue.—The "Times" learns that underwriters of the Vickers issue made in connection with the acquisition of shares of the Metropolitan Carriage, Wagon and Finance Co. have been left with 30 or 40 per cent. of the amount. The amount of the issue was £7,000,000 of preference shares and £5,100,000 of ordinary shares, so that about 2,000,000 preference and 1,500,000 ordinary shares will be taken up by the underwriters.

Chiswick Electricity Supply Corporation, Ltd.—Revenue for 1918 £31,983, profit £8,558, plus £6,034 brought forward. After meeting debenture interest, paying 6 per cent. dividend, and putting £1,561 to depreciation reserve fund, £685 is to be carried forward.

Stock Exchange Notice.—The following are to be officially quoted:

White (J. G.) & Co., Ltd.—180,000 7 per cent. cumulative preference shares of £1 each, fully paid (Nos. 1 to 180,000).

West India and Panama Telegraph Co., Ltd.—Final dividend of 6d. per ordinary share, and a bonus of 3d. per share, free of tax.

New Issue.—*Marconi International Marine Communication Co., Ltd.*—This company has this week been offering to the shareholders 600,000 new shares of £1 each at par.

Clarke, Chapman & Co., Ltd.—An extraordinary meeting is to be held on the 23rd inst. to confirm resolutions for the alteration of the articles so as to permit of the capitalisation of surplus profits. Further resolutions will then be submitted (1) to increase the capital to £550,000 by the creation of 250,000 ordinary shares of £1 each and (2) to capitalise £222,030 of the undivided profits and to distribute it in the form of 222,030 fully-paid ordinary shares among the holders or ordinary shares.—*Financial Times.*

Oldham, Ashton & Hyde Electric Tramway Co., Ltd.—The ordinary dividend for the year 1918 is 6 per cent., not 7 per cent., as stated last week. £10,000 is put to reserve, and £4,957 is carried forward. In connection with the purchase of the undertaking, it is stated that arrangements are being made to refer to arbitration the question of the price to be paid to the company by the various purchasing local authorities.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets continue very animated. The week contains no slack day. Though there are set-backs and reactions, they come up against lines of fresh buyers. Compared with the rises that have occurred since a month ago, the declines have been insignificant. Investment money continues to pour into the markets. Everybody seems to want to know what to buy, and—what is more—will buy the stock if it has reasonable prospects. The war has made the public much more inclined to speculate than of yore; this is the logical result of the decline in the purchasing power of money. So the popular preference share is that which carries participating rights, while the debenture stock upon which interest is paid free of income-tax up to so much in the £ is assured of attentive consideration.

The Electricity Supply Bill just introduced into the House of Commons is of such importance to the industry that, from the merely market point of view, its provisions are hardly grasped, and quotations remain unchanged on the week. The District Boards which are to be set up "must" provide or secure the provision of a cheap and abundant supply of electricity, and are given wide powers to this end. A standard price is to be paid for generating stations and main transmission lines. In the case of a company or individual, the standard price will be the equivalent of the cost of construction, and of the acquisition of the site less depreciation. In default of agreement, the sum to be paid will be determined by a Board of Trade arbitrator. (We hope arbitrators will like working overtime!) The sum of 20 million pounds out of the Consolidation Fund is to be placed at the disposal of the Board of Trade, and the powers of the latter under the Bill are to be transferred to the Ministry of Ways and Communications when this Ministry is established.

The provisions of the Bill are to be put into force with convenient speed after passage of the measure, but with the best of goodwill to expedite matters it is obvious that the change-over will take long to complete. Authorities in the Stock Exchange are inclined to think that things will continue much as they are at present for some considerable period. Any developments in prices will be keenly watched, however, to see if they afford any clue to what is likely to be the attitude of the general body of proprietors in electricity supply companies towards the coming alteration in conditions.

Meanwhile, manufacturing companies and shares are doing well. The British Westinghouse has just issued the best report it has had for four years. It may be recalled that the results for 1917 were disappointing, but these are wiped out by the 1918 figures. The net profit of £146,800 is nearly £60,000 better than that of the preceding year, and the preference receive their new rate of 8 per cent. Preference shareholders have the right to convert into ordinary shares within two years from April 14th last. We have already been asked whether the right thing to do is to convert! With a two years' option, the right thing to do is nothing at present. So far as we are aware, there is no market yet for the ordinary.

The Brush Electrical Engineering has had so good a year that the directors recommend a dividend of 6 per cent. for the years 1914, 1915, and 1918. For the two intervening years, 1916 and 1917, the same dividend was distributed. The company last year made a net profit of £91,098, and the report states that the improved results are due in a measure to the manufacture on a large scale of standardised war products. The ordinary stock keeps good at 82½. The London United Tramways report shows a loss on working of £11,000 before payment of the debenture interest. The Metropolitan Electric Tramways took £84,800 more in receipts, and paid away £83,900 more in working expenses. Such figures may be commended to the notice of those journalists who are "stunting" the so-called traffic scandal.

General Electrics have gained £3 at 22. Edison Swans have been strong on the basis of 23s., and the new shares spurted to 1s. 6d. premium. Electric Constructions are a good market around 25s. 9d. Westinghouse preference have risen to 2⅝. Abroad, it is interesting to notice that the River Plate Electricity Co. has had to fall back upon part of last year's carry-forward in order to maintain the dividend on the ordinary stock at the regular rate of 7 per cent.

The Marconi International Marine is offering its shareholders 600,000 new shares of £1 each at par, share for share. This makes a handsome bonus, and the new are quoted 2 5/16 premium, while the old have risen to 3 5/16 ex the rights. Marconis are also higher at 5 9/16, the preference at 4¾, a wave of profit-taking being countered by an influx of buying orders. Canadians jumped to 17s. 6d.

Cable stocks and shares have again advanced, thanks to the increase in the Globe Telegraph & Trust dividend. Eastern ordinary gained 5 points at 167½, and Eastern Extensions at 16⅝. Westerns at 17⅛ are ⅜ and ½ higher respectively, while Globes have spurted to 16⅛.

Toronto Power 4½ per cent. debenture is 3 higher at 84. Brazil Tractions are again a point better. A timid recovery in British Columbia Electric deferred followed upon the recent severe fall. Mexicans remain depressed. The Auckland Electric Tramways Co. has given an option to the Auckland (N.Z.) Corporation to buy the undertaking. In the winding-up of Fraser & Chalmers, it has been decided by Mr. Justice Astbury that surplus assets must be rateably distributed between the ordinary and preference shareholders—rather a blow to the hopes of the former class. The rubber share market has yielded a little of its strength, and amongst armament shares, Vickers eased off on the prospects of selling by underwriters who had to take 30 or 40 per cent. of their obligations under the new issue. Babcock & Wilcox at 4 are 5s. better, and at 35s. British Aluminiums show 1/16 gain. London and Suburban Traction preference are dull on the report showing no dividend on the preference shares in respect of the past year.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies

	Dividend		Price May 13, 1919.	Rise or fall.	Yield p.c.
	1917.	1918.			
Brompton Ordinary	10	8	6¾	—	£5 8 16
Charing Cross Ordinary	4	4	3⅜	—	6 18 4
do. do. do. 4½ Pref.	4½	4½	3¼	—	6 18 4
Chelsea	6	6	3 11/16	—	4 1 1
City of London	8	8	11¾	—	6 16 2
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 3
do. do. 6 per cent. Pref.	6	6	9¾	—	6 3 1
Kensington Ordinary	7	6	5⅞	—	5 2 2
London Electric	Nil	Nil	1½	—	Nil
do. do. 6 per cent. Pref.	6	6	3⅞	—	7 14 10
Metropolitan	4	5	3⅛	—	8 0 0
do. 4½ per cent. Pref.	4½	4½	3¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	5	5	2¾	—	7 6 6
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	8	8	6½	—	6 3 1

Telegraphs and Telephones.

	1917.	1918.	Price	Rise or fall.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	98½	—	6 1 10
do. Def.	1½	33/6	22¼	—	7 8 0
Chile Telephone	8	8	7⅜	—	5 8 6
Cuba Sub. Ord.	7	7	11½	—	*5 7 4
Eastern Extension	8	8	16⅝	+⅜	*4 16 3
Eastern Tel. Ord.	8	8	167½	+5	*4 15 7
Globe Tel. and T. Ord.	7	8	16⅛	+1⅛	*4 19 3
do. do. Pref.	6	6	10½	—	5 14 3
Great Northern Tel.	22	22	80½	—	7 4 0
Indo-European	13	13	67½	—	5 18 0
Marconi	20	20	5 9/16	+7/16	3 12 0
Oriental Telephone Ord.	10	15	2½	—	6 3 0
United R. Plate Tel.	8	8	7⅛	—	*5 1 7
West India and Panama	1/3	1/3	1 19/32	+1/32	*4 3 4
Western Telegraph	8	8	17⅛	+½	*4 13 5

Home Rails.

	1917.	1918.	Price	Rise or fall.	Yield p.c.
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan	1	1¼	28	+1	4 9 3
do. District	Nil	Nil	25	+1½	Nil
Underground Electric Ordinary	Nil	Nil	3⅛	—⅛	Nil
do. do. "A"	Nil	Nil	9/-	—3d.	Nil
do. do. Income	4	5	95½	—½	*5 4 9

Foreign. Trams, &c.

	1917.	1918.	Price	Rise or fall.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	Nil	3¼	—	—
do. do. 2nd Pref.	—	—	3	—	—
do. do. 6 Deb.	5	5	68½	—	7 3 6
Brazil Tractions	—	—	69	+1	—
Bombay Electric Pref.	6	6	10¾	—	6 11 7
British Columbia Elec. Rly. Pfce.	5	5	59	—	8 10 0
do. do. Preferred	Nil	Nil	40½	—1	Nil
do. do. Deferred	Nil	Nil	32½	—	Nil
do. do. Deb.	4½	4½	62	—	6 17 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	60	—	Nil
do. 6 per cent. Bonds	Nil	Nil	46	—1½	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	67	—	—

Manufacturing Companies.

	1917.	1918.	Price	Rise or fall.	Yield p.c.
Babcock & Wilcox	15	15	4	+¼	8 15 0
British Aluminium Ord.	10	10	1¾	+1/16	5 14 3
British Insulated Ord.	25	12½	2 1/16	—	6 1 1
British Westinghouse Pref.	7½	8	2⅝	+⅛	6 2 0
Callenders	25	25	10	—	6 5 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	3⅞	—	6 3 1
Edison-Swan, "A"	—	—	1 3/16	+1/16	6 6 4
do. do. 5 per cent. Deb.	4	5	75½	—	6 12 8
Electric Construction	10	10	1 9/32	+3/32	7 16 0
Gen. Elec. Pref.	6	6½	10⅝	—	6 6 4
do. Ord.	10	10	22	+3	*4 11 0
Henley	25	25	2⅛	—	5 0 0
do. 4½ Pref.	4½	4½	3⅞	—	6 16 9
India-Rubber	10	10	16⅝	—	*6 0 4
Siemens Ord.	—	10	6 11/16	+5/16	*7 4 0
Telegraph Con.	20	20	25	—	4 15 0

*Dividends paid free of Income Tax

AN ELECTRICAL DEVICE FOR CHECKING THE STEAM CONSUMPTION OF SMALL-POWER MIXED-PRESSURE TURBO-GENERATORS.

By J. B. HARRISON.

The labour difficulty during the period of the war has led to the introduction of many electromechanical devices with a view to meeting the reduction in staff, or to compensating for the poor quality of the labour available.

The privately-owned power systems of works or mills employing steam turbines of 500 to 1,000 KW. capacity have been particularly hard hit from this point of view; I may quote a case coming under my control in which all the original staff was called up for military service during the early period of the war, and I had to employ any class of labour that was available to keep up the power supply.

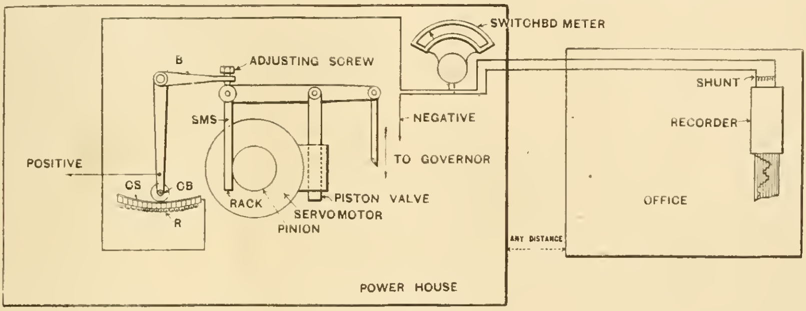

Fig. 1.

The supply was maintained with reasonably good results, but on checking the coal consumption, I found that it was going up out of all proportion to the output of the generator, and this, coupled with the increasing difficulty of obtaining coal, and the rising price per ton, made it imperative that some action should be taken.

The plant under review was of the mixed-pressure turbine type, and I found that I had to be constantly visiting the power house to check the steam consumption; but as I could not spare the time for constant visiting, I tried various devices to record the steam consumption, and eventually developed the following arrangement, which affords a direct check on inattention on the part of the man in charge of the plant.

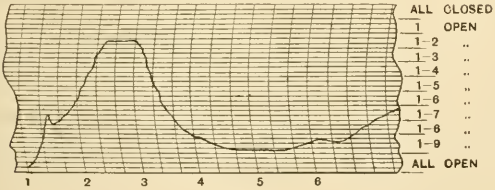

Fig. 2.

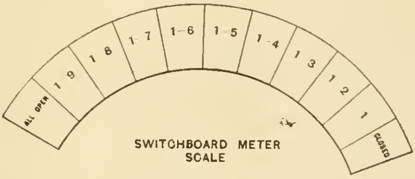

Fig. 3.

With a purely high-pressure turbine the position of the valves would follow more or less the KW. output of the generator, but in the case of mixed-pressure machines the position of the high-pressure valves is controlled from two sources, viz., the KW. output of the generator and the volume of low-pressure steam available at the time. The efficiency of the mixed-pressure turbine to which I am referring depends to a great extent on the human element, as the low-pressure auxiliary valves have to be periodically adjusted to meet the conditions.

When the turbine is started up, all the high- and low-pressure valves are open, and the spindle S M S of the servomotor (see fig. 1), the movement of which is directly proportional to the position of the valves, is in the bottom position; the lever B, which rests on S M S, moves up and down in correspondence with the movement of the valves.

Attached to one end of the lever B a contact C B is fixed which travels up and down the face of the commutator C S, the function of C B being to cut out the resistance R as the lever B rises.

Fig. 1 shows the commutating device and the turbo-servomotor.

Fig. 2 shows the recorder chart, upon which the position of the valves is indicated by the movement of the pen. As the valves close, the resistance R is gradually cut out of the recorder circuit, and the pen moves over the chart, recording the position of the valves in four steps per valve.

The voltage of the supply is practically constant, therefore the only variation of the movement of the pen is due to the amount of resistance in the circuit at R.

An indicating instrument (see fig. 1) can also be incorporated in the scheme; this can be of the usual voltmeter pattern, but the scale is recalibrated (fig. 3), and it can be fixed on the switchboard so that the switchboard attendant is also able to observe the operation of the steam side of the turbine.

The controlling switch on the turbine is completely enclosed in an ironclad case, and cannot be tampered with by an unauthorised person.

The device consumes practically no current, and is simple for installing, provided that one is in possession of a recording ammeter of the shunted type. This arrangement has proved its value in actual practice from the point of view of knowing exactly the position of the valves, as the valve curves can be compared with the KW.-output curves of the generator at any time when the generator is working.

Experiments on Electric Shock.—Experiments have proved that low-pressure electricity in sufficient quantity may be dangerous to life on account of palpitations induced in the ventricles of the heart, says the *Engineer*; A.C. with a periodicity of 35 to 50 cycles is four times more dangerous than D.C. Experiments in France showed that 100 milliamperes of A.C. at a pressure of 100 volts would kill a dog in a few seconds, while 400 to 500 milliamperes of D.C. could be applied before death occurred. The effect of very high pressures ranging from 10,000 to 50,000 volts is similar to that of low pressures because of the potential fall set up by the electric arc formed between the body and the electrical conductor.

LARGE POWER TRANSFORMERS.

By A. G. ELLIS, A.M.I.E.E., and J. L. THOMPSON, M.Sc., A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

(*Concluded from page* 546.)

From the manufacturer's point of view both core and shell type transformers can be satisfactorily built for either single-phase or three-phase.

The core type as usually constructed lends itself better to small and high-tension units, as small conductors can be better wound in circular coils and the insulating problem is simplified. For medium size units the three-phase core type makes a satisfactory job, but in very large units the bracing and cooling become quite problems. In large units it will generally be preferable to split up into three single-phase units forming a three-phase group.

The shell type is generally preferable for single-phase units except for small sizes at high voltage. The construction is simpler, more robust, and less liable to damage in handling and transport. The windings can be very rigidly braced, and the construction gives very large cooling surfaces of windings and core.

Regarding electrical performance, there is little to choose between the two types for the same amount of active copper and iron. Also there is little difference in cost.

From the standpoint of service requirements the core-type windings are in general more liable to shrinkage, as insulation is always under a permanent compressive stress. This is not so aggravated in the case of single-layer spiral windings of copper strip wound on edge, where the shrinkage is practically negligible. In section or coil-wound transformers the total shrinkage after twelve months in general service may be of the order of 2½ per cent., *i.e.*, 1 in. in 40 in. of winding length for a 20,000-volt transformer.

In shell-type transformers the expansion of the copper is much less than in core-type transformers, and there is no compression due to the weight of the coil, and consequently no periodic adjustment of the coil supports is necessary under normal service conditions.

Some form of coil support is essential in all transformers; and, further, it may be necessary to provide means of adjustment to compensate for the shrinkage.

Means for automatically compensating the shrinkage in the windings of core-type transformers generally take the form of spiral springs arranged so as to exert an axial thrust on the coils tending to oppose directly any axial movement due to the shrinkage of the insulation.

While such springs undoubtedly follow up any shrinkage that may occur, the more the springs expand, the lower the pressure they are able to resist without movement. Consequently the windings, even during normal operation, may be in a state of permanent vibration, and, under abnormal conditions, may be subjected to considerable movement. Any such movement is naturally undesirable. The spring should be so placed relatively to the windings that the weight of the latter exerts no pressure which would counteract the effect of the spring.

Another disability of the use of springs relates to core-type transformers with very long cores, especially for high voltages and large outputs, where the shrinkage of the windings may be as much as 1 to 1½ in.

A spring able to follow this amount of shrinkage and still be able to exert sufficient pressure on the windings would lead to complicated and inefficient construction and involve loss in winding space and higher core loss. While the springs provide adjustment the above-mentioned disabilities outweigh, in the authors' opinion, the resulting advantages claimed. Vibration or movement due to shock can be overcome if some means are provided whereby the spring, after having performed its function of following up the shrinkage, is prevented from any possible recoil due to sudden shock. An arrangement due to Mr. G. Harlow which achieves this end is shown in fig. 4. It consists essentially of a spring which surrounds the plunger of a small dashpot and exerts pressure between the dashpot and its plunger. The plunger is supported on the top frame of the transformer and the dashpot transmits the pressure of the spring on to the windings. The dashpot is provided at the back end with a small hole serving as an oil inlet and escape. When shrinkage of the windings takes place this is followed up by the spring acting on the plunger, and any possible sudden recoil is prevented by the sluggish action of the dashpot and plunger.

In the shell type, shrinkage is practically negligible, and automatic adjustment is unnecessary.

Given first-class design and manufacture, there is in general very little to choose between core-shell types. The choice of type from this standpoint and the ultimate result depends largely on the individual manufacturing facilities.

In the shell-type the voltage per turn is considerably higher than in the core type. The insulation between turns must be heavier for shell-type designs, and this becomes more important in very large outputs.

The reinforcement of the insulation of the end turns is to some extent easier in shell-type designs, as the total number of turns is smaller and fewer turns have to be reinforced. For power systems with underground cables the end-turn reinforcement is less important than in transformers connected to overhead transmission lines subject to atmospheric disturbances. Up to a voltage of 30 kilovolts, experience shows that reinforcement to the extent of about 1 per cent. of the winding per 10 kilovolts of line voltage is sufficient, *i.e.*, for 30 kilovolts 3 per cent. of the winding from each line terminal is reinforced. The reinforced insulation should be of sufficient strength to withstand normal line voltage momentarily between adjacent turns, in about 1 per cent. of the winding.

For transformers connected to overhead transmission lines up to 100 kilovolts the number of reinforced turns should generally be about 5 per cent. of the total winding. The reinforcement is necessary at all ends of the windings which are connected to the line; thus in delta-connecting windings both ends of each phase must be reinforced.

On switching in, the period of abnormal voltage stress lasts usually only about 1/10 second, and the voltage may rise to a maximum of twice normal voltage.

The curves in fig. 5 show the relation between breakdown voltage and time for sheet insulating materials commonly used in transformer construction.

The insulation between the end turns of the winding needs to be sufficiently thick to withstand full voltage for, say, one second, which corresponds to about 60 per cent. of normal voltage applied for 1 minute or more.

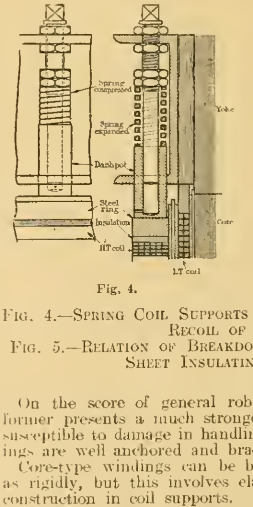

Fig. 4.

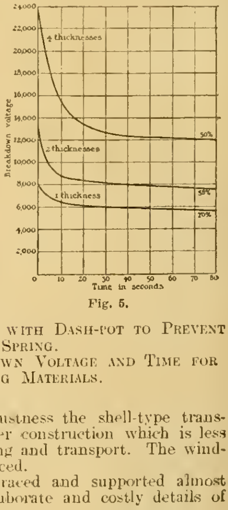

Fig. 5.

Fig. 4.—Spring Coil Supports with Dash-pot to Prevent Recoil of Spring.

Fig. 5.—Relation of Breakdown Voltage and Time for Sheet Insulating Materials.

On the score of general robustness the shell-type transformer presents a much stronger construction which is less susceptible to damage in handling and transport. The windings are well anchored and braced.

Core-type windings can be braced and supported almost as rigidly, but this involves elaborate and costly details of construction in coil supports.

In general any elaborate system of coil bracing either in shell-type or core-type transformers, involves a certain amount of sacrifice in electrical performance and increase in cost.

Special mechanical attachments for coil bracing are not generally necessary for transformers for normal service on systems under about 20,000 k.v.a., but are desirable on large transformers and on large systems, or in cases where the operating conditions are severe.

On an 8,000-k.v.a., 25-period, single-phase, shell-type transformer having 6 per cent. impedance voltage, the maximum total stress over the whole of the surface of each end coil is approximately 300 tons under short-circuit conditions. This amounts to about 3 tons per sq. in. of coil surface.

On a 5,000-k.v.a., three-phase, core-type transformer the axial stress between h.t. and l.t. concentric windings may amount to 200 tons per leg under short-circuit conditions. The circumferential stress in the outer concentric coils is of the order of 8 tons per sq. in. of copper section. The strength of the copper in the windings is usually sufficient to resist this hoop stress.

The protection of transformers against mechanical damage due to short-circuits has become of increasing importance with step-up transformers situated directly on the station busbars, and distributing transformers situated often relatively near to the power station.

Mechanical strains may be restricted by limiting the short-circuit current, by introducing a sufficiently high impedance in the circuit.

Actually external reactance is more efficacious, since, with the same limitations of short-circuit current, the mechanical stresses on the windings are less than those produced when the same current limitation is obtained by internal reactance.

Questions of costs, space, and simplicity weigh against this consideration. It is quite possible, by designing the transformer with a suitable amount of inherent reactance, to limit the short-circuit stresses to such a value as can be safely dealt with by a robust mechanical construction. This is the general tendency of modern practice.

Where it is necessary or desirable to install external protective reactances, the following general considerations should be taken into account.

The ironclad type consists of a choke coil with an iron core similar to a standard transformer but with a large air-gap, or a number of small air-gaps interposed in the path of the magnetic flux.

The air-core type consists simply of a plain coil in air, the inductance of which is designed to give the required choking effect without the use of an iron core. Either type can be built to give satisfactory service. The choice depends mainly on the type of service obtaining, and on the location and space available.

As regards the type of service, the choice reduces itself largely to a question of capital cost; the relative prices depend on the short-circuit current required in terms of the normal current.

Busbar reactances are usually arranged to limit the current transference from one section to another to about 4 to 5 times the normal current in each set of busbars, corresponding to a voltage choke in the reactance of 25 to 20 per cent. of the line voltage.

In generator reactances the current limitation is usually about eight times the normal current, which, allowing for 7.5 per cent. inherent reactance in the generator, requires an additional 5 per cent. external reactance, or a total of 12.5 per cent. reactance.

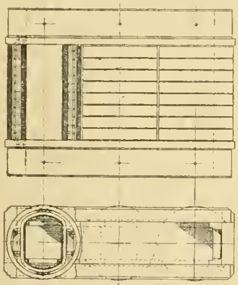

Fig. 6.—High-reactance Transformer for Rotary Converter.

Feeder reactances are generally proportioned for a smaller voltage drop of about 5 per cent., corresponding to a current limitation of 20 times normal.

The cost of such reactances increases with the value of the current limitation for a given normal current. This consideration does not arise in the air-core type, but in point of cost the ironclad type can be designed to compare favourably with the air-core type up to limiting currents of about eight times normal.

In this respect the ironclad type has the advantage over the air-core type in that there is no stray field. Air-core reactances should be so installed that there is no iron-work nearer than a distance approximately equal to the overall diameter of the coil.

This is often an important factor where the space available is limited, as is generally the case in older stations where extensions necessitate the use of such apparatus.

The safety factor of the insulation on the windings of transformers is an indeterminate quantity in such portions of the windings as may be subjected to uncontrollable electrical strains during operation. In this case, so far as can be predetermined from experience, an ample safety factor is provided for, by means of reinforcement of the insulation between turns. The greater part of the winding is not subjected to such conditions, and here the safety factor of the insulation may be approximately determined from knowledge of the properties of the insulating materials and the test conditions.

The average operating safety factor of insulation between turns (based on the normal working voltage) is from 166 to 900. This factor may seem high, but it is determined by the minimum practicable thickness of insulation.

From the manufacturer's standpoint the safety factor must be reckoned on the test voltage to which the transformer is subjected.

Usually transformers are submitted to an overpotential test of 2 to 2½ times normal voltage for a period of one minute. Hence the factory safety factor (based on the test voltage) is of the order 83 to 450.

It is possible to insulate up to almost any voltage between coil sections required in service by means of solid insulation. This method has its limitation as the size of the transformer increases.

In coils of radial depth greater than about ¾ in. to 1 in., it is necessary to introduce ventilating ducts for the cooling medium to circulate, which themselves lead to an improved insulation between sections.

TABLE III.

Working pressure.	Approximate breakdown pressure.	Operating safety factor.	Test pressure.*	Factory safety factor.
KV.	KV.		KV.	
2·2	40	18·2	5·4	7·4
6·6	60	9·1	14·2	4·25
11	80	7·25	23	3·5
22	110	5·0	45	2·45
33	140	4·25	47	2·1
55	200	3·65	111	1·8

* B.E.S.A. standard test voltage = 1,000 volts + 2 × normal voltage.

Table III shows the average breakdown voltage for the insulation usually employed between H.T. and L.T. windings and between windings and frame.

Similar data for insulation between windings and the inside surface of the tank give a safety factor to earth through the oil of from 5 to 3 for the operating safety factor, and 2½ to 1½ for the factory safety factor based on a disruptive strength of dry oil of 15,000 volts between needle points ½ in. apart at 15 deg. C.

The creeping distance over the surface of porcelain terminal insulators should be so proportioned as to allow an operating safety factor of about 3 and a factory safety factor of about 1½; that is, the flash-over voltage of such insulators should be about three times the working voltage, or 1½ times the test voltage of the transformers.

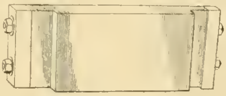

Fig. 7.—Packet of Iron for Magnetic Shunt for High-reactance Transformer.

The mechanical parts of a transformer subjected to stresses from the windings are proportioned for the usual safety factors employed in machine design.

In well-designed transformers the maximum temperature occurring at any point on the winding should not exceed the average temperature in the windings by more than about 5 deg. C.

The service conditions in the interlinking of power systems differ from those of ordinary sub-station step-down transformers.

The usual means of obtaining the requisite voltage regulation consist either of tappings on either or both sides of the transformer for, say, 2½ and 5 per cent. above and below normal voltage, or of some form of voltage regulator if a wide range or frequent adjustment is required.

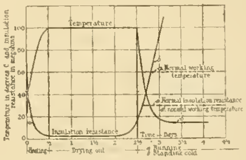

Fig. 8.—Variation of Insulation Resistance with Temperature and Time.

In the case of two-phase or three-phase systems interlinked at one point the connections of the interlinking transformer are of no consequence unless there are more than two stations interlinked.

In ring connection the question of phase relation enters. Star connection is generally preferable.

Transformers for use with rotary converters are worthy of special mention in that they in many cases require special electrical characteristics which are not met with in standard power transformers. Where the voltage on the D.C. side of the converter is obtained by means of static or synchronising boosters, the main transformers are of identical design and construction with standard power transformers. When the D.C. voltage regulation is obtained by means of field regulation, the transformer must be provided with sufficient internal reactance to meet the peculiar requirements. The transformer reactance voltage required may range from 5 to 30 per cent.

With shell-type transformers the coil grouping can be easily varied, and internal reactance voltages of from 8 to 10 per cent. for a 500-K.V.A., up to 12 to 15 per cent. for a 1,000-K.V.A. transformer, can be obtained. Above these values magnetic shunts generally have to be resorted to in order to attain the extra reactance required.

With core-type transformers the value of the reactance required is readily obtainable up to any required value by means of the coil grouping and suitable spacing of the primary and secondary windings.

This method was superseded by magnetic shunts consisting of a sheet or sheets of iron arranged concentrically between H.T. and L.T. windings. To avoid trouble due to the magnetic saturation of the magnetic shunts introduced into the transformer, a new type of magnetic shunt of multiple-gap construction was designed and patented by the authors.

A large number of transformers built with this type of magnetic shunt are in commission and building, ranging in size from 165 to 2,200 K.V.A. for 150 to 2,000-KW. rotary converters.

Transformers of this type give a high degree of utilisation of active material compared with the older types, and they are easily designed to have a straight-line volt-ampere characteristic. They also present a robust construction and have reduced losses and improved efficiency, with a resulting saving in annual charges.

A transformer of this type compared with that of the old type, either with sandwich winding or saturated magnetic shunts, would have a copper or load loss of only about two-thirds of that of the older types, and a corresponding improvement in efficiency. This type of construction is illustrated in fig. 6, and also in fig. 7, which shows a built-up magnetic shunt for one side of the core of a 1,650-K.V.A. transformer.

The switching in and out of transformers may present difficulties unless the transformer is correctly designed. The correct way to switch in is slowly to close the switch, during which interval the distance between the contacts becomes smaller until the voltage causes the current to jump across the gap. This jump will take place at or near the point of maximum voltage, which is the point of the wave desired for minimum current rush.

If the switch is closed at the maximum point of the voltage wave no rise of voltage will be experienced unless the core has residual magnetism. In modern transformers the possible voltage rise will not exceed 1.6 to 1.8 times normal voltage unless the flux density is low, when it may reach a value up to 3 to 5 times normal voltage under adverse switching conditions. This latter condition is rarely met with except in high-frequency transformers. A similar result occurs when switching out a transformer. Frequent or unnecessary switching should be avoided and transformer switches should be closed slowly. By taking the above precautions it is quite possible to switch large and high-voltage transformers directly on to the line without danger.

All transformers of moderate and high voltage should be dried out before being put into service. The insulation resistance should be measured during the drying-out period, and the values should follow characteristics similar to the curve shown in fig. 8, which shows variations for oil-immersed transformers before, during, and after drying out, if the process is proceeding satisfactorily.

"Megger" readings of the insulation resistance values, while useful, are not safe.

It is desirable, as far as possible, to ship transformers in their tanks ready for service, the drying out being done before leaving the factory.

The Housing Problem in the United States.—According to the American Society for Electrical Development, because of the Government restrictions placed on building materials during the war, there have been practically no dwellings erected in the past two years. The average number of buildings erected yearly before the United States entered into the war was between 300,000 and 350,000. Building contractors base their calculations for the next twelve months on the erection of not fewer than 700,000 new homes. There are said to be, in the city of New York alone, 30,000 families searching hopelessly for homes. And New York reflects the situation in other large cities. It was believed by many that there would be a surplus of labour, and that with restrictions off the prices of building materials would decline. On the contrary, labour wage is almost certain to remain at its old scale—if it does not climb still further; in fact, in the New York papers of March 20th appeared the notice of an increase of one dollar per day to all classes of labour in the building trades. This was the decision of Supreme Court Justice P. Henry Dugro, umpire, selected by the Building Trades Association and the United Brotherhood of Carpenters and Jointers to consider their dispute over wages. It is certain that prices, in the future, will be at even a higher level. In addition to the proposed construction of new houses, thousands of homes, more than the annual average number, are booked for remodelling, redecorating, and other renovating. In view of these facts, the Society for Electrical Development of New York City has inaugurated a national campaign, scheduled for April 1st to May 15th, called "Electrify Your Home," which is intended to stimulate trade activities.

ELECTRIC FURNACE PRACTICE.

At a joint meeting of the Institution of Electrical Engineers and the Iron and Steel Institute on May 8th, six papers on electric furnaces were discussed. Abstracts of the papers are given below :—

Electric Furnaces in the United Kingdom, 1918.

By R. G. MERCER, M.I.E.E.

This paper deals chiefly with the operation and output of the various types of furnaces under actual working conditions. The main object is to give information which may tend to increase the general efficiency of electric steel furnaces in this country.

There are installed, or being installed, 141 electric furnaces with a total capacity of 112,000 K.V.A. Of these, 24 are, or will be, used for Swedish substitute, cupro nickel, alundum, manganese copper, and ferro alloys. The remaining 117 are electric steel furnaces having a total charging and K.V.A.-capacity of 384 tons and 98,769 K.V.A. respectively, and a total nominal output of 31,170 tons per month, based on five days a week, four weeks per month. Assuming that all these furnaces are working at full load, the total nominal output at the end of a year would be 405,000 tons.

TABLE 1.—Electric Steel Furnaces in the United Kingdom.

Make.	Number of furnaces.	Total tons, size.	Total K.V.A.	Nominal tons output per month.
Electro-Metals	27	73	20,274	6,740
Greaves-Etchells ...	26	64½	18,830	5,680
Héroult	45	180½	43,220	13,760
Rennerfelt	4	7	1,895	750
Snyder	6	9½	3,150	1.200
Special	2	2	750	280
Stassano...	2	2	600	240
Stobie	5	45½	10,050	2,600
Total	117	384	98,769	31,250

The actual charge is in most cases, especially in the case of 6-ton furnaces, greater than the rated charge. The actual output, giving the best month's output of each furnace is purposely taken, and is 65 per cent. of the nominal output. Assuming that the furnaces to be installed have an actual output of 65 per cent., the actual output per month would be 2,028 tons, making a total of 7,047 tons per month, or 91,637 tons in the ladle per annum, for castings, against a total nominal output of 140,920 tons per annum. The furnaces are mostly working on day shift. The actual output is purposely taken from the best month's output of each furnace, and is 78 per cent. of the nominal output. Assuming these had a ratio of 78 per cent. actual to nominal output, the actual output would be 2,410 tons per month. These furnaces represent those sanctioned by the Ministry of Munitions of War and do not include those ordered since November, 1918, after which date sanction was not required.

On the above assumption, we have in this country furnaces capable of producing a total possible output of over 300,000 tons of electric steel per annum with 98,769 K.V.A. behind them. Taking the average output per month over a period of time we get very different results, as follows :—

	Nominal.	Actual.	%
Castings	7,720	3.557	46
Ingots	16.530	9,855	59

Comparing these with the best month's outputs there is a difference in each case of 19 per cent. Delays are largely responsible for this.

The author found that while some users kept proper records of the operation and output of their furnaces, others confined themselves to the output, and kept no proper records of current and electrode consumption or causes of delays.

It was decided, therefore, to send out electric furnace log-sheets to all users, and to ask for fortnightly returns to be made to the Ministry of Munitions. Instead of giving full particulars of each individual heat, the total number over a fortnight was given. These, with the particulars previously given, were sufficient for the requirements of the Ministry, and enabled the latter to note especially those furnaces which were not operating well, and the reason. The results are embodied in a number of tables in the paper; the figures, taken over a period of one to six months, show the comparative performance of furnaces working as nearly as possible on the same class of steel, and under similar conditions in the various steel works.

In making comparisons the author considers it to be necessary to take furnaces having the same K.V.A. capacity, and not the rated charging capacity in tons. The heats per day in the table are the average number of heats taken over the whole period of 20 days a month, and include "delays." Under "best month's output" the average number of heats per day are shown with "no delays."

After a careful comparison of the various sizes and types of furnaces, the author has arrived at the results given in Table II.

TABLE II.—Ratings of Electric Furnaces.

Ingots or castings.	Size, tons.	K.V.A.	Average hours per heat.	Number of heats per day.	Nominal tons per month of 20 days.
Ingots ...	½	250	2·75	7	70
Castings ...	½	250	2·25	8	80
Ingots ...	1½	500	3·25	6	180
Castings ...	1½	500	3	7	200
Ingots ...	2-2½	650	4·25	5	220
Castings ...	2-2½	650	3·5	5	240
Ingots ...	3-3½	850	5·75	4	280
Castings ...	3-3½	850	4·75	4	280
Castings ...	5	1,000	4	5	500
Ingots ...	6	1,500	7·5	3	360
Ingots ...	7	1,800	7·5	3	420
Ingots ...	10	2,500	7·5	3	600
Ingots ...	15	3,000	7·5	3	900

The nominal output per month is based on the assumption that the weight of charge is equal to the rated charging capacity of the furnace. In actual practice, however, this is not the case in many furnaces. The 6-ton furnaces, for instance, take from 6·8 to 10·2 tons per charge on the average. Consequently the actual output is increased, though the heat period would increase and the average number of heats per day might be less than the above estimate. The author sees no reason why the above outputs should not be easily reached under proper conditions. While it is difficult where there are a number of furnaces working together to arrange things so that they may be teemed as and when ready, it should not be difficult for a single furnace to get the necessary attention. Failure due to breakdown of generating plant and lack of spare plant occurred in one or two cases. The generating stations were working at their maximum capacity and were at times severely overloaded. The result was that when shortness of supply happened, the first plant to be shut down, with little or no notice, was the electric furnace. It was easier to shut down than a lot of small and not so important users. There is no doubt that all the users of electricity were doing important work during the war, but very much less consequential damage and interference would have resulted if the furnace user could have been kept going until he had at any rate a chance of cleaning his furnace so as to prevent a possibility of freezing. When this was pointed out the supply engineer always showed his keen appreciation and, although at his wits' end to try to accommodate everybody, he most certainly gave the electric furnaces first consideration. The author thinks a debt of gratitude is due to the various corporations and other electric supply departments. Like the Navy they worked silently, and their existence was chiefly brought to mind when anything adverse happened.

Delays due to breakdown of furnaces have been far too frequent. In the author's opinion the tilting gear and general arrangement of electrode feed-gear on certain types have not been designed to withstand the conditions in a steel works. He has many records of stripping on the tilting gear, of stripping of the electrode gear, and every possible transformer trouble. The makers concerned are eliminating these bad features. If the reliability can be improved it will certainly pay the user to have his furnace brought up to date as far as possible.

Water-cooled collars at the electrode entrance in the roof have been a source of constant trouble and delays. Their breakdowns are undoubtedly due chiefly to failure of water supply.

Electrode holders of certain types also give a lot of trouble. Personally, the author has no use for a water-cooled electrode holder; its use is an admission that it is exposed to hot gases. If electrodes (especially amorphous carbon) are operated at a proper current density, and assuming they are not of inferior quality, the holder should be able to carry the necessary current without undue heating. Against this it may be argued, and with some reason, that where, say, a furnace is fitted with 14-in. amorphous carbons, which at a current density of 25 amps. per sq. in. should carry about 4,000 amps. each, the user nearly always runs them at 5,000 or 6,000 amps. The user may say, in explanation, that he cannot otherwise get his heat in the furnace (there is plenty outside). The answer is that he should either put in a larger electrode if the furnace can take it or one be got for, say, 8-in. graphite, which with a current density of 100 amps. per sq. in. will enable him to run at 5,000 amps. per phase. It may further be argued (and again with some reason) that amorphous carbons are very often of inferior quality, and it very often happens that while one batch may be good the very next batch out of the same heating furnace may be very inferior.

Table III shows the total amperes which amorphous or graphitic carbons should carry at a current density of about 25 to 100 amp. per sq. in. respectively:—

TABLE III.

Diameter of electrode (in.).		Amperes per electrode.	
Graphite.	Amorphous.	Graphite.	Amorphous.
5⅛	10	2,000	2,000
6	14	3,000	4,000
7	16	4,000	5,000
8	18	5,000	6,500
9	20	6,500	7,800
10	—	8,000	—
12	—	11,000	—

Some electrode holders are fairly reliable and efficient (without water cooling) where a reliable electrode economiser is fitted. The great difficulty is to find an economiser which will stand up in existing furnaces of the gallows-arm type fitted with amorphous carbon electrodes. The gallows arm comes down so close to the roof that a comparatively shallow economiser has to be employed.

Table IV.*

K.V.A.	250	450	650	765	750	1,200	1,500	2,500	3,000
Size, tons	½	1¼	3	2½	3	6	7	10	12
Best month's output, tons	96	180	266	237	279	652	422	357	791
Units per ton	768	770	625	720	817	647	677	945	869
Heats per day	2·8	6	3	4·8	4	3	2·4	2·3	3·6
Electrode dia., in... ..	4A	5⅛G	14A	8G	8G	18A	18A	18A, 10G	10G
Electrode consumption, lb. per ton in ladle ..	17	21	47	12·6	13	30	100	30	12·9

* This table is a summary of the best results.
A = amorphous; G = graphite.

The problem is not so difficult with graphitic carbon electrodes. Self-adjusting economisers demand attention periodically, and are not sufficiently fool-proof. The author's view is that after the maker has done his best to improve an existing furnace by such an addition, it is up to the user to see that proper care and inspection of the same are practised. The whole question of "human element" is by far the most important in the operation of a reliable furnace.

Of the gallows-arm type of furnace the Snyder can claim over a period an electrode consumption as low as 7 lb. of 4-in. graphite per ton of steel in ladle. The Héroult, Greaves-Etchells, and Electro-Metals have with economisers each shown a graphite consumption over a period of 13 lb. per ton. Of the furnaces having no gallows arm the Stobie shows an electrode consumption of 9-in. graphite as low as 6·5 lb. per ton over a period of 5½ months.

Low-tension conductors have not received the necessary attention in the past. A current density of 750 amp. per sq. in. is ample for copper strip, for they are nearly sure to be run at a higher rate in actual practice. The maker should himself be responsible for all joints being properly made in the first instance, and should instruct the user to have them periodically inspected.

Transformers are the most important part of the furnace installation. Until recently, two transformer makers have had the bulk of the furnace business. Breakdowns of both makes have occurred due to the makers not appreciating the very heavy service their apparatus would be called upon to stand up to. Notwithstanding recent improvements breakdowns, though less frequent, happened owing to causes quite outside the transformer maker's control.

Automatic voltage and current regulators are going to help not only the transformers but also the power supplier. Woolwich Arsenal has a set running in conjunction with one of two 6-ton 2,000-K.V.A. Greaves-Etchells furnaces.

(To be continued.)

Discussion in London.

Six papers were taken as read and discussed together.

Mr. Harbord opened the discussion by explaining that there were always two stages in the process, first melting the metal and then refining it. He was not competent to express an opinion as to which particular type of electric furnace was the best, that was a purely electrical question, but there was no difference from the metallurgical point of view. Unfortunately the induction furnace had not held its own, but he thought the problem to-day was still how to do away with the electrodes. Some steel makers used the Bessemer process for the first half of the process, and finished off by placing the molten metal in an electric furnace. In this way products equal to those produced by the open hearth method were obtained. In the speaker's opinion, some combination such as this would probably be found to be the best. With regard to melting ore in electric furnaces, not much progress had been made, and the output was small. Until very cheap power was obtainable electric blast furnaces could not compete with the ordinary furnaces, and he could not see any prospect of electric melting holding its own.

Mr. A. G. Ellis pointed out that the total output of electric steel in England had not been given. The current used in a furnace was limited by the size of the electrode, whereas in open-top carbide furnaces up to 40,000 amps. could be used. There was no limit to the size of transformers that could be built, even up to 50,000 amps. He was glad to see that emphasis had been laid on the necessity of making good jobs of transformer installations He pleaded for simplicity, especially regarding connections and tappings; the latter should be brought right out of the transformer. In his opinion switchgear was much more likely to give trouble than transformers. Much of the trouble with the latter in the past had been due to short capacity. The right size of transformer had been arrived at mostly by trial and error methods with the result that transformers had not been made large enough. He did not think it was necessary to brace transformer coils in all directions, as it was quite a simple matter to determine in which direction coils would tend to move Regulator tappings should always be brought outside the transformer so that it could continue working should the regulator break down. It was possible to obtain external regulation with 11,000 volts.

Mr. Campbell's remarks were chiefly confined to the production of ferro alloys. In 1918 the whole of the country's supplies of ferro chrome were produced electrically. Something like 10,000 tons were produced, and 80 millions of electrical units were used. The manufacture of tool steel had also been very large, and it was his opinion that electric steel equal in quality to crucible steel could be produced if equal care was taken in manufacturing He thought that more attention should be given to electrical power contracts.

In Sheffield good work had been done, but no account was taken of power factor. It would be advantageous if a uniform method of charging could be adopted, this could consist of a fixed price plus power factor and coal clauses. With regard to the control of electric furnaces, it was possible to have a master controller that would regulate a number of furnaces on one feeder, so that the whole could be controlled from the power station.

Sir Robert A. Hadfield, F.R.S., congratulated the authors on the useful information that had been collected in the papers. The whole thing turned upon the cost of power; it was essential to have cheap power, and he hoped the national electricity supply scheme would have the desired result. This country would be in a very bad state indeed if that scheme did not give them really cheap power. In this country they were producing electric steel at a cost of between £2 and £3 per ton, whereas in Canada it was produced at 10s. per ton. Electric furnaces had been a very great help to his firm during the war, they had enabled them to make use of 100,000 tons of scrap metal which they would not otherwise have been able to utilise. He took that opportunity of thanking Mr. S. E. Fedden, manager and chief engineer of the Sheffield Corporation electricity undertaking, for his valuable help in getting the furnaces to work. The speaker's opinion was that electric furnaces had come to stop, but it was very desirable that they should have cheap power. In the U.S.A. they were using electricity not only for melting and refining metal, but also for annealing and such purposes; and it was therefore important to lower the cost of energy. A further point was that electrical heat was not the same as heat obtained from combustion; it was possible that electrical heat had some effect on the molecular structure of metals. It was claimed by one manufacturer that steel made in an ordinary furnace was improved by having an electric current passed through it while being cooled. He had examined samples of such steel, and although he had found no such superiority, that was no reason why the claims should be discredited.

Mr. W. M. Mordey said that reducing the cost of energy was not, in his opinion, necessary; it would serve a much more useful purpose if the amount of heat lost in the furnaces themselves could be reduced, and he thought a penalty should be imposed on steel makers for every unit wasted in this and other ways. These were matters beyond the electrical engineer; it was up to the user once he had got a good piece of apparatus to see that it was operated on the most economical lines. Another direction in which expenditure could be reduced was by exercising care with the electrodes. Much could be done to save energy by furnace inspection, and the application of common sense, for instance, by the use of Stobie electrode economisers. He thought that the secret of the great growth of electric furnaces during the war was to be found in the word swarf. The experience gained in this way was very valuable, and would lead to still more in the near future. In reply to those who depreciated the electric furnace, he would say that the tide had risen, and still continued to rise, in spite of all that was said against such furnaces. He would like to know whether the induction furnace was really dead. A paper setting out not its merits, but its defects, and the exact reasons why it had failed, would be very useful.

Mr. G. W. Partridge spoke as a supplier of electricity, and suggested that users of electric furnaces should exercise a little patience before they clamoured for cheap rates. He was of the opinion that if supply engineers were allowed reasonable time to make up for the lost time during the last few years in repairs and renewals, there was no reason why they should not supply energy at costs below ½d. per unit within the next three or four years. He thought that ¼d. per unit was too low, but special rates for load factor were certainly desirable. After supplying power for railways, he thought electric furnaces would give them very little trouble, and an out of balance of 20 per cent. would make very little difference to an ordinary system. He was in entire agreement with the previous speaker as to the units consumed per ton produced. The importance of improving the consumption was shown by the statement that the consumptions of the same types of furnaces varied from 500 to as much as 5,000 units per ton of steel produced.

Mr. Payne said that the point that struck him was that of costs. The cost of steel in the ladle varied as much as 2½ times for exactly similar types of furnaces. In his opinion there was no great difference in types of furnaces or the consumption of different types, the whole thing was a question or management. His advice would be always to adopt automatic control, and, except for small furnaces, to use transformers which could be repaired on site.

A speaker said that electric furnaces had helped very greatly in Canada in dealing with large amounts of turnings and scrap metal. They had been able to make excellent steel from 100 per cent. turnings. With an installation of ten 6-ton furnaces they had been able to produce between 391-400 tons of steel per day at a consumption of between 550 to 750 units per ton. There was no economy in electrical apparatus unless it possessed a high factor of safety.

Another speaker said that some people attempted to run down electric furnaces, but it was significant that when a steel maker installed an electric furnace he very soon made enough money to install a second one, and always did so.

Major A. M. Taylor inquired whether single-phase furnaces were likely to go ahead in the future, and, if not, was it solely because supply engineers favoured the three-phase load? He suggested that if a single-phase E.M.F., of any frequency whatever, were superposed at the generating station on a three-phase feeder, a single-phase supply of that frequency could be drawn off any point of that feeder, and without materially unbalancing the supply on the three-phase mains. Existing three-phase transformers would be unaffected if the voltage wave were not too much deformed. On a 6,000-volt, three-phase system, if a single-phase E.M.F. of 1,500 volts were "injected" into each phase at the generating station, as much as 4,500 KW. of single-phase energy (roughly) could be passed over a feeder designed for 10,500 KW. three-phase, without deforming the E.M.F. wave sufficiently to injuriously affect existing transformers. As regards the cost of power, Major Taylor had given very close attention to this matter a few years ago in connection with the true "running cost" of energy put into large batteries (*i.e.*, the net out-of-pocket cost of the energy supplied at the time of no peak, and with such limitations as would avoid creating a peak), and he had found it to be of the order of ⅛d. per unit at the generating station. This figure had, in his opinion, nearly sufficient margin to be allowed to stand, at present prices of coal, if generation was on a big enough scale. The cost of "fixed charges" on a 100 per cent. load factor, which might be obtained with proper relays of furnaces working all night and all day, would probably only add another ⅛d. to ¼d. He could not see why, even now, on a fairly large scale, energy could not be supplied between 11 p.m. and 7 a.m. at under ¼d. per unit, and the rest of the day at ½d. per unit. Electrical engineers went through all this sort of experience 15 years ago with the motor load, and offered prices in order to get that load, which neglected all their old capital investments and labour commitments, and assumed conditions which seemed almost "ideal"; but they got the motor load, after which they found certain unexpected things develop in their favour. Let them have similar enterprise now, and it might bring unexpected advantages in its wake. Everything depended on the load factor and the making of a 100 per cent. load factor was entirely in the hands of the furnace people themselves.

The authors of the papers reserved their replies to the discussion for publication in the *Journal* of the Institution.

ALL-METAL PASSENGER CARS.

At the Institution of Civil Engineers on April 8th two papers were read on the construction and equipment of all-metal passenger cars for British railways, with special reference to those in use on the Manchester-Bury section of the L. & Y. Railway.

Mr. F. E. Gobey, O.B.E., dealt with the causes necessitating the change from timber to metal construction for the body of the car—the under-frame and bogie being already built of metal. Supplies of timber are now inadequate, while metal is readily available; Board of Trade recommendations with a view to reducing the effects of accidents support the change; timber cannot be made literally fireproof, though jarrah is practically non-inflammable, and has been successfully adopted for cable-troughing; and metallic construction, besides preventing fire, would render telescoping impossible. Very few wooden passenger-cars have been built in the United States in recent years. The only all-metal passenger cars constructed in Great Britain are those in use on the L. & Y. Railway, Manchester-Bury electric service; these have centre corridors with vestibule gangways and doorways at the ends, and are 63 ft. 7 in. long by 9 ft. 4 in. wide. The metal body is built directly on the under frame, and is designed as a weight-carrying structure. All the panels are of aluminium, the roof being single No. 14 S.W.G., and the sides below the windows double-cased with No. 14 and No. 18 S.W.G. The window-frames are of aluminium. The flooring is of galvanised iron No. 22 S.W.G. riveted to the under-frame and covered with composition.

In designing a metal car every detail has to be considered before issuing the drawings, as the various items have to be prepared in the machine shop before erection. The cars are built by the same staff as wooden cars. Owing to the necessity for interchangeability of parts, and the different tools employed, the work is very different from the building of wooden bodies. As regards weight, the all-metal electric motor-cars of the L. & Y. Railway, seating 74 passengers, weigh (unloaded) 120,960 lb., compared with 114,240 lb. for wooden cars seating 68, or 1,634 lb. per seat compared with 1,680 lb. Tho trailer cars are designed for conversion to motor-cars, if desired; deducting the additional weight (2,512 lb.) for this purpose, the comparison is 62,448 lb. for 95 passengers, or 643.7 lb. per passenger, as against 61,768 lb. for 97 passengers, or 636.7 lb. per seat.

The costs (excluding electrical equipment) show an increase of 5 to 8 per cent., *ceteris paribus*. Forty-six all-metal cars have been in service for three years, running 250,000 miles per car per annum. The under-frames and bodies have remained true and square, the materials have not corroded, and the cars are quiet in running. Three collisions have occurred, from which it appears that the damage is limited to the ends of the cars, the doorways and vestibules bear the brunt of the shock, and there is no difficulty in effecting repairs.

Aluminium is preferable to steel for panelling and roofing, showing a return of 20 per cent. per annum due to saving in weight, and it requires less maintenance, being almost non-corrodible. After the car is built the steel work is sand-blasted *en bloc* to remove scale and rust and hold the paint, which is applied immediately afterwards; temporary bogies are used during this process. In the United States baking ovens holding a whole car are in use, temperatures ranging from 120 to 250 deg. F. being employed.

The author discusses designs of all-metal cars for main-line and suburban services, recommending the open type of car. The most economical length of car is 63½ ft., seating 103 passengers, and weighing 5 cwt. per seat (trailer car). The all-metal open car has many advantages over wooden compartment cars, in width, weight, comfort, paying load, maintenance, safety, &c. Metal compartment cars can be built in metal, but there are great advantages in combining the metal structure with the open-car design.

Appendixes show that the number of passenger cars in use on standard-gauge British railways in 1913 was 52,631, of which 1,019 were renewed in that year, at an average cost of £827.

In the United States there were in 1917 64,816 passenger cars, of which 17,601 were of steel; the latter are increasing at the rate of 1,885 per annum, while the number of wooden cars in service is decreasing at the rate of 1,541 per annum.

In his paper on "The Electrical and Mechanical Equipment of the All-Metal Cars of the Manchester-Bury Section, L. and Y. Railway," Mr. George Hughes, M.Inst.C.E., gave a full account, with numerous illustrations, of the apparatus installed. The 1,200-volt current is collected from the live rail by shoes, which are directly connected with the main trolley-cable running along each side of the car. A rotary transformer supplies current at 100 volts for the operation of the contactors, pump-motor, lighting, and auxiliary apparatus, with the exception of the heaters, which are supplied direct from the trolley-cable and effectively protected by an earthed metal cover. The Aspinall side-contact live rail has been adopted. For the housing of the trolley-cable, after trying many substitutes for timber, it was found that nothing was so satisfactory as jarrah wood, which will not burn with a flame, and smothers an arc when one is formed. The high- and low-pressure couplers between the coaches were designed by Messrs. Dick, Kerr & Co., Ltd., who were contractors for part of the equipment.

All the 1,200-volt apparatus is housed in a high-pressure compartment with sheet-metal walls and door, the latter being interlocked with the main isolating switch, which can be opened only with the reversing-key of the controller. The rotary transformer is a compound-wound machine of 10 KW. capacity, with a double-wound two-commutator armature, and is attached to the under-frame of the motor-car. It is operated on the motor side by an automatic control-switch of the contactor type.

The control equipment is of the shunt multiple-unit contactor type, arranged so that automatic or manual operation may be used at will in the forward position, and manual only in the reverse. By preventing the driver from exceeding the normal acceleration current the maintenance of the motors and gearing is reduced; on the other hand, considerable attention is required to keep the relays and interlocking secondary contacts in an efficient working state.

There are two master-controllers on each motor and trailer car, each being only 8 inches wide, and weighing about 100 lb. There are nine positions of the controller-handle, and four of the reversing handle (manual and automatic ahead, off, and reverse). There are two main circuit-breakers on each car, which can be tripped or reset from the driver's compartment by 100-volt solenoids; there are also two groups of contactors on each motor-car, each group controlling two motors. Two motor cut-outs are provided, by means of which any motor can be cut out. The reversers, each of which controls two motors, are solenoid-operated.

The motor-bogie is built up on the lines of the best locomotive practice. The gear-wheels are pressed on the axle and bolted to flanges cast on the running-wheels; the latter are 3 ft. 7 in. in diameter, and have Siemens-Martin open-hearth steel tires. A 9-ft. wheel-base is used. Each bogie is equipped with two 200-H.P. motors, with a gear ratio of 2.36 : 1. The gear-wheel and pinion are mild steel forgings, owing to pressure of work in the steel foundry; steel castings have given every satisfaction on the Liverpool and Southport line, having an average life of 250,000 miles. The teeth are of involute shape. Pressed-steel gear-cases have been found to give the best results. Half the weight of the motor is spring-borne.

The motors are of 200-H.P., on account of the heavier gradients in the neighbourhood of Manchester, and in order to maintain a high schedule speed; on the Southport line 150-H.P. motors were used. Other changes in design include the use of a solid field frame, improved ventilation, interpoles, the enclosure of the field and interpole coils in brass cases, larger bearings, and solid mica insulation for the armature coils. The field-coils are vacuum-impregnated, and are packed tightly into the brass boxes; experience shows that the cost of maintenance of brass-cased coils is negligible. For the field-frames the steel employed has the following composition: C, 0.11; Si, 0.32; S, 0.07; P, 0.06; Mn, 0.82; this has a permeability of 250 at a flux density of 17,000 lines per cm². The weight of the motor per H.P. is 36.92 lb. The tractive effort at 200 H.P., full field, is 2,850 lb., and the efficiency (through the gear) 88 per cent., the speed being 26 M.P.H. Vacuum brake gear is used, operated by motor-pumps, of 5 H.P.; the motors run at 1,000 R.P.M. on 100 volts, and are controlled by a two-contactor starter and an automatic regulator. If the driver releases the controller handle whilst running, the brakes are applied and current is cut off the main and pump motors.

Signal bells and emergency lighting are supplied with current from storage batteries, either six "Ironclad-Exide" cells or ten Edison cells, capable of discharging at 150 amps. for 5 hours. Each motor-car is lighted with 33 35-watt lamps at 100 volts, and heated by 20 heaters in series at 1,200 volts, taking 7 amps.

The equipment is inspected twice a week, and a weekly examination is made of the controlling gear, brushes, and commutators. Every six months a general overhaul takes place, the motors being taken out and the armatures removed, &c. Once a year the contactors and controlling gear are dismantled and put in order. This system has contributed to efficiency of service, the average total number of faults per month for the year ending July 31, 1918, being 72.4, and the faults per 1,000 motor-car miles 0.78. A record of faults is kept, and is analysed, so that any particular class of fault that develops can be watched and remedied. Curves showing the results of train tests with a dynamometer-car are given in the paper, and appendixes give details of construction of the motors, the weights of the cars and equipments, the method of testing the 1,200-volt motors with a supply pressure at 400 volts (a modification of the Kapp-Hopkinson test), and particulars of the train tests above-mentioned.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Portable Welding Plant.

A new company, to be known as the A.C. Cutting and Welding Co., Ltd., is putting on the market for the first time in this country an electric arc welding plant which is a complete unit and portable, and takes its power supply from A.C. mains of any voltage or frequency. The outfit, which is made entirely in England, and protected by British patents, is furnished complete with welding handle, helmet, shield, switchboard, plugs, &c., and is ready to operate upon receipt.

As this machine can be made to operate equally well on any frequency, the equipment is immediately adapted to the power supply, whether at 25, 50, or 100 cycles, without changing any of its characteristics. Its operation does not depend on reactance or inductance in any way; the design of the transformer is such that all requirements of the arc are met automatically in the design of the machine, without moving parts of any kind. The machine can be made to operate on any primary voltage, such as 220, 440, or 550. The apparatus can be connected in whatever way is most satisfactory to the power supply, thus reducing any possible disturbances in the circuit. Machines can be made which

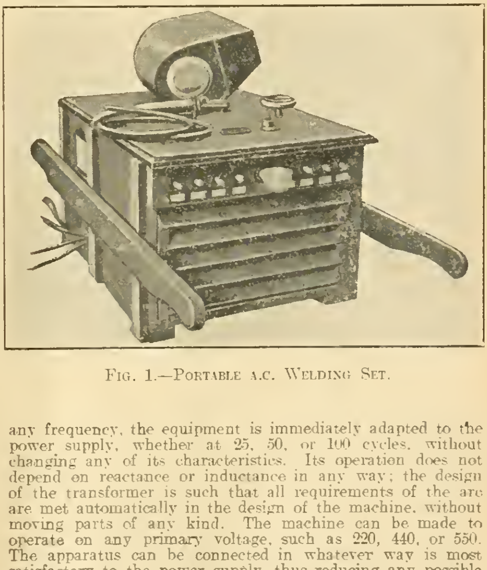

Fig. 1.—Portable a.c. Welding Set.

will take power from more than one phase, although that is not commonly recommended. As the maximum demand for this machine is less than 5 kw. for welding, and less than 10 kw. for both cutting and welding, the unbalance of any one single-phase machine is negligible. The largest size weighs between 200 and 300 lb., and may therefore be carried about by two men without difficulty.

A well-designed transformer is naturally an efficient piece of apparatus, and the regulation used does not materially affect the efficiency, so that a very high electrical efficiency overall can be obtained. The makers claim a consumption of between 1 and 2 kw.-hr. per lb. of metal deposited. When the work is scattered and too large to be brought to the machine, the set can be wired from the high-pressure or primary side, whereas all other systems must be wired from the low-pressure or welding side, at a great disadvantage as to cost of copper and interference when welding. The only moving part is a self-contained cooling blower with ball bearings, requiring no oil. Constant watts mean a constant rate of heating, which is what is desired in welding; the current reduces with this machine just enough with the lengthening of the arc to supply practically constant watts to the arc. The amount of the watt input to the arc can be adjusted to the work and electrode by means of an easily moved shunt in the magnetic field circuit, together with voltage taps on the switchboard. The machine can be operated or left short-circuited continuously without undue temperature rise; in fact, the short-circuited primary power is less than the full-load kw.

Until the new company is incorporated all information regarding it and its products can be obtained from Mr. F. Farquhar, c/o American Supplies Co., Ltd., 162, Great Portland Street, London, W.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

10,453. "Safety device for securing terminal nuts on sparking plugs, accumulators, magnetos, &c." D. Benda, R. Freshwater, F. P. Houching and J. H. Pettinger. April 28th.

10,483. "Distributor or commutator for internal-combustion engines." P. W. Corless. April 28th.

10,484. "Safety locking-switch." P. W. Corless. April 28th.

10,490. "Treatment of zinc-bearing ores for recovery of zinc by electrodeposition." Electrolytic Zinc Co. April 28th. (Australia, April 27th, 1918.)

10,512, 10,514. "Magnetos for internal-combustion engines." C. F. Godwin. April 28th.

10,532. "Transmitters for wireless telephony." H. J. Round. April 28th.

10,533. "Electric generators." H. J. Round. April 28th.

10,543. "Timing gears for valve cams and magnetos for petrol engines." B. Poynton. April 29th.

10,550. "Ignition plugs for internal-combustion engines." F. Umpleby and R. D. Umpleby. April 29th.

10,579. "Electric light fittings." C. E. Hirst & C. T. O'Callaghan. April 29th.

10,603. "Electric apparatus for indicating and repeating movements at a distance." Schneider et Cie. April 29th.

10,608. "Protective devices for electrical distribution systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 29th.

10,613. "Electric filament projection lamps." W. Williams. April 29th.

10,618. "Electrolytic cell, and method of operating same to produce oxides and powders of metals and alloys." A. E. White (Becker Bros.). April 29th.

10,628. "Signalling apparatus for aerial traffic." McKenzie, Holland and Westinghouse Power Signal Co. & L. H. Peter. April 29th.

10,644. "Electrical transmission disengaging lock switch." J. J. Wheatley. April 30th.

10,692. "Switches for electric bells." T. B. Sharp. April 30th.

10,698. "Thief-proof switch." R. W. Emerson. April 30th.

10,709, 10,710. "Telegraphy." B. Davies & Eastern Telegraph Co. April 30th.

10,716. "Manufacture of lead-covered electric cables." A. Olier & P. Roussillon. April 30th.

10,721. "Controlling supply of electric currents." J. Tavener. April 30th.

10,722, 10,723. "Manufacture of insulating, &c., compositions." F. J. Commin. April 30th.

10,725. "Electromagnets and apparatus employing same." International Electric Co. & H. E. R. Roose. April 30th.

10,737. "Means for supporting shade of electric incandescent lamp." L. G. Flory. April 30th.

10,755. "Manufacture of manganese and its alloys in electric furnaces." C. L. Lenoir. April 30th. (France, January 8th, 1914.)

10,769. "Insulators." British Thomson-Houston Co. (General Electric Co., U.S.A.) April 30th.

10,773. "Sparking plugs." A. Lyonnet. April 30th.

10,789. "Sparking plugs for internal-combustion engines." C. E. Tinson and G. N. Travers. April 30th.

10,844. "Sparking plug and terminal fitting." J. C. Roe. May 1st.

10,855. "Electric radiators." J. R. Quain. May 1st.

10,857. "Electrodes for electric welding." A. C. Hyde. May 1st.

10,725. "Electromagnets and apparatus employing same." International Electric Co. April 30th.

10,870. "Presses for assembling parts of sparking plugs." A. Lyonnet. May 1st.

10,877. "Magneto-electric machines." C. T. J. Opperman. May 1st.

10,878. "Sparking plugs." W. H. Norman & Southern Transport Co. May 1st.

10,881. "Primary electric batteries." Lithanode, Ltd., & A. N. Hazlehurst. May 1st.

10,910. "Microphones or electric transmitters for submarine signalling and reception of subaqueous vibrations." J. Gardner. May 2nd.

10,926. "Electric light, &c., lanterns." Cable Accessories Co. & F. H. Reeves. May 2nd.

10,932. "Apparatus for lamp signalling in overhead wire systems of electric traction." A. M. Willis & Brecknell, Munro & Rogers. May 2nd.

10,939. "Electric heaters." E. Delille. May 2nd. (France, September 25th, 1918.)

10,942. "Electric generators and motors." J. Shepherd. May 2nd.

10,943. "Vibration galvanometers, oscillographs, &c." F. O. Hunt. May 2nd.

10,975. "Arrangement for amplifying electric currents." M. D. Dimitrievitch. May 2nd.

10,986. "Transformation of polyphase currents in electric furnaces, &c." J. Bibby. May 2nd.

11,000. "Apparatus for indicating failure of electric circuit." H. Jones. May 3rd.

11,008. "Process for coating wire, &c., with metals by electro-deposition." S. O. Cowper-Coles. May 3rd.

11,030. "Automatic cut-outs for electric circuits." W. A. Cocking & W. E. Hean. May 3rd.

11,032. "Electrical resistance and manufacture of same." G. Turnock. May 3rd.

11,038. "Thermo-telephone receivers." A. Williams & L. D. Williams. May 3rd.

11,086. "Method of indicating, locating, and/or isolating faults in electric transmission or distributing systems." Ateliers de Construction Oerlikon, P. Dawson, F. W. Fawory, P. Luder & G. Wuthrich. May 3rd.

11,102. "Sparking plug." H. Wenger. May 3rd. (Switzerland, May 3rd, 1918.)

11,115. "Electric switches." G. Wightwick. May 3rd.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

7,091. Electromagnetic sound receivers and producers. S. G. Brown. May 18th, 1916. (125,104.)

8,003. Underground electric circuit-making and breaking device. E. Brodsky. June 6th, 1916. (125,134.)

8,021. Synchronising of flash signalling apparatus. A. W. Sharman. June 6th, 1916. (125,135.)

8,259. Apparatus for manufacturing tubes of small diameter. S. O. Cowper-Coles. June 12th, 1916. (125,142.)

8,421. Optical signalling apparatus. A. W. Sharman. June 14th, 1916. (125,144.)

8,957. Electric control arrangements for the conversion of functions for use in connection with calculating apparatus, and for other purposes. H. R. Wright. June 26th, 1916. (125,165.)

1918.

3,726. Electric furnaces. J. Bibby. September 2nd, 1918. (125,179.)

3,925. Number dials for automatic and semi-automatic telephone systems. Automatic Telephone Manufacturing Co., Siemens Bros. & Co., Western Electric Co., G. W. Moore & J. E. Collyer. March 6th, 1918. (125,183.)

4,040. Ignition circuits of magnetos. Compagnie Generale de Magnetos. September 29th, 1917. (120,191.)

5,584. Telephonic attachment for phonographs and talking machines. H. Okell. April 2nd, 1918. (125,195.)

5,780. Electric lamp fittings. British Thomson-Houston Co. & H. C. Wheat. April 4th, 1918. (125,197.)

5,917. Vacuum electric discharge apparatus for lighting. British-Thomson-Houston Co. (General Electric Co., U.S.A.) April 6th, 1918. (125,201.)

5,970. Starting switches for alternating-current electric motors. British Thomson-Houston Co. & W. P. Hamlyn. April 8th, 1918. (125,206.)

6,138. Electrical switches. A. E. Read, J. E. Franks, M. Brooks & W. Compson. April 11th, 1918. (125,215.)

6,146. Electric signalling systems. H. Green. April 11tb, 1918. (125,216.)

6,196. Systems of electric distribution having storage batteries, electrolytic cells, and the like. C. O. J. Montelius. March 24th, 1917. (115,623.)

6,222. Means for indicating in connection with the ignition circuits of the engines of aeroplanes. J. Roberts. April 12th, 1918. (125,222.)

6,256. Electric resistances. Brush Electrical Engineering Co. & C. C. Sutton. April 12th, 1918. (Addition to 1609/17.) (125,225.)

6,273. Electric lighting apparatus. Benjamin Electric, Ltd. April 19th, 1917. (115,030.)

6,599. Synchronous dynamo-electric machines. British Thomson-Houston Co. & R. D. Given. April 18th, 1918. (125,234.)

7,659. Electrical relays. S. G. Brown. May 7th, 1918. (125,252.)

7,727. Electric dry batteries. E. Armelin. May 8th, 1918. (125,254.)

7,745. Prizing or adjusting devices for electrical machines and turbines. Brush Electrical Engineering Co. (Aktiebolaget Ljungstroms Angturbin.) May 8th, 1918. (125,255.)

9,745. Electrical frequency meters. B. P. Romain. June 13th, 1918. (125,276.)

9,943. Electric circuit breakers. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 17th, 1918. (125,279.)

15,060. Thermostats. C. E. Hearson. September 16th, 1918. (125,316.)

17,442. Electric fuse switches. Edison Swan Electric Co. & F. Shergold. October 25th, 1918. (125,325.)

18,716. Windings of the armatures of magneto machines. British Lighting & Ignition Co. & E. O. Turner. November 14th, 1918. (125,331.)

18,819. Electrical heating elements. G. Pate & N. C. Barrett. November 16th, 1918. (125,332.)

19,317. Electric time switch. Landis & Gyr Akt. Ges. December 18th, 1917. (121,594.)

21,311. Magnetos. Compagnie Generale de Magnetos. July 12th, 1918. (125,342.)

1919.

2,366. Electrical amusement apparatus. S. J. Levi. January 30th, 1919. (125,352.)

2,835. Rotary electric converters. British Westinghouse Electric and Manufacturing Co. March 13th, 1918. (124,193.)

German Export Trade Plans.—An Imperial Commissioner is to be appointed for the promotion of German export trade and for securing goods for sale abroad.—*Times.*

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

AN EXAMPLE OF INDUSTRIAL CO-OPERATION.

THE May number of *Unity* contains an article which is of unusual interest to all electrical engineers, inasmuch as it is a description of an experiment entered upon a couple of years ago by one of the largest electrical manufacturing concerns in the kingdom. The article is written by Mr. H. Mensforth, C.B.E., the well-known General Manager of Works of the British Westinghouse Electric and Manufacturing Co., Ltd.

It is evident, not only from Mr. Mensforth's article, but generally throughout industry, that there has been an increase of sympathy, and an appreciation of the need for co-operation, between the various groups of individuals engaged in industry. There is a tendency to realise the other fellow's difficulties, which brings about a desire to help things forward. We may accept at once the axiom with which Mr. Mensforth starts out—viz., "that the great majority of all classes of the population are both well-meaning and honest." It is a great thing to get people to believe in their own honesty, for if a man believes himself to be upright, he is less likely to do anything which will besmirch his record in his own eyes.

It is perhaps paradoxical, but it is true, that an increase of sympathy may initially manifest itself as an apparent increase in antagonism. The appreciation of a difficulty brings about a search for a method of overcoming it, and when this method is found, and appears to the finder to promise adequate solution of the problem, failure to apply it immediately is apt to produce great impatience, which may show itself in various ways of varying degrees of unpleasantness.

Mr. Mensforth "is looking forward to the time when, in the consideration of the undertaking or execution of a large contract, it will be possible to have representatives from the body of the workmen, who can be consulted in connection with these matters, and who are in a position to signify their willingness to take a certain amount of responsibility and interest in the proper execution thereof." He is, as this extract shows, very strong on the need for co-operation between the manual workers and the management, or direction; but what, in this connection, is the precise position of the administrative staff, which might with more aptness be called the management? Does Mr. Mensforth think it safe to rely on their constant sympathy with, and support of, the employers' interests? Who are "the representatives of the management" mentioned by him as members of the Works Committee? They are, of course, members of the staff, but they are not there to represent the views of the staff employés. Here, of course, we come right up against the outstanding defect in all such schemes, including the first Whitley Report itself. "Co-operation in industry"—that is the magic word which is to bring about peace in the industrial world. But when the project is examined, it is found that two parties only are considered—viz., capital, or the employers, and organised bodies of workers, that is to say, the Trade Unions interested in each particular case. The article under discussion says that all members of the Committee, *of course* (our italics), with the exception of the management, are prominent Trade Unionists—none else can serve. We therefore have, on the one side, the Trade Unions, and on the other—not directors, not large shareholders, not bankers, but—members of the staff.

This state of things brings many dangers in its train. The workers' Trade Unions will naturally be suspicious of any attempt on the part of staff men to form Trade Unions for their own protection, for have they not always been brought face to face with these same men as the representatives of the employer class? This, we are sure, is the whole difficulty between the E.T.U. and the E.P.E.A., and various tactless statements on both sides have not tended to ease the situation.

On this subject much might, and, indeed, ought to, be written, for the purpose of clearing away the haze that obscures the situation, but further consideration must be reserved for another occasion.

While we believe that Mr. Mensforth has the root of the matter in him, and is, in general, proceeding on right lines, he none the less labours a few prevalent fallacies, to which we must take exception at once. The first is that the war has been a great teacher—for good, we suppose he means. The war has taught us nothing new that is good. Co-operation, brotherly love, mutual assistance, all of these were eternal verities before August, 1914. The war has taught men to make use of poison gas, of flame-throwers, and other means of wholesale slaughter, and these are new. Necessary, we admit, but wholly evil.

The second fallacy is that it is the war that has taught us that the average Briton can be led, but not driven, and the third is that the same teacher has brought out the value of proper team work. A moment's consideration of the thousand-year development of our Empire will show that, whatever may be new under the sun, these truths were truths from the beginning, and will remain truths for ever.

The Danger of Bureaucracy.

The Government scheme (for the re-organisation of electricity supply on a totally new basis, if it is carried out, will have many effects quite apart from those which are contemplated in the Bill, and some of these will be as unwelcome as they are unexpected. It is only when the car gets under way that the presence of sand in the bearings makes itself known and puts the brake on progress. The Electricity Supply Bill which is now before Parliament commends itself to us as, in the main, a sane and moderate measure by which great benefits should be conferred upon the industry and upon the public generally; but it is open to amendment, and now is the time to find out its weak points and to anticipate not only its direct results but also, if possible, those remoter and less obvious consequences against which safeguards should be provided.

One of these undesirable effects was recently brought to our notice by a well-known central-station engineer, who fears that the appointment of Electricity Commissioners and District Electricity Boards will inevitably bring with it a tendency towards that baneful effect which is invariably the offspring of bureaucratic control—namely, the repression of initiative and originality. It is a phenomenon which is by no means peculiar to State or municipal control, though it attains to its most luxuriant growth in the former; it is found also in any large industrial organisation of long standing, such as a great railway company or a huge manufacturing concern, and if it does not actually sprag the wheels, it certainly acts as a brake on progress.

Granted that there are honourable exceptions—that some big firms endeavour to encourage their staffs, from the chief to the office-boy, to put forward new ideas and to point out defects in current practice—even in such cases it is well-known that the disease can be only partially eradicated; there are always some officials who frown upon the presumption of their subordinates when the latter broach suggestions for improvements, and either suppress new ideas altogether as impracticable or because "we tried that long ago, and it wouldn't work," or seek to appropriate them for their own benefit.

Now, as our friend pointed out, the new scheme while subdivided territorially, will, nevertheless, constitute a single huge organisation extending from the Commissioners to the labourers, and after a time—when the spirit of bureaucracy has permeated the whole mass—it will become an offence for anyone but a highly-placed official to have any ideas of his own as to how things should be done; those who wish to retain the goodwill of their superiors will not disturb their equanimity by proposals of reform, no one will dare to communicate signed articles to the technical Press, and the subject of electricity supply will become a closed book to all who are outside the industry. As initiative will be restricted to the higher-placed officials, who are necessarily the older members of the profession, and, consequently, more cautious and less fertile of ideas than the juniors, technical progress will be slow and timorous. How often does a young railway official propound a new idea? If he does not mind his P's and Q's, he knows very well that he will be rewarded with the "sack." A similar spirit prevails in the Post Office, which has also taken the telephone industry under its wing, with consequences which are notorious.

How is this very real danger to be avoided? In his paper before the Society of Arts, of which we give an abstract elsewhere, Mr. J. S. Highfield points out the importance of providing a margin of profit to be applied to research, and this appears to offer unquestionable advantages: we would add that the policy should be adopted of providing facilities for every man engaged in the industry to have direct access to the controller of the research departments, with the certainty of appropriate reward in the event of his ideas being utilised. But even this leaves it open to the inventor's immediate superiors to vent their jealousy on him in one way or another for daring to be cleverer than themselves. It is a serious question, and we commend it to the notice of those who are piloting the Bill through Parliament.

Conscience in a New Form.

In the course of a leading article in our issue of March 28th of this year, we commented on the fact that many American tramway undertakings were in great trouble because their revenue was insufficient to meet the enhanced expenditure arising out of war conditions. This state of affairs is, unfortunately, not confined to American tramway systems, but the majority of people are unable to increase their incomes by the direct means at the disposal of those concerns.

We remarked that it had been found that increasing the fares did not bring about a proportionate increase in the revenue, and it seems that there are more reasons than one for this disappointing result. If fares are too dear, passengers adopt other means of locomotion; but America, ever to the fore in introducing novelties, has developed a new type of conscientious objector. This product of the times takes his ride, but refuses to pay the fare, and we are told that in the one City of Columbus, Ohio, during the months of September and October, 1918, no fewer than three million passengers took this line of action.

This reveals a condition of fatuity which surely cannot be allowed to last. At the moment of writing we do not know what is the population of Columbus, but it is quite clear that these passengers do not consist of three million different persons. There must be a considerable amount of repetition joy-riding going on. Are one-man cars used? If so, it is questionable whether the economy thereby gained is commensurate with the loss that seems to be permitted.

We shall watch the American traction papers with interest for the solution of the difficulty.

THE ELECTRICAL EQUIPMENT OF THE U.S.S. "NEW MEXICO."

The April issue of the *General Electric Review* is devoted almost wholly to an exhaustive account of the equipment of the U.S.S. *New Mexico*, the first battleship propelled by electric power. Three sister ships—the *California*, *Maryland*, and *West Virginia*—are being similarly equipped, and a number of 35-knot battle cruisers are under construction, each of which will have power plant six times more powerful than that of the *New Mexico*. The accompanying particulars and illustrations are derived from the journal above mentioned.

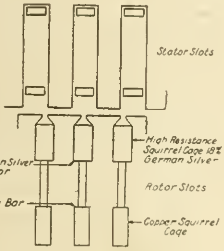


Fig. 1.—Section of Motor Slots.

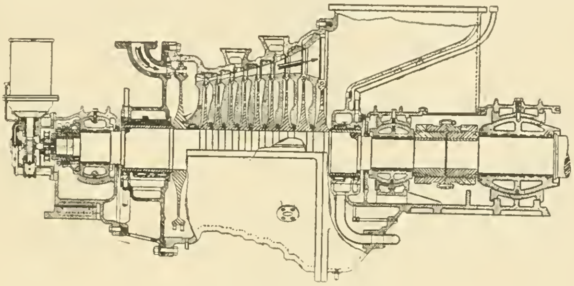


Fig. 2.—Section of Turbine.

The qualities which led the U.S. Navy Department to make this important departure from the usual practice were the great flexibility afforded by the electrical method of propulsion in the arrangement of the equipment, and the economy of fuel, which may amount to as much as 30 per cent. The reliability of the electric drive had already been demonstrated by the performance of the U.S.S. *Jupiter*, which had only been delayed once during the past five years by trouble with the electrical equipment, and then only for a few hours, repairs being effected by the ship's own staff. The complete independence of the propelling motors and the generators from one another is a most valuable feature in case of injury to any item of the plant, and the facility of reversal of the propellers without reversing the direction of rotation of the turbine or generator perfectly solves a difficult problem. There is no great difference between the electrical drive and geared turbines in respect of weight or space occupied; at full speed the latter have a slight advantage in economy, but at the lower speeds more generally required, the former is materially superior—especially in the case of battle-cruisers. As regards safety from torpedoes and gunfire, the electrical system has an enormous advantage over all other types of machinery, and greatly facilitates the designing of the ship to afford protection against such risks; here, in fact, is found the main reason for the adoption of electrical propulsion. Incidentally, the motors can be placed far aft, shortening the main shafting, the boilers can be grouped round the generators with short and direct steam piping, the various items of plant can be isolated in water-tight compartments, and the lay-out generally can be designed on the most convenient lines.

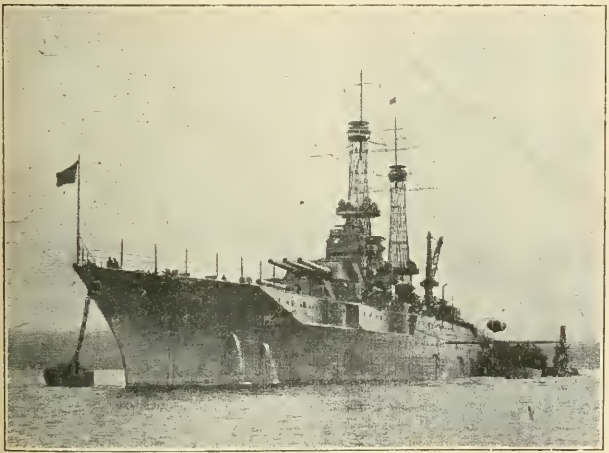


Fig. 3.—U.S.S. "New Mexico."
Tonnage, 32,000 tons; speed, 21 knots; power, 31,000 h.p.; armament, 12 14-in. guns in four turrets.

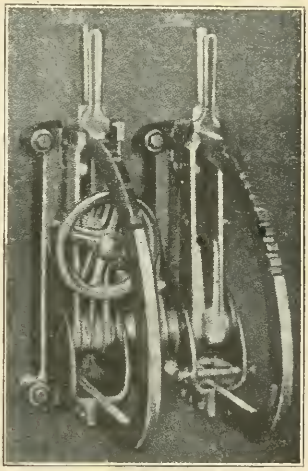


Fig. 4.—Steam and Field Control Levers.

Turning to the installation on the *New Mexico*, it is interesting to observe that the design of the whole plant is dominated by the characteristics of the propellers, and that the solution of the problem has been found in the field excitation of the main generators, involving a wide departure from ordinary practice. While the continuous output of a turbo-generator is limited by heating, the maximum momentary output depends upon the excitation, varying approximately as the square of the field current; and assuming that the generator and motor are designed to work together under the most advantageous conditions, the maximum power of the motor thus depends upon the field excitation of the generator.

The motors on the *Jupiter* were of the slip-ring type, but for the *New Mexico* squirrel-cage motors of special design have been adopted. The rotor contains two squirrel cages, of high and low resistances respectively, and so inductively related that the high-resistance cage produces a high reversing torque, whilst the other provides a low-resistance path for the current at full speed. The characteristics of the motor are so co-ordinated with those of the propeller, together with the excitation of the generator, that a quick reversal of the propeller is ensured a matter which is by no means so simple as it might appear. A section of the stator and rotor slots is given in fig. 1.

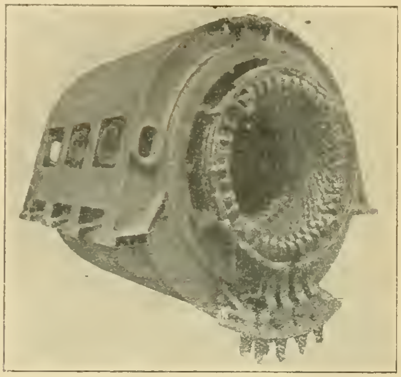


Fig. 5.—Stator of Generator.

The turbines are of the Curtis impulse type, with 10 admission valves to the first-stage nozzles, and 10 stages, and operate with steam at 250-lb. gauge pressure, superheated 50° F., and an absolute back pressure of 1·5 in. of mercury. A section of the turbine is given in fig. 2, which shows that it is axially very short, the over-all dimensions of the turbo-generator being 34 ft. 10 in. × 10 ft. 2 in. wide and 12 ft. high.

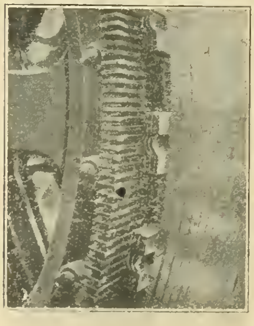


Fig. 6.—Detail of Rotor Winding.

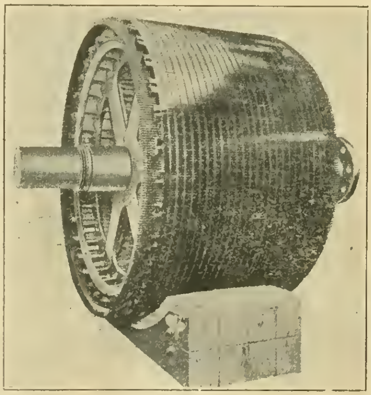


Fig. 7. Rotor of Induction Motor with Double Squirrel-cage.

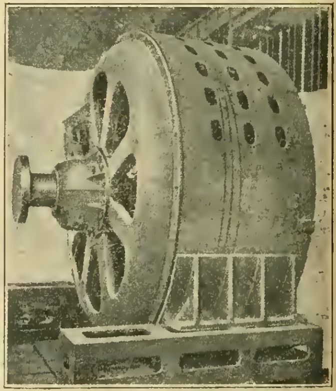


Fig. 8.—Complete Motor.

The generators, rated at 10,500 k.v.a., at 78 per cent. power factor, and 13,500 k.v.a. at the full speed of the ship, operate at a maximum frequency of 35 cycles per second, 2,100 r.p.m.; they have an overload capacity of 25 per cent. (16,850 k.v.a., at 78 per cent. power factor), for four hours. The stators are wound two-phase, and the circuits can be connected in two ways, giving 3,000 and 4,240 volts respectively. All speeds up to 17 knots are obtained by the use of one generator with the low-voltage connection, feeding the four motors; for higher speeds both generators are used, with the high-voltage connection, each feeding two motors. The efficiency at a load and speed corresponding to 10 knots is 95 per cent., and at 21·5 knots 97 per cent. The generators are in general of similar design to land machines, except that the turbine and generator base castings are replaced by a stiff structural steel foundation built into the ship's framework. A view of the stator is given in fig. 5.

The motors are wound with circuits giving 24 and 36 poles, according to the connections; with the former number the speed reduction is 12 : 1, and with the latter 18 : 1. To give intermediate speeds the speed of the generators is varied over a range from 1,440 to 2,100 r.p.m. (10 to 21 knots).

During the operation of reversal, which is always done on the 36-pole connection, at maximum speed, an excess excitation of 60 per cent. is applied to the generator field, and the line current rises to about three times the steady running value; the whole operation occupies 20 seconds, but the excess excitation is applied for only eight seconds. A very complete system of forced ventilation is provided for the generators and motors.

The winding of the motor stators is so designed as to give a balanced two-phase distribution for either 24 or 36 poles, with eight terminals. The rotor, as already explained, has two squirrel-cages, the end connections of which are seen in fig. 6.

The bars are driven into close-fitting slots without insulation, to allow the heat to flow freely into the rotor iron; the outer cage is of high-resistance metal, short-circuited by copper end-rings, into which the bars are brazed, these rings also being closely in contact with the rotor body. This is of importance during reversal, when the greatest amount of heat is generated in this winding, and the heat capacity of the rotor iron is thus utilised to keep the bars cool. The sections of the end-ring are joined together with expansion joints of laminated copper.

The inner cage is of copper bars electrically welded to a copper ring; as this winding remains cool under all conditions of running, no expansion joints are provided in it.

The complete motor is shown in fig. 8; it is rated at 6,700 h.p. at 4,000 volts on the 24-pole connection, and 2,050 h.p. at 2,800 volts on the 36-pole connection, with an overload capacity of 8,375 h.p. at 173 r.p.m. At speeds from 8 to 15 knots the four motors are operated on the 36-pole connection from one generator; from 15 to 17 knots, the same on the 24-pole connection; above 17 knots, two generators are used, each separately feeding two motors (the generators are prevented by interlocking gear from ever being put in parallel). The control gear is in itself an elaborate equipment, being provided with a great variety of interlocks to prevent wrong connections, and is described as the most intricate and important part of the equipment.

Two 300-kw. turbine-gear-driven exciting sets are provided, generating at either 120 or 240 volts, and two motor-driven boosters, one for each generator field, which can raise or lower the voltage by 60 volts. The main cables have a fibre core, pure rubber insulation, and a covering of asbestos braid filled with fire-resisting paint, and are protected with sheet-iron covers. The cables carrying direct current are insulated with pure rubber, lead-covered, and armoured with galvanised steel wire.

In addition to the propelling equipment, a complete outfit of electrically-driven auxiliaries is provided, embracing circulating, air, and hot-well pumps in duplicate, four lubricating-oil pumps, oil coolers, and blowers for ventilating the main motors. The total weight of the complete plant, with spare parts, was guaranteed not to exceed 700 tons; the actual weight was 590 tons. The steam consumption was guaranteed not to exceed the following figures with dry saturated steam at 250 lb. per sq. in. (gauge), including the auxiliaries:—At 10 knots, 15·38 lb. per shaft H.P.-hour; at 15 knots, 11·57 lb.; at 19 knots, 11·32 lb.; at 21 knots, 11·53 lb. Heavy penalties were attached to these guarantees.

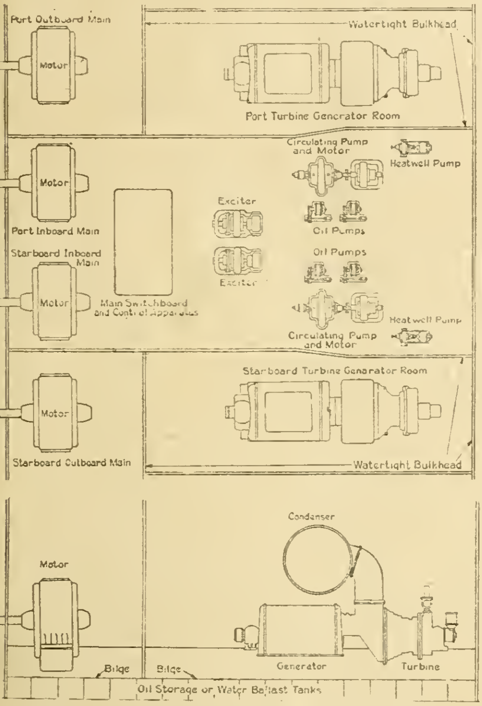


Fig. 9.—Plan and Elevation of Engine-Room.

The contract price for the complete plant was $431,000.

Gunfire tests were carried out, including the discharge of all the 12 14-in. guns at the same instant, but no effect was observed on the electrical equipment or the turbines.

The official trials of the equipment were carried out on December 16th-18th, 1918. Owing to overloading which increased the displacement by 1,000 tons, the power required to drive the ship was greater than was anticipated, amounting to 31,000 H.P. at 21·25 knots, at which speed a four-hour trial was run. The results were regarded as highly satisfactory. As the normal conditions did not obtain, the steam consumption was somewhat above the guarantees at the higher speeds.

A.C. Arc Welding.—The advantages of A.C. compared with D.C. for metallic arc welding are pointed out in the *Electrical World* with considerable bias in favour of the A.C. system. It is claimed that the efficiency of A.C. welding is higher (1 lb. of metal being deposited for less than 2 KW.-hours). It is said that the power factor ranges from 35 to 65 per cent. in welding, and from 65 to 90 per cent. in cutting. Finally, it is pointed out that the user pays for KW.-hours regardless of power factor. This is still the case in most supply areas, but the evil effects of low power factor are becoming generally appreciated, and it is probable that tariffs penalising low power factor will become common.

WAGE SYSTEMS IN RELATION TO EFFICIENCY.

By Major E. A. Pells, R.E.

Good work claims good wages, and it is obvious that it can profit no one if the value of the work done is less than the payment received by the worker. Many and varied are the methods that have been evolved from time to time by employers to get the best from their employés and yet to give them an equitable reward. Whatever the system of pay may be, it is laid down in a special clause in the Factory Act (S. 116, F. and W. Act, 1901) that all workers must be supplied with a clear explanation of the wage system under which they are paid. It is also to the advantage of the employer to do this, as nothing causes dissatisfaction quicker than for the workers to get the impression that they are being swindled in some way. To procure a proper day's work, the reward in pay must be sufficient to make the operative work willingly and to enable him to live well and comfortably, so that his efficiency is not impaired by ill-health. The method of payment that is most commón is payment by time, and this has been considered satisfactory from the point of view of many, and has in some cases, with suitable environment and good faith on the part of employers and employés, given very good results. But one cannot get away from the remarkable fact that actual results in certain munition works showed a 24 per cent. increase on day shift, and 40 per cent. on night shift, in output on the introduction of piece rates.

The piece-rate method of pay is much more satisfactory to the employer and the industrious employé, but is viewed with disfavour by the "weaker brother." It is usually in the fixing of piece rates that the employer and worker find themselves at loggerheads, and it is in this direction that Trade Unions could prove useful by appointing members on a combined committee of employers and employés to fix the piece rates for their particular industry. If this were done, it could not but work satisfactorily, as the rates would hold good throughout the trade, and there would not be the undercutting which has been one of the greatest curses in the industrial world.

The whole of the blame for cutting rates should not be placed on the employer, for he has often been tempted by the worker to do that which he had originally not the slightest idea of doing. Rates fixed by a combined committee would be far more likely to be quite equitable, and therefore more satisfactory, to the whole industry concerned.

However, although piece-rate methods of pay commend themselves as being payment for value received, yet there are several objections to them. Where accuracy is very important there is always the danger of scamped work, and it is only by careful inspection that quality can be ensured as well as quantity. Another drawback is that they do not give you a method of reward by which you can get the best out of your employés. In other words, they encourage the wrong workers. What is needed is a system of wages which has the effect of especially encouraging the weaker workers, yet without discouraging those who are in "championship form."

The Gantt bonus system comes into this category, and is, therefore, in my opinion the best. It is easily explained and understood, being perfectly straightforward, and is therefore best from the point of view of efficiency. All workers completing their task in the working day receive a bonus and also a piece rate for all work over. Any worker who does not complete the task still receives the regular time rate for that kind of work, so that the weaker worker is not completely discouraged; but with the assistance of the special foremen detailed to instruct, he will very soon succeed in completing the task satisfactorily in the time allowed, which is usually about 160 per cent. of the standard. The Towne Halsey premium-bonus system is similar in general idea, the difference being that the work done beyond the task is not paid for by piece rates, but by a correctly calculated and scheduled bonus increasing in direct ratio to the output.

The criticism levelled at these systems by the exponents of the Rowan premium-bonus system is that they are not correct scientifically, and the principal advantage they put forward on behalf of the Rowan system is that being calculated scientifically it protects the worker from himself, as up to 150 per cent. efficiency the bonus is an increasing amount, but past this point it is a dropping curve. My objection to this system is the difficulty often experienced in explaining to the worker the reason for the payment getting smaller again. In works where standards have been very successfully fixed, and very few workers reach 150 per cent. efficiency and none ever exceed it, this objection does not arise, and the introduction of this method of payment has given very good results.

Profit-sharing is a very beautiful idea, but the reward is usually such a long time deferred that it very often misses its object completely as an encouragement to increased output. This especially applies among the lower-grade workers.

Some employers have given bonuses for good time-keeping, but good time-keeping does not necessarily mean good and efficient work. The question of the best wage system for the character of work and type of worker is a matter for careful study; whatever system is used, the study of wages paid, increases, &c., is very useful, and enables the management to investigate any apparent limitation of output. In all questions of wages the principal thing to keep in view is the effect of a "square deal," and the whole question revolves on general social, economic, and hygienic considerations.

TRADE STATISTICS OF BRAZIL.

The following figures show the imports into Brazil of electrical and similar goods during the year 1917. The figures for 1916 have been added for purposes of comparison, and notes of increases or decreases, as the case may be, are given:—

	Dollars. 1916.	Dollars. 1917.	Dollars. Inc. or dec.
Dynamos and electrical generators.—			
From United States ...	43,500	36,000	− 7,500
,, Great Britain ...	7,000	—	− 7,000
,, Switzerland ...	26,000	55,000	+ 29,000
,, Other countries ...	6,500	16,000	+ 9,500
Total	83,000	107,000	+ 24,000
Electric motors.—			
From United States ...	42,000	100,000	+ 58,000
,, Great Britain ...	28,000	18,000	− 10,000
,, Switzerland ...	40,000	29,000	− 11,000
,, Other countries ...	13,000	21,000	+ 8,000
Total	123,000	168,000	+ 45,000
Transformers.—			
From United States ...	131,000	91,000	− 40,000
,, Great Britain ...	14,000	4,000	− 10,000
,, Other countries ...	7,000	12,000	+ 5,000
Total	152,000	107,000	− 45,000
Other electrical machinery.—			
From United States ...	876,000	1,349,000	+ 473,000
,, Great Britain ...	128,000	129,000	+ 1,000
,, France	37,000	24,000	− 13,000
,, Other countries ...	85,000	92,000	+ 7,000
Total	1,126,000	1,594,000	+ 468,000
Steam engines.—			
From United States ...	2,000	1,000	− 1,000
,, Great Britain ...	11,000	1,000	− 10,000
,, Other countries ...	4,000	3,000	− 1,000
Total	17,000	5,000	− 12,000
Industrial machinery.—			
From United States ...	288,000	488,000	+ 200,000
,, Great Britain ...	315,000	229,000	− 86,000
,, France	54,000	84,000	+ 30,000
,, Other countries ...	101,000*	51,000†	− 50,000
Total	758,000	852,000	+ 94,000
Motors, gasoline, kerosene, &c.—			
From United States ...	41,000	29,000	− 12,000
,, Great Britain ...	8,000	6,000	− 2,000
,, Switzerland ...	15,000	44,000	+ 29,000
,, Other countries ...	150,000	7,000	− 143,000
Total	214,000	86,000	− 128,000
Motors, n.o.e.—			
From United States ...	40,000	64,000	+ 21,000
,, Great Britain ...	16,000	10,000	− 6,000
,, Sweden	19,000	—	− 19,000
,, Switzerland ...	32,000	36,000	+ 4,000
,, Other countries ...	4,000	10,000	+ 6,000
Total	111,000	120,000	+ 19,000
Hydraulic pumps and accessories.—			
From United States ...	56,000	76,000	+ 20,000
,, Great Britain ...	11,000	11,000	—
,, Other countries ...	24,000	18,000	− 6,000
Total	91,000	105,000	+ 14,000
Other machinery (except textile and agricultural).—			
From United States ...	936,000	1,597,000	+ 661,000
,, Great Britain ...	331,000	223,000	− 108,000
,, France	97,000	38,000	− 59,000
,, Belgium	3,000	—	− 3,000
,, Italy	21,000	6,000	− 15,000
,, Switzerland ...	82,000	136,000	+ 54,000
,, Sweden	55,000	108,000	+ 53,000
,, Other countries ...	77,000	198,000	+ 121,000
Total	1,602,000	2,306,000	+ 704,000
Electric wire or cable.—			
From United States ...	381,000	722,000	+ 341,000
,, Great Britain ...	34,000	19,000	− 15,000
,, Italy	25,000	21,000	− 4,000
,, Other countries ...	9,000	68,000	+ 59,000
Total	449,000	830,000	+ 381,000
Wire, copper, electrical.—			
From United States ...	342,000	346,000	+ 4,000
,, Great Britain ...	9,000	2,000	− 7,000
,, Other countries ...	5,000	13,000	+ 8,000
Total	365,000	361,000	+ 5,000
Wire, copper, n.o.e.—			
From United States ...	85,000	149,000	+ 64,000
,, Great Britain ...	8,000	9,000	+ 1,000
,, Other countries ...	4,000	1,000	− 3,000
Total	97,000	159,000	+ 62,000
Wire, copper, uninsulated.—			
From United States ...	27,000	19,000	− 8,000
,, Great Britain ...	2,000	—	− 2,000
,, Other countries ...	1,000	—	− 1,000
Total	30,000	19,000	− 11,000
Telegraph and telephone posts, and bridge and fence material.—			
From United States ...	52,000	59,000	+ 7,000
,, Great Britain ...	73,000	1,000	− 72,000
Total	125,000	60,000	− 65,000
Insulators.—			
From United States ...	53,000	71,000	+ 18,000
,, Great Britain ...	17,000	27,000	+ 10,000
,, Other countries ...	5,000	4,000	− 1,000
Total	75,000	102,000	+ 27,000
Electric lamps.—			
From United States ...	237,000	370,000	+ 133,000
,, Great Britain ...	14,000	17,000	+ 3,000
,, Holland	40,000	55,000	+ 15,000
,, Other countries ...	21,000	13,000	− 8,000
Total	312,000	455,000	+ 143,000
Scientific instruments.—			
From United States ...	48,000	64,000	+ 16,000
,, France	20,000	10,000	− 10,000
,, Great Britain ...	20,000	14,000	− 6,000
,, Other countries ...	12,000	18,000	+ 6,000
Total	100,000	106,000	+ 6,000

* Sweden, $35,000. † Italy, $5,000.

Denmark-Sweden Tunnel.—The proposed tunnel to connect Denmark and Sweden will start on the eastern side of the Amagar Island, says the *Engineer*. Construction will, however, be commenced by sinking shafts on the island of Saltholm. The tunnel will be 11 miles long, and the total length of the railway will be 31½ miles.

ELECTRIC FURNACE PRACTICE.

(*Continued from page* 581.)

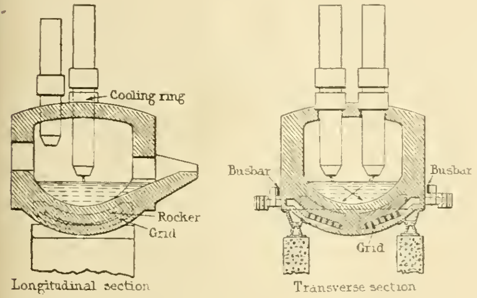
The Booth-Hall Electric Furnace.

By W. K. BOOTH.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

It is the purpose here to describe a new type of electric furnace which has been developed during the last year, and which is known as the Booth-Hall electric furnace. It comes under the conducting-hearth, vertical-arc class, and is illustrated diagrammatically in figs. 1 to 4.

Fig. 1 is a longitudinal sections of the two-phase electric furnace with the auxiliary electrode resting upon the charge and arcs drawn between the main electrodes and the charge. A pool of metal is shown forming on the hearth of the furnace.



Figs. 1 & 2.—Booth-Hall Two-phase Furnace.

Fig. 2 is a transverse section of the two-phase electric furnace, showing the crossing action of the current in the bath and the grids embedded in the hearth.

Fig. 3 shows the electrical connections for the two-phase electric furnace employing two single-phase Scott-connected transformers. This diagram shows the connections from the transformer terminals to the main electrodes and to the auxiliary electrode and grids. A two-phase electric furnace so connected gives a balanced load on a three-phase power service. The auxiliary electrode is shown in black.

Fig. 4 shows the arrangement of main and auxiliary electrodes in singe-, two-, and three-phase furnaces. The auxiliary electrodes are shown in black.

The general principle is a furnace having a solid hearth which becomes conductive of electricity when hot, and the use of an auxiliary electrode which acts as a return for the electric current until the hearth becomes heated and conductive. In starting on a cold charge the auxiliary electrode is lowered until it rests on top of the charge, and the arc is then drawn between the charge and the main electrodes, the auxiliary acting as a return. The auxiliary is so arranged that it presses with its entire weight on top of the charge, and consequently no arc can form underneath the auxiliary; experience has demonstrated that no arc does form. The auxiliary is connected in parallel with the conducting hearth, and when the main electrodes have melted enough metal to form a pool on the bottom the hearth becomes conductive and the auxiliary is withdrawn from contact with the charge. In a cold furnace the auxiliary is in operation from 30 to 45 minutes, and in a furnace which is hot less than 15 minutes; only long enough to assure a positive start and a balanced load on the line.

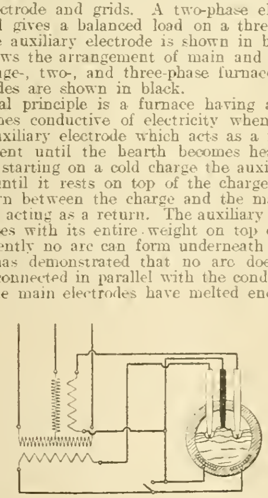


Fig. 3.—Electrical Connections of Two-phase Furnace.

Furnaces from ½ to 6 tons' holding capacity are generally built for two-phase operation, taking power from three-phase service by means of Scott-connected transformers, as shown in fig. 3. In the hearth of the two-phase electric furnace two sets of grids are embedded, which are electrically insulated from each other, and are so related to the main electrodes that the currents of the two phases cross in the bath, thus giving a maximum of circulation of the molten metal and causing, in conjunction with the effect of the bottom heating, a very thorough mixing of the metal in the bath. The conducting grids are placed as far as possible from the heated interior of the furnace, and experience has shown that they never become overheated or require special cooling. The grids are so constructed as to handle large currents, furnishing large areas of contact with the material of the conducting bottom, and preventing local heating due to contact resistance.

By the use of the auxiliary electrode a positive start of the furnace is guaranteed, and there is no possibility of failure to secure contact. Each main electrode is independent of the other, as there are no arcs in series, and consequently the regulation of the furnace is very simple, giving a balanced polyphase load on the power service lines. As with the two-phase connection there are only two electrodes to regulate, this offers the minimum number of electrodes for a balanced polyphase load, and the smaller the number of electrodes requiring regulation the smoother becomes the furnace operation.

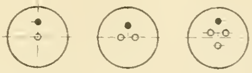


Fig. 4.—Single-, Two-, and Three-phase Electrode Arrangement.

The hearth is either acid or basic, as desired, and in each case is at least 24 in. (60 cm.) in thickness, being sintered in place layer by layer and forming a monolithic mass. By using the main electrodes in conjunction with the auxiliary, the materials of the hearth are sintered together in thin layers similar to open-hearth practice, thus forming a very durable bottom and making the danger of run-outs a minimum. The furnace hearth is consequently solid, with no water cooling of any kind. With the basic hearth, dead burned dolomite is used to maintain the slag line; in the acid furnace, ground ganister is used for the same purpose. The conducting hearth gives a uniform bottom heating of the entire bath, prevents sculls, and makes speedier and more thorough distribution of the heavier alloys, which tend to sink to the bottom of the bath. The effect of this bottom heating is considerable.

With the two-phase electric furnace a minimum of electrode consumption is secured. The loss on the auxiliary electrode is small. The electrode jaws are made to grip or release by turning a handwheel at the side of the furnace. The jaws are arranged in segments so as to adjust themselves to the inaccuracies in the surface of the electrodes. A roomy charging door of special construction is provided in the rear of the furnace, and another door in front over the tap. This construction permits a battery of furnaces to be arranged side by side and a charging machine to serve them all. The furnace tilts or rocks backward as well as forward, and slagging operations can be handled from either the rear or the front as desired.

The furnace is motor tilted, in all sizes, for pouring, but can be tilted by hand in emergency. The smaller sizes of furnace are built for hand operation only, if desired. All parts of the tilting mechanism, including gears and motors, are arranged so that they do not come beneath the furnace, and therefore there is nothing under the furnace that can be injured in case of a run-out.

The main electrodes are automatically regulated, and also, in every case, they can be regulated by hand. The power input can be maintained at any point from one-fourth to full load by means of voltage reduction and control switches.

In making steel for the ordinary grade of steel castings, the Booth-Hall electric furnace has operated with a power consumption as low as 446 kw.-hr. per 2,000 lb. (906 kg.) of steel poured, but the average will be between 500 and 550 kw.-hr. per net ton for continuous operation. In one 4-ton furnace a considerable quantity of low phosphorous pig-iron has been made, running over 0.035 per cent. in phospherous and sulphur, also special steels requiring refining with two or more slags.

A New Type of Electric Furnace.

By AXEL SAHLIN.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The furnace which is the subject of this paper has been designed with a view to embodying the advantages of both the direct-arc and the free-burning-arc furnaces, at the same time avoiding as far as possible the disadvantages of both.

The furnace is built as a circular ladle with contracted top and dished bottom. The shell plates are perforated by drilled holes, spaced about 12 in. apart and serving as vents for moisture contained in the lining. The steel casting trunnions are riveted to the shell, and rest in bearings set so as to allow for expansion and alignment. To the overhanging end of one trunnion is keyed a crank which, by means of an enclosed screw, running in oil, working in a swivelled crosshead and turned by handwheel (or motor) serves to tilt the furnace. The bottom of the furnace is made up of a layer of coke dust and tar rammed in, supporting double layers of brick. On top of this is rammed and fixed in successive layers a hearth consisting of burnt dolomite and tar for basic operation, or of ganister in case the acid process is adopted. Supported and resting on the firebrick, outside the hearth, is placed a circular lining backed by a heavy insulating layer of asbestos sheet and formed of circle-bricks laid with ground joints and thin mortar. This lining may be made of magnesite brick for basic process, or of silica brick for acid process. In the lining are placed on the same vertical lines two holes for each pair of electrodes, and one door opening which serves both to charge the furnace and to pour the steel. On top of the contracted top of the side lining rests the dome-shaped roof built of basic or acid brick fitted-in a circular steel frame, forming a rigid skewback. The roof joint is made of a layer of powdered dolomite or ganister spread on top of the side wall. The roof can be removed by crane without delay, and replaced by another preheated roof held in readiness. It is also possible to charge the furnace through the top by removing the roof while the charge is put in place.

The electrodes, graphite or carbon of cylindrical form, are extended as they are burnt away by screwing a new section of electrode to the rear end of the electrode in operation. The joint is made by threaded dowls of graphite. The electrodes slide through water-cooled electrode holders. The electrodes are wrapped in sheets of asbestos, mica, or fibre, and are thus insulated from the furnace body. The electrode cooler with its insulation is placed between the fixed upper and sliding lower jaws of a clamp which is pivoted to a frame bolted to the furnace shell. Both halves of the grips are water-cooled. Both grips are made with an extending wing, to which is bolted the bronze cable socket. Both the swivelled guides are adjusted in a vertical sense, controlling at will the inclination of the electrodes.

The number of electrodes proposed is for a furnace hearth up to 3 ft. 6 in. dia., 1 pair; from 3 ft. 6 in. to 5 ft. dia., 2 pairs; from 5 ft. to 7 ft. dia., 3 pairs; from 7 ft. to 9 ft. dia., 4 pairs; from 9 ft. to 11 ft. dia., 6 pairs.

The electrodes should be preferably of graphite, varying from 2 to 6 in. dia. Each pair of electrodes enters the furnace in the same vertical plane, but at different and adjustable angles. The upper electrodes are supplied with current. The lower electrodes, as well as the furnace body (and, if the furnace is going to be used largely for refining work, a bottom electrode bedded in the hearth) are connected with the common of the transformer, or earthed. For a one-pair furnace, D.C. or one-phase A.C. is used. For a two-pair furnace it is preferable to employ two-phase current, generally obtained by three-phase transformers arranged in Scott's coupling. For a three-pair furnace, three-phase current is used, one phase being coupled to each upper electrode.

For furnaces with more than three pairs of electrodes, groups of two pairs are coupled in parallel; therefore, a four-pair electrode furnace uses two-phase current, whereas a six-pair furnace should be supplied with three-phase current. If for any reason it may be found desirable, the upper electrodes can be earthed, and the current can be supplied through the lower electrodes. A bottom electrode bedded in the hearth may be used or not; it is useful when refining.

The pressure of the supply should preferably be transformed to 100 volts which, by plugs on the transformer, may be reduced at option to 80 or 70 volts.

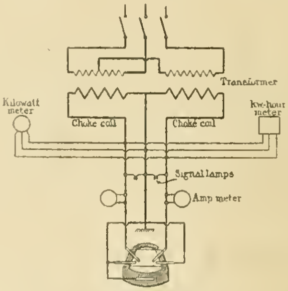


Fig. 5.—Wiring of a Two-pair Sahlin Furnace.

The connections for a two-pair furnace are shown in fig. 5. All the electrodes are distributed around the half of the circumference of the furnace opposite to the tapping hole and charging doors. For the smaller sizes, the electrodes are fed forward by handwheels.

For melting and refining steel, the first operation is the heating of the furnace to the proper temperature by gradually advancing the points of the convergent electrodes of each pair until an arc is formed. Experiments have proved that as long as the points of the electrodes are at a certain distance from each other an arc is formed between the two electrodes. As the electrodes approach each other this arc bends outward, forming a loop. If the distance is still further reduced, the loop breaks and the arc rushes forward, sweeping downward toward the surface of the metal like a broom. If the top electrode is advanced beyond the bottom electrode, the broom is deflected downward (fig. 6). The form and direction of the arc can easily be modified by altering the angles of the electrodes and their relative position to each other. The free-burning arc heats the furnace while empty.

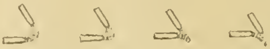


Fig. 6.—Direct Arcs Observed with Different Positions of Electrodes.

When the furnace is heated, current is taken off, and the electrodes are drawn toward the back wall of the furnace to prevent their being injured, while the material to be melted is pushed into the furnace through the charging door, or top. Numerous momentary arcs are formed between the upper electrodes and the charge, but as this latter is melted away in the vicinity of the electrodes, the regular free-burning "broom" arc is formed between the two electrodes and the working of the furnace settles down to normal. The radiation and reflection caused by the free-burning arc are most effective for rapid melting. As the bath is formed, this kind of arc reaches only the slag-covered surface of the metal. At this point the free-burning arcs are broken by the retirement of the lower electrodes and a direct arc is formed by the advancing of the upper inclined electrodes toward the surface of the slag. If the bottom electrode is employed, the current will penetrate toward this bottom electrode which is earthed. The furnace now creates an arc which causes a rapid circulation in the bath and direct transfer of heat to the metal.

In furnaces with more than one pair of electrodes, it is possible to have some of the electrodes produce a direct, and some a free-burning arc, thus making use of the effective radiating and reflecting action of the free-burning arc, at the same time as the bath is agitated by the direct arcs.

For use as a heating furnace for very high temperatures it is proposed to suspend the furnace shell containing the side walls and roof with the electrodes and their mechanism from four lifting rods, operated by electric motor. The bottom of the furnace, which for this work does not require any bottom electrode, would be placed on a truck. On this portable bottom would be placed the material to be heated, and the furnace body would be lowered on to the truck enclosing the pile of material. A free-burning arc would now be started between the electrodes in each pair, and the furnace would be brought up to the required temperature. The material having been thoroughly heated or calcined, the furnace body would be lifted from the truck, which would be run away to give place to a second truck loaded with fresh material. The loaded trucks could be preheated in a gas-fired furnace before the bottom was placed under the electric furnace.

The Sahlin furnace has not yet been placed on the market owing to the difficulty of its construction during the war, but a furnace is now being built in Great Britain intended for the production of steel ingots and castings.

(*To be continued.*)

Discussion at Birmingham.

The six papers were discussed before the South-Midland Centre of the Institution on May 7th.

Mr. F. J. Moffett gave a brief general account of electric furnaces followed by a *résumé* of the six papers.

Mr. C. M. Walter followed with an account of the work which he had done on externally-wound tubular resistance furnaces. These furnaces had been successfully used by him in the research laboratory of the Birmingham Corporation gas department for heat treating and hardening of steel. Mr. Walter showed samples of articles treated, and mentioned that he had designed a furnace for hardening sewing needles in an inert atmosphere contained within an electric tubular furnace. The needles were suspended in a box or held up by a magnetised plate, and when they had been heated to the proper temperature they were dropped into an oil bath at the bottom of the furnace. This furnace had proved highly successful, and the ordinary scale-removing operation, requiring several days for its completion, was eliminated.

Mr. W. Wilson remarked that no mention had been made in any of the papers of the fact that by means of such electric furnaces it was possible to treat a wider range of iron ores than had proved to be practicable in furnaces of ordinary construction. In particular he mentioned magnetite iron sand, which existed in a certain deposit in enormous quantities and in a state of great purity. All attempts to smelt this ore in ordinary furnaces had failed owing to its finely divided state. Mr. Wilson also referred to the omission from Mr. Moffett's introductory remarks of any reference to electric furnaces for the fixation of nitrogen, and drew attention to the commercial possibility of such furnaces.

Mr. J. D. Morgan spoke on the economic aspect of the subject. Reference to efficiency figures probably did not help the prospective user very much. It was said that such furnaces gave an efficiency of 80 per cent., whereas the efficiency of solid-fuel furnaces was often very considerably lower than 1 per cent. The contrast put in this way was somewhat misleading, because the overall efficiency of a plant involving an electric furnace, *i.e.*, the efficiency from the fuel for generating electricity to the heat generated in the furnace, would not be more than 8 per cent., and it was this figure which should be compared with the performance of a solid-fuel furnace.

Mr. W. F. Whittaker asked whether it was possible to produce a downwardly deflected arc with a three-phase supply without the use of Scott connections. He pointed out that there were certain special cases in which the use of such an arrangement would be advantageous, but he had not been able to find out how it could be obtained.

A SMALL HYDRO-ELECTRIC PLANT.

Messrs. Mitchell Bros., Old Town Mills, Hebden Bridge, have resorted to the generations of electricity from water power to drive their woollen spinning mills. Several natural springs controlled by the firm exist, and the fullest advantage has been taken of the energy available. In designing the scheme of electrification it was decided to provide a reservoir having a capacity of six million gallons, and fed by springs rising some 1,500 feet above sea level.

By means of this reservoir a fall of 500 feet has been obtained, the water being conveyed through 9-in. cast-iron pipes to the power house, which lies three-quarters of a mile below. The conditions imposed upon the contractors laying down the installation were that the turbine plant should be entirely automatic and self-governing; that it should be started and stopped from the mill half a mile away; that the speed should be kept constant under all conditions, to ensure the very steady drive required by a textile mill; and that it should be unnecessary for an attendant to pay more than one visit per day to the power house. Messrs. Mitchell Bros. report that all these conditions have been amply fulfilled by the contractors. The power house contains a tangential wheel of the Pelton type (manufactured by Messrs. Gilbert Gilkes & Co., Ltd., of Kendal) running at 600 r.p.m., and coupled to a 68-kw. G.E.C. "Witton" dynamo, as shown in fig. 1. The generator is compounded so that the mill voltage is maintained constant at all loads. The speed control of the turbine is obtained by Messrs. Gilkes's patent governor, in which the coupling head is mounted direct on the shaft, thereby avoiding the use of chains or belts for driving and eliminating any possible chance of the set running away through the breaking of the intervening mechanism. There are no rotating parts on the governor, so that there is nothing to heat or seize; nor are there oil pumps, moving pistons or cylinders. The result is that whereas an ordinary governor can turn off water in case of accident in less than three to five seconds, the water in this case can be shut off in a fraction of a second without any shock on the pipe-line. The governing proper is effected by means of deflectors. A simple deflector would use the full quantity of water at all loads, and would waste that which was not required. In the deflector installed a spear is inserted into the nozzle and controls the quantity of water flowing into the wheel, the motion of the spear being slow in order to avoid shock on the line, while in coming out when the load is thrown on the motion is very rapid. On tests it was found that with full load thrown off, the momentary speed variation was but 1 per cent. above the normal, while the permanent speed variation between full load and no load was one-half of 1 per cent. above and below normal.

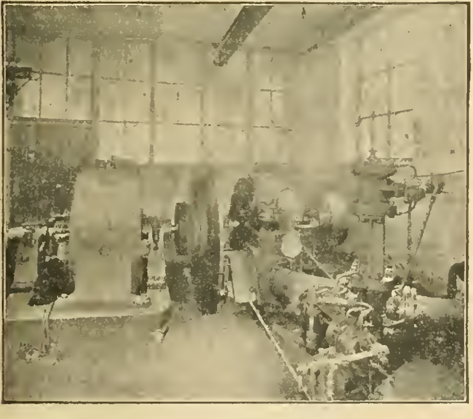


Fig. 1.—The Hydraulic Turbo-generator in Messrs. Mitchell Bros.' Power House.

The remote-control device comprises a hydraulic cylinder, the supply of water to which is controlled by a solenoid which operates a four-way valve. The magnets are controlled through overhead wires by a switch situated at the mill, the current for energising the magnets being taken from a battery of accumulators.

The transmission line is entirely overhead, the conductors being carried on wooden poles to the mill. The poles also carry the wires for the starting and stopping gear, as well as the lighting and telephone wires. The conductors are cradled at points where the overhead line passes over public paths. This line is protected by lightning arresters at each end.

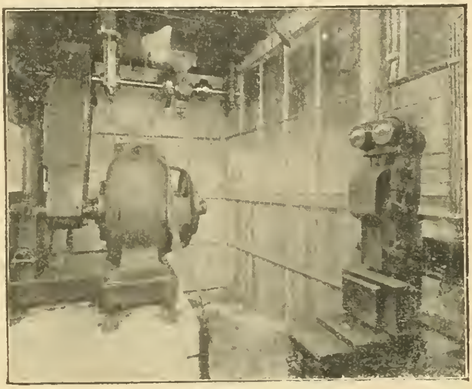


Fig. 2.—The 500-volt, 70-h.p. "Witton" Motor for Group Drive.

In the mill, the whole of the plant is driven by a "Witton" motor of 70 h.p. running at a speed of 630 r.p.m., the motor being housed in a totally-enclosed central motor house. The motor is seen in fig. 2.

The connection between the motor and the mill shafting is through a Hans Renold silent chain running in an oil bath, the ratio of transmission being 5 to 1. In view of the fact that the motor operates at 500 volts, a small "Witton" dynamo, driven by the mill shafting, is used to supply current for lighting at a pressure of 200 volts.

The hydraulic portion of the scheme was undertaken by Messrs. Gilbert Gilkes & Co., Ltd., of Kendal, and the whole of the electrical plant by the General Electric Co., Ltd., of Witton, Birmingham, through its office at Victoria Bridge, Manchester.

Substitute for Platinum in Electro-Analysis.—The scarcity and extraordinarily high price of platinum in Germany created a great demand for metal substitutes. Hence the experiments which Prof. Gewecke, of the Chemistry Department of Bonn University, made in this direction deserve consideration. According to the *Chemiker Zeitung* he endeavoured to find a suitable substitute, equivalent in all respects to the platinum dishes generally used in electro-analysis as cathodes, and weighing about 30-40 grammes. He discovered that glass dishes could be used advantageously if silver-plated inside. To obtain a thoroughly adhesive coating of silver on the glass dish, the inside must be treated with a fine sand jet to give a dull surface. This operation does not succeed quite so well with hydro-fluoric acid fumes, as the effect produced is not, as a rule, so even as with a sand jet blower. The dishes must be thoroughly cleansed with chromic acid before the first silver plating is carried out. After this preliminary treatment the glass dishes can be plated, preferably with ammoniacal solution of nitrate of silver, which has been reduced by adding 2 cb. cm. of a 40 per cent. solution of formaline. At a temperature of at the most 30 deg. C. a silver precipitate of "mirror" is obtained of 0.03 to 0.05 grammes in three to four minutes. It is evenly dull throughout, and when looked at against the light appears a very dark blue. The dish when dry is fitted with a thin strip of platinum 2 mm. broad, of which the one end touches the silver coating, while the other is bent outwards over the edge of the dish and provided with a pressure screw. Trials which had been made to find a substitute for platinum anodes, *e.g.*, by using carbon anodes, have, so far, not given satisfactory results, but are to be continued with Acheson graphite. Trials carried out with these silver-plated glass dishes show that they can very well be used as substitutes for the expensive platinum ones.

LEGAL.

B T H Co, Ltd., v. Duram, Ltd

In the Court of Appeal, last week, before the Master of the Rolls and Lords Justices Warrington and Duke, an appeal was heard by the British Thomson-Houston Co., Ltd., from the judgment of Mr. Justice Sargant, in the Chancery Division, dismissing its application for leave to amend a claim in its patent specification regarding a process for the treatment of metallic tungsten, and for the manufacture of tungsten filaments for electric lamps. As reported in our issue of April 25th, 1919, Mr. Justice Sargant, in dismissing the application, said the amendment was not duly authorised by the Act, and apart from the Act the circumstances were not such as to justify the Court in exercising its discretion in favour of the applicants.

Mr. Colefax, K.C., Mr. J. Hunter Gray, K.C., and Mr. Basil Watson appeared for the appellants, and Mr. Thomas Terrell, K.C., Mr. Kerly, K.C., and Mr. Courtney Terrell for Duram, Ltd., and Mr. Mark Romer, K.C., and Mr. R. Frost for other respondents (opponents to the application), and Mr. Austen Cartmell represented the Board of Trade.

Mr. Colefax said there were several actions pending on the patent. Mr. Frost appeared for the Corona Lamp Works, Ltd. There was an action pending against them, and they counterclaimed for revocation. All the opponents to the application to amend were defendants in the litigation except Duram, Ltd., who were the petitioners for revocation. There were also two or three firms in addition to the defendants who had given notice of opposition to the application to amend. The difficulty which had opposed the path of the present patent in the Courts was the use of the words "coherent tungsten," which appeared in the specification, and the construction which the Court had put upon the first claim of the specification. "Coherent tungsten" included fused tungsten. What the patentees had done was to show how to get coherent tungsten, and the patent referred to working it without hammering, treating, and rolling, &c. The learned counsel contended that the amendment which the appellants sought would not, as Mr. Justice Sargant had said, enlarge the invention, and that his clients were entitled to have leave to amend.

Mr. J. Hunter Gray followed on the same side.

The case is continuing.

Marconi's Imperial Wireless Chain Litigation.

For the purpose of the assessment of damages payable by the Crown to Marconi's Wireless Telegraph Co. in the action it brought in March, 1918, Mr. Justice Lawrence sat as arbitrator in the King's Bench Division on Thursday, May 15th

Counsel engaged in the arbitration were. For the Crown, the Attorney-General (Sir Gordon Hewart, K.C.), the Solicitor-General (Sir Ernest Pollock, K.C.), Mr. Terrell, K.C., the Hon. E. Charteris, K.C., and Mr. Giveen; for the Marconi Co., Sir Edward Carson, K.C., Mr. Leslie Scott, K.C., Mr. Hunter Gray, K.C., Mr. Stuart Bevan, K.C., and Mr. Hildesley.

Sir Edward Carson stated that that sitting was merely a preliminary one. The main question was, what were the damages to be paid for breach of the contract. So far as he could see his Lordship would have to decide whether the contract existed over 18 or 28 years, and he would have to be somewhat sympathetic in his estimation of the damages, taking into consideration eventualities which might or might not arise. The main question he would have to determine was: What did the company lose by the breach of the contract?

His Lordship then fixed the date of hearing for June 2nd.

Calmont King & Co, Ltd., v. Groom.

In the City of London Court, on May 15th, before his Honour Judge Atherley-Jones, K.C., a claim was made by Calmont King & Co., Ltd., electrical engineers, of Milton Street, E.C., against Mr. G. W. Groom, of St. Albans, for £3 for six dozen refill electric lamps supplied.

Mr. H. Strouts, plaintiffs' solicitor, said that in July of last year the defendant gave a written order for electric lamps. There were three dozen refills ordered for electric torches, and they were to be supplied in November and December. The other goods were duly delivered and paid for, but when the refills were delivered acceptance was refused, the defendant saying that they were not ordered. He added that at the beginning of November he could not get any batteries from the plaintiffs, and that he had lost all his trade

Mr. Mardlin, plaintiffs' manager, said that they took thousands of orders for delivery during the month. That meant that they could deliver at any time during the month. They never undertook delivery by any specific date. They made about 20,000 lamps a day.

Defendant said plaintiffs had sent him six dozen refills above the contract.

Mr. Mardlin said that was not so. The order was for six dozen in November and December. That meant six dozen in each month obviously.

Defendant: No, it meant I was only to take three dozen in November and three dozen in December. When I say six dozen in November and December it means three dozen in each month

Mr. Mardlin. No. I could show you thousands of orders in support of my view. When a man says six dozen in November and December and January he does not mean he wants two dozen a month, but six dozen in the month.

Judge Atherley-Jones: If I order six dozen in November and December does that mean I am to take 12 dozen and not six?

Mr. Mardlin said it did.

Defendant: I say it does not mean anything of the sort. I was away doing my bit when the order was given.

Judge Atherley-Jones said it was not an easy case to decide. The documentary evidence was all in favour of the plaintiffs. He had not the slightest doubt that there had been a misunderstanding and that the plaintiffs were quite honest in the matter. If the order meant 12 dozen in November and December, it should have said so. While the defendant's letter could be read as the defendant contended, he thought on the whole he must find against the plaintiffs. As a commercial man he would say six dozen in November and December meant six dozen in all and not 12 dozen. There was a delivery of only three dozen in November.

Mr. Strouts: That is because we were short of commodities, and sent half the quantity.

Judge Atherley-Jones did not doubt there were many possible explanations. But he must find for the defendant with costs. It was the sort of case that might be argued in the Court of Appeal for three days.

CORRESPONDENCE.

Letters received by us after 5 p.m. on Tuesday *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The E.P.E.A. Award.

Your correspondent, Mr. Harding, can rest assured that he is not the only chief engineer of a small undertaking who has refrained from joining a Trade or professional Union on the ground that it would be *infra dig.*; one can quite imagine them doing so. I suppose he and his colleagues would also consider it *infra dig.* to accept from their employers any advances which might be offered them as the result of any members of their staff who, through their Union, had advances granted to them, and so brought their salaries too dangerously near their own. With regard to his query as to whether some of the big stations participate, and the small ones not, I would remind him that in certain small stations the only man eligible for membership of the E.P.E.A. is the chief engineer, and if he happens to be one of Mr. Harding's colleagues, how can the award apply?

Wessex.

May 17th, 1919.

The Re-settlement of Officers.

Your criticism of my letter in your leading columns of the 16th inst. somewhat resembles a Minister's reply to a question asked in the House. It seems to suggest that nothing better could be expected, and that such bad methods are bound to exist. Certainly, it would be a miracle if all things went well.

With regard to "the machinery of the Appointments Board not being ready when hostilities ceased," all I can say is that it ought to have been. If I remember rightly, the skeleton of the system of demobilisation was drawn up in 1917. Do you mean to say that the problem of re-settlement was left alone until the time for demobilising the services? It didn't take long to arrange for the training of the New Armies after the outbreak of war. Of course that was something of greater importance, and there was an organiser behind that. I am well aware of the large number of young men between the ages of 22 and 23 who have spent the best part of their life in the Army or Navy. I am one of them, as I shall not be 21 until August next. That, however, does not excuse the Board in the least.

You respect my independence in not accepting the O.W.D. of 29s. weekly, but think I am making a mistake. It can hardly be termed "charity," but I don't see how you can compare it with the pay received whilst on active service. I was in the Army for a definite purpose, and there was certain work for me to do. Whether I did that work does not matter. The O.W.D. is given for doing nothing, and in spite of its being a meagre allowance, thousands manage to exist on it, and take cover when work comes their way. It encourages unemployment, as was shown a few days ago, when the Minister for Labour was told in the House that of 82 men sent from the Labour Exchange to a certain engineering works, only two turned up. I do not like rubbing shoulder to shoulder with this type of man. Now you know why I am too proud to claim it. I still have a few pounds left, and when that is spent I shall take off my "starched collar," leave the district, and take the first thing that comes my way—road-sweeping or hawking.

The problem of re-settlement is a difficult one as every sane-minded person knows, but it hasn't taken our friends across the Atlantic long to get the matter in hand. A few weeks ago I was speaking to the counter clerk at the G.P.O. in the town in which I reside, when an American traveller came in and handed a cablegram across the counter, and paid £12 10s. for it. The clerk told me later that he came in two or three times a day with 'grams costing £3 or £4. Evidently their motto isn't "Wait and see." Procrastination. £400 a year, and 29s. a week, are the chief causes of all our trouble and delay.

I have just re-read my letter of the 6th inst., and it looks to me as if I am accusing employers of "war profiteering." That, however, was due to hurried writing. To insist upon the Excess Profits Tax at 80 per cent. now the war is over, betrays an ignorance of the business needs in the face of reconstructing our industries on a peace footing. However, I don't think it is necessary to dwell upon the subject any more this week, as I expect there will be a few replies to my former letter alongside this.

Still Trying.

May 19*th*, 1919.

The Mechanical Equivalent of Heat.

What *is* the mechanical equivalent of heat—772, 778, or 780 ft.-lb.?

Ignoramus.

[Quite a lot could be written on this subject. As the temperature at which the British thermal unit is taken has never been authoritatively settled, its value depends on whether the unit is defined to be the heat required to raise 1 lb. of water from 59° to 60° F., or to be $\frac{1}{180}$th part of the heat required to raise 1 lb. of water from 32° to 212° F. The calorie is fixed on the latter basis—$\frac{1}{100}$th of the heat required to raise 1 gm. of water from 0° to 100° C., which is practically the same as that required to raise it from 17° to 18° C. The mechanical equivalent is 778·2 ft.-lb. if the B.TH.U. is defined at 59°—60° F., and 777·5 ft.-lb. if it is defined at 63°—64° F. (which is identical with the mean value between 32° and 212° F.). Another value is defined at 68° F. The value usually accepted is 778 ft.-lb. —Eds. Elec. Rev.]

The Election of the I.E.E. Council.

I read with interest the letter of your correspondent and the editorial in reference thereto. It will be interesting to see whether the Council and the Institution will take the necessary steps at once to amend the by-laws so as to enable the Associate Members to nominate their own class for election to the Council.

As one who believes that the Council would be sympathetic with the justice of such an amendment, I am waiting to see whether it will put the necessary machinery in motion, or whether the members will be put to the inconvenience and trouble of calling the necessary special meetings to enable the by-laws to be so altered.

A good many of the adverse criticisms of the Council are, no doubt, unnecessary, and are probably due to circumstances of which the ordinary member has no knowledge; but explanations from time to time of the action of the Council on certain matters would remove what one imagines to be uncalled-for criticism. Take, for example, the calling of the annual general meeting. Now that the war is over the necessity, or otherwise, which has existed for early meetings no longer exists. It has been called this year at 2.30 p.m. on a Thursday afternoon, which precludes all members who are actively engaged in business from attending. Moreover, it prevents the largest body and class of member from representing any views which might be to the benefit of the Institution.

P. A. M.

May 20*th*, 1919.

The Southampton Appointment.

In order to give expression to their resentment at the manner in which the Southampton Corporation Electricity Committee has dealt with the vacant position of borough electrical engineer, the whole of the staff and employés of the department have signed the enclosed protest, copies of which have been forwarded to the Southampton Corporation, A.S.E., E.T.U., the local Press, and the local Trades and Labour Council.

It is felt that the widest publicity should be given to the circumstances both in the interests of the electrical profession and for the maintenance of integrity in municipal control, and while seeking the hospitality of your columns for this purpose, it is deeply regretted that the adoption of such a course should become necessary.

A. Reeve, *Secretary, Electrical Trades Union.*

Southampton, *May* 19*th*, 1919.

We, representing all grades of the staff and employés of the Southampton Corporation Electricity Department, wish to lodge an emphatic protest against the irregular and questionable tactics adopted in filling the vacant position of borough electrical engineer.

Owing to the publicity given to the Electricity Committee's action both in the lay and technical Press generally, the town has been brought into disrepute throughout the electrical supply industry and it is undoubtedly a fact that the undertaking is boycotted by all electrical engineers of standing, many of whom under normal conditions would have applied for the position, and from among whom one of high qualifications could have been appointed whose services could have been beneficially devoted to the department.

The low age limit, which was obviously fixed to favour one applicant, has certainly prevented many suitable engineers from applying for the position.

We would also point out that the successful operation and welfare of the department is affected by the loyalty and enthusiasm of the staff and employés, and this can only be maintained when there is confidence in the Committee. It is, therefore, felt that no confidence can be placed in those who have been responsible for bringing the Department under reproach, and we consider that the members of the Electricity Committee should be called upon to resign forthwith. Notification of this should appear in the technical Press, and the position should be re-advertised, at the same time giving an undertaking that the appointment will be made in a straightforward manner. By this means some of the best engineers might be induced to apply for the position, and the present stigma be removed from the town and undertaking.

AN ELECTRIC FURNACE IN THE PHILADELPHIA MINT.

A Rennerfelt electric furnace was installed in the Philadelphia Mint in 1917 for melting silver, nickel, and bronze alloys. It had a capacity of 1,000 lb., and effected a saving, as compared with gas and crucible melting, of approximately 40 per cent. (for nickel bronze, 50 per cent.).

New furnaces of 1,000 and 2,000-lb.-capacity are to be added; these will rotate about a pouring lip as fulcrum, and permit metal to be poured directly into moulds mounted on trucks under the pouring lip. The new type will have automatically-controlled electrode feeds, by which the temperature will be regulated.

The original furnace was first used on July 9th, 1917; three-phase, 60-cycle current received from outside at 2,200 volts was transformed at the furnace to 110 volts. The total weight of the furnace was 12 tons.

No absorption by the nickel of the carbon of the incandescent electrodes was observed, but the results have shown that every precaution must be taken to keep the surface of the molten metal covered, if good unoxidised ingots are to be obtained. Should the furnace attendant not keep the doors closed and the metal covered, trouble would result. In any open furnace there will always be some trouble with the refractories fusing and being carried over into the mould; practically all this can be obviated if a spout is built upon the ladle, so as to secure the results of a bottom pourer (where the ladle system is used). With a ladle system there is always a loss of heat between the furnace and the moulds on account of the chilling effect of a thin stream of metal (18 in. or more) in the spout.

The Mint adopted the process of hanging a 200-lb. ladle in a shank on bearings, which can be rapidly filled. Turntables carrying the moulds are within 10 ft. of the furnace mouth, and the operation of taking off the heat with two ladles pouring simultaneously into two sets of vertical moulds takes 15 minutes, and is done with no confusion. A shank with one swivel is preferred. The weight of the ladle, shank, and metal is about 200 lb., but this weight is borne by the two men for only a fraction of a minute, after which the shank is placed on a bail on a chain hoist in a position for pouring. As the ladle is emptied, the man on the swivel end of the shank operates the chain to maintain a proper pouring distance between the lip of the ladle and the mouth of the mould. To prevent oxidisation of the metal in the ladle, as pouring from the furnace starts, granulated pine charcoal is immediately placed on top of the molten metal in the ladle. Owing to a specially-constructed skimming spout, the charcoal is held back, the surface remains well covered, and only clear metal, free from carbon, flows into the moulds. Ordinarily, no metal shows results of oxidisation within the furnace itself; yet it is possible for it to oxidise, particularly with scrap metal, if all due precautions are not exercised. The above furnace is rated at 125 KW. and 750 lb. of metal: it is found, however, that 1,000 lb. per charge is correct.

The furnace is never allowed to cool off entirely, except when repairs are necessary. After a run of 8 to 12 hours, if a shut-down period follows, coke or lump charcoal is thrown in and renewed from time to time until the current is put on. Analysis of cupro-nickel and bronze shows a good mixture—the former requires no stirring during a melt. The volatilisation loss appears to be somewhat higher on zinc in the bronze alloy than in a crucible furnace, the assayer reporting losses averaging about ½ to ¾ per cent. These figures, however, are not yet conclusive. Silver coin melting results show homogeneity in samples taken from the top and bottom of a 1,000-lb. melt.

The first roof on the furnace lasted for 799 heats, while the cylinder was not renewed until 1,277 heats had been made. These were of cupro-nickel and bronze, the former predominating. On a second run the roof lasted for over 1,000 heats.

Variety of metal.	Gross ounces melted.	Time to melt 1,000 lb., in minutes, hot furnace.	Kilowatt-hour consumption per net ton average.
Cupro-nickel... ...	15,980,341.50	100	500
Bronze	11,988,277.25	70	300
Silver...	10,031,101.00	60	[illegible]
Tin	57,147.00	10	46

The cost of melting cupro-nickel in this electric furnace is $9.45 per net ton, which is less by 50 per cent. than is shown with gas and crucible-furnace melting.

The above notes are taken from the Annual Report of the Director of the Mint, Treasury Department, Washington.

BUSINESS NOTES.

Transhipment of Goods in the United Kingdom.—The Export Licence Department announces that goods of any description (other than foodstuffs from Europe destined for extra-European destinations) may be brought to this country for transhipment to any destination to which exports are ordinarily allowed, provided that in the case of any goods in Sections "A" or "B" of the list of prohibited exports the bills of lading clearly show that the goods were intended for transhipment before they left the country of origin, or that other satisfactory evidence to that effect is produced to the Export Licence Department. If these conditions are observed it will, therefore, in future be unnecessary to obtain the provisional approval of that Department before bringing goods to this country for transhipment. In the case of goods destined for the border neutral countries in Europe, the goods must be consigned to the approved Import Associations in accordance with the regulations for the time being in force in respect of direct exports from the United Kingdom. Applications for transhipment permits should in all cases still be made on Form S. 90, to the Customs authorities at the port of arrival; and as regards any goods in Sections "A" or "B" of the lists of prohibited exports, the bills of lading if available should accompany the S. 90 Form.

Starting and Lighting Batteries.—The Exide battery and its adaptability to motor-car starting and lighting service is well known. For many years the Chloride Electrical Storage Co., Ltd., has been making Exide batteries of similar design to the Exide fitted to so many American cars. During the war this firm's output has been entirely absorbed by the Admiralty for the under-water propulsion of submarines, but it is now in a position to offer these batteries for starting and lighting purposes. This battery, which has given satisfaction on American cars, is quite capable of performing the same service on British-built cars, which operate, for the most part, where the variations of temperature are not so great.

Import Restrictions.—The President of the Board of Trade, after duly considering the recommendations of the Consultative Council on Imports, has given the following further directions with regard to the Prohibitions of Import:—

The restrictions on the importation of the following articles are to be removed:—

146. Motor-car jacks and track jacks.
147. Files.
148. Bronze castings (machine or phosphor bronze).
154. Friction clutches.
155. Piercers, punches, and round-hole perforators.
156. Adjustable pipe tongs.
157. Flexible metallic tubing.
167. Time-recorder parts.
168. Rubber manufactures other than tires, boots and shoes, and stationery articles.

In accordance with the above, general licences have been issued for all the foregoing articles.

The importation of the following articles is to be licensed only exceptionally as and when required.

173. Portable shop cranes, electric hoists, and steel pulley blocks, except Yale triplex pulley blocks and Yale triplex electric hoists, which are to be rationed to regular pre-war importers at the rate of 100 per cent. of 1913 importations.
174. All types of jacks except motor-car jacks and track jacks.
175. Crowbars, pinch bars, or hand-wagon movers.
183. Trolleys and trucks for warehouse and wharf.
184. Shaft bearings, shaft-bearing boxes, blocks for shafting, shaft collars, shaft coupling, shaft hangers, shaft hanger frames.
185. Iron and steel pulleys, except pressed steel pulleys, of which 200 tons (actual net weight) are to be admitted until September 1st, 1919.
186. Fan blowers and forges.
187. Metal baths and fittings thereof.
188. Flat or laundry irons.
189. Cast-iron pipe fittings and cast-iron pipes, rainwater pipes, and soil-guttering pipes, in so far as at present prohibited.
190. Aluminium hollow-ware.
191. Iron and steel welded tubes up to 2 in. in diameter.

The importation of the following articles is to be restricted as shown:—

195. Rubber tires are to be admitted at the rate of 50 per cent. of 1913 importations.
196. Rubber boots and shoes are to be admitted at the rate of 50 per cent. of 1913 importations.

Applications for special licences should be made, as usual, to the Department of Import Restrictions, 22, Carlisle Place, London, S.W. 1.

Export Restrictions.—A further list of alterations in export restrictions is published in the *London Gazette* for May 16th.

Non-Ferrous Metal Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for May 16th.

A Committee on Workmen's Compensation.—The Home Secretary has appointed a Committee to inquire into the working of the present system of the payment of compensation to workmen for injuries sustained in the course of employment and to consider and report whether it would be desirable to establish a system of accident assurance, under the control or supervision of the State; and to report, further, what alterations of the law will be required to remedy defects which experience has disclosed or to give effect to their recommendations.

Mr H. Holman Gregory, K.C., M.P., is chairman of the Committee. The secretary is Mr. G. R. A. Buckland, the Home Office, Whitehall.

Poland.—According to *l'Electricité*, a strong company is under formation at Warsaw, with a capital of 10,000,000 Polish marks, to organise the importation of raw materials into Poland from Allied countries. Of the company's capital, 25 per cent. will be French, 25 per cent. British, and 50 per cent. Polish.

British Trade with Rhineland.—Some 70 British firms are represented at Cologne, and recently they decided to organise a British Chamber of Commerce there, in order to assist British enterprise. An Information Bureau is being organised at 136, Hohestrasse, Cologne.

Patent Restorations.—Orders have been issued restoring the following patents.—R. Haddan (Universal Turbine Co.), for "Improvements in fluid pressure or steam turbine engines," No. 614, of 1913; Mr. T. P. Payne, for "Improvements in metal-punching machines," Nos. 22,067 and 8, of 1913.

Magneto v. Coil Ignition.—According to the *Financial Times*, at a recent interview Mr. Goodwin, of Messrs. C. A. Vandervell & Co., Ltd., stated that though his firm was turning out seven or eight hundred magnetos weekly, these were for motor-cycles only; the company did not manufacture magnetos for cars, because it believed that ignition by means of the high-pressure coil and distributor could be made to give even better results than the magneto, and a greatly improved apparatus would be put on the market within a few months. The company had obtained better results than the American coil makers with half the current consumption. At present, output was hampered by the lack of skilled labour, and it was impossible to cope with the number of orders that were being received for batteries.

New French Electrical Engineering Companies.—L'Electro-Construction, Société d'Applications de l'Electricitè is the name of a new electrical engineering concern which has lately been formed in Paris with a capital of £9,000.

The shareholders of the Energie Electrique de la Basse Loire have been called together to sanction an increase of the present capital of 6,000,000 fr.

Among French companies recently formed are the following:—Constructions Electriques du Rhône, procédés Dick, Kerr, 8,000,000 fr., Paris; Amondraz et Cie, hydroelectric sawmills, 100,000 fr., Paris; Etablissements P.-J. Hazard, electric material, &c., 2,000,000 fr., Paris; Etablissements Postel, electric installations, &c., 250,000 fr., Paris; Liliaz Frères, hydro-electrometallurgic works, &c., 4,600,000 fr., Paris.

There has been formed at Paris a company under the style of Bandin et Cie, with a capital of 175,000 fr., for mechanical and electrical objects.

E. Gougé et E. Vilcoq is the title of a concern formed at Paris, with a capital of 25,000 fr., to carry out electrical installations.

Building Costs.—In the Standing Committee on the Civil Service Estimates for the year ending March 31st, 1920, Mr. Illingworth, the Postmaster-General, made a statement concerning the rebuilding of the General Post Office, East. The original total estimate was £210,000, and the revised total estimate provided for an expenditure of £525,000. In addition, provision was made for the expenditure of a sum of £175,000, chargeable to the telephone capital account. The building was mainly wanted for the Accountant-General's department, which, with its staff of 3,000, was now scattered all over London. The country generally insisted on better and proper management of the Post Office in every direction. Things had got out of order, and they must now get them back to better businesslike management. Sir Alfred Mond, the First Commissioner of Works, said that the large increase in the estimate was largely due to the abnormal increase in the cost of materials. Bricks, which were 25s. a thousand before the war, were now 90s. a thousand, while Portland cement had gone up 98 per cent., timber 160 per cent., switches 137 per cent., electric light installation 100 per cent., lead 100 per cent., and cheap glass 153 per cent. He did not think any real economy could be achieved by postponing the scheme. The estimates were agreed to.—*The Times.*

Trade Announcements.—Mr. Geo. Morrison, electrical engineer, has opened new premises at 81, Fishergate, Preston, with Mr. W. Lewthwaite as manager. He invites electrical firms to forward catalogues and price lists there.

Mr. J. M. Devine, who has been carrying on business as electrical and mechanical engineer, at 17, Franklin Street, Bridgeton, Glasgow, has entered into partnership with Mr. T. J. McCosh, late of Wm. Wilson & Co., Tollcross, as from May 1st, 1919. The new firm will take over Mr. Devine's business, and trade under the name of McCosh & Devine, at 55-57, Peel Street, Mile End, Glasgow, as electrical, motor and general engineers. Manufacturers and agents are invited to forward catalogues.

Messrs. Ward & Goldstone have removed from their Glasgow offices and showrooms to more commodious and central premises, which will be opened on the 23rd inst., at Mercantile Chambers, 65, Bothwell Street, Glasgow.

Mr. Hugh Goldie has opened an electrical engineering business at 87, Bank Street, Coatbridge.

The Hoffmann Manufacturing Co.'s Manchester office has been removed to Cleveland Buildings, 94, Market Street, Manchester. Telegraphic address, "Mannhoff, Manchester"; telephone No., "2761 City." A staff of trained engineers is stationed at the office and emergency stocks of bearings are carried.

With reference to a note which appeared in our issue of May 2nd, Messrs. Bullers, Ltd., desire to point out that Mr. G. V. Twiss occupied the position of engineer with them, not technical adviser, and that high-tension work was an appreciable part of their business before he entered their service.

Openings for Trade in Greece.—In a recent issue allusion was made to the opportunity offered by the Exhibition at Athens organised by the Federation of British Industries for reintroducing British manufactures into the Grecian and surrounding markets. The classes of goods of interest to the electrical and allied trades which figured amongst Greece's purchases prior to the war included all kinds of manufactured iron and steel, notably galvanised wares, wire, sheet iron, iron bars, builders' hardware, and cutlery.

Machines and equipment will be needed for carrying on the varied mineral industries, as well as in other smaller vocations, *e.g.*, the manufacture of textiles, ice, paper, flour, liquors, leather goods, and furniture.

The Grecian Government recently prepared an official statement of the post-war requirements of its country. It is not surprising to learn from this statement that the country is short of all machinery and equipment. Furthermore, it is a fact which has an important bearing upon the future needs of the country that the shortage of fuel and the increased cost of labour will create an abnormal demand for labour-saving devices and various kinds of machines not hitherto exported to Greece to any great extent.

Greece is reported to possess plenty of iron ore of good quality, plant for the working of which it is desired to obtain and set up.

At Esoreaus it is proposed to equip shipyards in order to bring the Grecian merchant marine back to its pre-war tonnage. It is said that 30 per cent. of its ships have been destroyed by submarines.

There are schemes on foot also for extending the manufacture of fertilisers and cement. The most active industrial district in Greece is Attica-Beotia. Considerable development is anticipated, too, at Salonica. Lathes and machine tools, together with boring, riveting, and polishing machines, are in demand. There is a certain limited output by local factories of pumps, boilers, presses, and the simpler kinds of agricultural machinery, but nevertheless there is plenty of scope for the sale of the imported article.

The importation of tubular boilers is of prime importance to Grecian industry.

Other types of engines and motors, it must be remembered, are also needed, notably turbines for the utilisation of water power, to develop which the Grecian Government has created a special department in the Ministry of Communications.

According to the latest industrial census, hydraulic power developed thus far in Greece amounts to only 6,272 H.P. Flour mills use 1,662 H.P., oil factories 202 H.P., chemical producers 1,095 H.P., cotton, woollen, and thread mills 3,228 H.P. The whole amount is but one-tenth of the potential hydraulic power of the country. Indeed, it is officially stated that steps are soon to be taken to make Greece's lakes and rivers yield 66,000 H.P., apportioned as follows:—

	H.P.
Lake Ostrovo, the Voda River, with three dams at Vladovo, Vodena, and the Divies River ..	34,000
Axios River	40,000
Aliakmon River	3,000
Moussa Falls	4,000
Verrin Falls	2,000
Gorgopotamos River	2,000
Reneos River	3,500
Strymon River (probably)	3,500
Other falls and rivers	10,000

The larger sources of power are to be worked either by the State itself or by companies to which grants are to be made under certain conditions.

The idea is to use the power obtained chiefly in the production of high-pressure electrical energy for the manufacture of nitrogenous fertilisers (calcium cyanamide), and also for supplying light to certain cities. When these plans mature it will be necessary to import large quantities of generators, transformers, transmission materials, and, in general, all accessory equipment.

At present the engine likely to be in greatest demand is the Diesel type. A lot of machinery will be required at the seaports, *e.g.*, steam or electric cranes. Up-to-date equipment is lacking at Piræus, Patras, Volo, Salonica, and Syra. Elevators and conveyors are needed for factories, hotels, as well as private residences.

British Trade Mark Applications.—Appended is a summary of the recent applications for British trade marks in respect of productions connected with the electrical industries:—

Saturn (letters and design). No. 388,765. Class 8. Electric cables. H. W. Smith & Co., Ltd., Lydbrook, Gloucester. February 28th, 1919.

Kaleflex. No. 398,936. Class 8. Rubber insulated flexible electric cables. Callender's Cable & Construction Co., Ltd., Hamilton House, Victoria Embankment, London, E.C. March 5th, 1919.

Maxlumi. No. 387,621. Class 13. Electric lamps and electric lanterns and reflectors and other electric lighting fittings. Veritys, Ltd., 31, King Street, Covent Garden, London, W.C. January 16th, 1919.

Autopax. No. 387,978. Class 13, and No. 387,979, Class 18. Electric heating and soldering irons and electric cooking utensils and plant. Automatic Telephone Manufacturing Co., Ltd., Milton Road, Edge Lane, Liverpool. February 2nd, 1919

Luxo. No. 388,651 Class 4. Electric carbons Fuller's Carbon & Electrical Co., Ltd., Chadwell Heath, Essex. February 25th, 1919.

Vanduara. Nos. 388,399, 388,400, and 388,402. Classes 1, 16, and 40. Electrical insulating compositions and materials John MacLennan & Co., 166, Ingram Street, Glasgow. February 17th, 1919.

Expreso. No. 389,092. Class 13. Electrical accessories Henry G. Osborn, 9, Rathbone Place, Oxford Street, London, W. March 10th, 1919.

Eraform. No. 386,719. Class 8. Telephone and the like receivers, and attachments thereto. Alexander Marr, 23, Reynells Road, Longsight, Manchester. December 11th, 1918.

Ysolyn. No. 388,866. Class 50. Electrical insulating preparations and substances. Portholme Aircraft Co., Ltd., St. John Street, Huntingdon, March 4th, 1919.

Elo (letters combined with key design). No. 389,579. Class 50. Electrical insulating materials made of asbestos, mica, resin, shellac, oils, &c. Arnold T. Birkby & F. E. Birkby, Woodfield Mills, Liversedge, Yorks. March 26th, 1919.

South African Electrical Market.—According to the *South African and Mining Journal* of April 12th, the electrical market is, if anything, worse than before, but hopes are entertained that when the builders' strike is settled quite a jump will take place in business and the prices firm up. During the week there have been inquiries for lamps, and many forward orders booked, always subject to normal conditions. A leading distributing house used to dispose of fifteen or sixteen hundred pounds' worth of lamps per month, but now the demand as compared with that turnover is small, therefore stocks have accumulated very considerably. A firm received a lot of material during the week, representing some £3,000, and quantities, it is understood, are on the water, which may mean a lowering of prices in the near future. Country business continues pretty fair

Excess Profits and Trade.—At the annual dinner of the Association of English Country Bankers and the Central Association of Bankers last week, according to *The Times*, Lord Faber welcomed the reduction of the excess profits duty, which had proved a great drag on trade. Germany could pay us to a small extent in timber, potash, &c., but she could pay us very well by using her industry to manufacture goods and send them to England. We should then be up against all sections of labour in this country. That was why it was difficult to get payment from Germany, and why, he was afraid, the payment would have to be rather protracted.

Mr. Illingworth, alluding to the excess profits duty, said that before he joined the Government he was on the Excess Profits Appeal Board in London, and the cases that came before them there proved that the tax, though just in theory, was one of the most unjust taxes ever imposed upon any community in the history of finance in this country. For the time being the injustice would be alleviated somewhat by the reduction of the tax to 40 per cent., and that would result, he hoped, in a certain amount of increased activity in business enterprise. The crushing financial burden which was on the country imposed a great and serious task on the trade community. There would have to be greater production, and employers and workers would have to work together harmoniously to create wealth which had been destroyed through the ravages of war. Bankers would have to be exceedingly liberal in their advances, not only advancing money on gilt-edged securities, but also on the character, the reputation, and the knowledge of those who were conducting businesses If that were not done, he could assure them in all seriousness that they were looking for trouble and would find it very quickly. He thought the outlook for trade, when peace was signed and things got more or less into a normal state, would be more brilliant than it had been for many years. Trade must, however, be freed from Government control at the earliest possible moment.

Enemy Camouflage. — *La Technique Moderne* calls attention to the fact that Germans, Austrians, and even Turks, are opening offices and works in Switzerland, and claiming that their products are "made in Switzerland" As a matter of fact, these works are only used for the assemblage of parts, and the goods are really of enemy origin. This contingency has not been overlooked here, but the word of warning is well timed.

Dissolutions and Liquidations. — The partnership between Messrs. F. Gill & W. W. Cook, consulting engineers, of Winchester House, E.C., will be dissolved by mutual consent as from May 31st 1919. Mr. Gill, who for the last two years has been with the Ministry of Munitions and is now a Controller of the Central Stores Department, will, on relinquishing that office on June 30th next, join the Western Electric Co. as their European chief engineer.

GELL TELEGRAPHIC APPLIANCES SYNDICATE, LTD.—Winding-up voluntarily. Liquidator, Mr. A. F. Dickin, Sardinia House, Kingsway, W.C. 2. Meeting of creditors at Sardinia House, May 27th.

Export of Coal.—In conformity with the policy of relaxing controls and facilitating the return to normal conditions, certain changes have recently been made in the conditions affecting the sale of coal for export, and it is now proposed, *inter alia*, to terminate the system of limited prices at present in operation in the case of coal shipped to France, Italy, and other Allied countries.

Book Notices.—*Electric Lighting Costs*, 1914-1919. London: Tyler & Freeman.—In this pamphlet Messrs. Tyler and Freeman give the results of a series of estimates prepared to ascertain the average increase in the cost of electric lighting installations during the last five years; for this purpose they have taken actual examples of work carried out either in 1914 or in 1919, and have got out estimates for both years, as well as alternative prices for other systems of wiring. The cases dealt with include small and large private houses, factories, flats, a church, and a London club; sufficient detail is given to serve the purpose in view. From a survey of the pages we gather that the increase ranges between 100 and 150 per cent., but in most cases is in the neighbourhood of 115-125 per cent. A table of costs of materials is added, which shows that these have advanced greatly during the interval: tubing, lead-covered cables, fuseboards, &c., have gone up by 100 to 200 per cent., wood casing and opal shades by more than double these rates, but ordinary cables have not advanced so much, and lamps have only put on 20 per cent. Wages have increased 100-120 per cent., but we regret to see that labour costs have gone up still more, as the output has fallen.

This pamphlet should be of great value to contractors, as it will assist them in checking their estimates, and will afford useful aid in convincing the purchaser that he is not being overcharged though it is, of course, issued only to the trade. No useful purpose can be served by concealing the truth In reality, of course, prices have not risen much—the value of "money" has gone down to one-half.

Circular No 79 of the Bureau of Standards. "Electrical Characteristics and Testing of Dry Cells." Washington: Government Printing Office. Price 10 cents.—The circular summarises the available information on dry cells. A brief description of the materials and methods of construction and elementary theory of the operation of the cells is given. The various sizes and kinds of dry cells on the American market are described. The electrical characteristics of the cells and methods of testing them are discussed In an appendix are given the proposed specifications for dry cells which have been prepared by the Bureau.

The British Engineering Standards Association has issued a list of British Standard Copper Conductors, an extract from the revision of British Standard Specification No. 7, for Insulated Annealed Copper Conductors for Electric Power and Light, which will shortly be available. It has been decided to issue this extract in order that immediate attention may be called to the reduction in the number of sizes, and the omission of a wire gauge as a means of designating the conductors. Copies of this pamphlet may be obtained gratis, or, post free, price 2d., from the Association.

"French Technical Words and Phrases." An English-French and French-English dictionary. By J. Topham. 324 pp. London: E. Marlborough & Co Price 5s. 6d. net.

"Zooms and Spins." By Rafbird. Pp. viii + 120 and 1 fig. London: Sampson Low, Marston & Co., Ltd. Price 3s. 6d. net.

"*Journal* of the Institution of Electrical Engineers." Vol. LVII, No. 281. April, 1919. London: E. & F. N. Spon. Price 7s. 6d. net.—This issue contains the following paper: "The Determination of the Efficiency of the Turbo-Alternator," by Dr. S. F. Barclay and Dr. S. P. Smith; and the President's Address to the Territorial Centres: also Report of the Council for 1918-19 and the Annual and Benevolent Fund Accounts for 1918.

"*Journal* of the Röntgen Society." No. 59. Vol. XV. April, 1919. London: Percy Lund, Humphries & Co., Ltd. Price 4s. 6d. net.

Catalogues and Lists.—Automatic and Electric Furnaces, Ltd., 281-283, Gray's Inn Road, London, W.C. 1.—Two pamphlets one describing the Wild-Barfield electric muffle furnaces, the other (Heat-Treatment Bulletin No. 10) dealing with "Salt Baths and 'Soft Skin'" heat-treatment of springs.

London Electric Stores, Fulwood House, High Holborn, W.C. 1.—Price list of accessories, small motors, bells and bell wire, and ironclad switchgear.

Quead, Ltd., 45, Marylebone Lane, W. 1.—Illustrated list of "Quead" electric fires, with interchangeable removable interiors, of capacities from 1 to 4 kw., and various patterns of case and finish.

Gent & Co., Ltd., Faraday Works, Leicester.—Pamphlet describing their "Start and Cease Work" sound signals, electrical escapements for time registers of all types, works electric clocks, office clocks, and impulse transmitters on the "Pulsynetic" system.

Wardle Engineering Co., Ltd., 196, Deansgate, Manchester.—Booklet on "Good Lighting," dealing with street and office lighting, and giving useful advice on the subject of illumination. An interesting description is included of the method adopted for lighting the clock tower of the Houses of Parliament with electricity in 1873.

LIGHTING AND POWER NOTES.

Accrington. — Proposed Extensions. — The scheme sanctioned by the T.C. for extensions to the electricity works has been approved by the Board of Trade. It was on the ground that the extensions would not be sanctioned by the London Authority that the Corporation Committee postponed a proposal to increase by £100 per annum the salary of the borough electrical engineer, Mr. A. W. Clegg.

Armagh.—Proposed E.L. Scheme.—The U.D.C. Committee on Lighting has reported in favour of seeking competitive plans for an electric installation scheme, with a prize of £20, Mr. J. J. Woods, manager, Clones Electric Works, to be called into consultation when the plans are executed.

Ayr.—Expert Advice.—The Lighting Sub-Committee, after considering reports from its own engineer and the Kilmarnock town engineer, recommends the T.C. to employ an expert to report on the whole situation, present and prospective.

Belfast.—Extension Scheme.—The week before last we referred to the serious position in which the Corporation has been placed in regard to its scheme of extending the electricity undertaking. Following the report by Messrs. Preece, Cardew, Snell & Rider, the consulting engineers, the Corporation held a special meeting to consider the whole matter. The first sitting resolved itself into an attack by several members on Sir John Snell, who prepared the estimate, but a motion to terminate the agreement between the Corporation and Sir John Snell was defeated after a lively debate. At the second part of the sitting, Mr. Rider addressed the Council, and said that his partner, Sir John Snell, in whose place he appeared, was somewhat at a disadvantage, because he had had nothing to do with the original figures. That, however, did not make his responsibility any the less, and he did not wish to shirk it. He wished to take for Sir John and himself the responsibility, so far as they were justified in taking it, for the position in which the Corporation now found itself. He defied any man to make an estimate of to-day's price and guarantee that it would hold good for next week. The figures in his latest estimates were very pessimistic. They were putting in the minimum amount of plant, and it was for the Corporation to decide whether it would go on or not. If it did not go on, the position would be infinitely worse than it was that day. It was not a proper suggestion to make that the advice had been given for what the firm was to get out of it. They were not being paid upon the usual basis of expenditure. Sir John Snell's fee was about half the usual engineering fee. His advice was that they must go on and extend the station as quickly as possible. Alderman Sir James Jonston moved:—"That the Council be recommended to apply to the L.G.B. for sanction to a loan of £630,000 for an equated period of 30 years, in substitution of the sanction applied for in March, 1918, and to take such further steps as might be necessary." The resolution was adopted.

Holding that the Corporation was not legally responsible for having, through the strike, failed to carry out contracts for supplying electricity, the Belfast Stipendiary, on May 12th, dismissed a summons brought by a manufacturer.

Bradford.—New Mains.—Electric mains from the Valley Road works to the Manningham Mills of Messrs. Lister and Co., Ltd., are to be laid at a cost of £8,275.

Continental.—Portugal.—A scheme for the utilisation of the power of the River Zezere at the mines of the Wolfram Mining Co., has been prepared and will probably be carried into effect at an early date.

France.—A new company has lately been formed at Lyons with a capital of £50,000, and the title La Société Hydro-Electrique de la Bredoire, to establish plant to utilise the water power of certain falls on the River Tiers at La Bredoire (Savoy), to generate electricity for lighting and power purposes.

The blast furnaces and foundries at Pont-à-Mousson have projected a scheme for a hydro-electric station on the River Derdogne, near Bort. It will develop the falls of La Diège, a feeder of the Derdogne.

The scheme for utilising the River Rhône to supply Paris with electricity has now at last reached maturity by the adoption by the Paris Municipal Council of the Genissiat Falls project, after satisfaction of the claims of riverside dwellers which stood in the way. The city of Paris has disclaimed the intention of appropriating the whole of the waters of the Upper Rhône, and has made provision for irrigation and navigation. It will develop the falls, donate Lyons with a great port, and irrigate the Carnargue region. The outlay will probably reach 1½ milliards of francs, and Paris will gain 200,000 kw. of electrical power. The works are to be carried out by a national company comprising all the interests concerned, with the help of the State.

Coventry.—Price Revision.—The T.C. has decided that the charges for power as from January 1st, 1919, be increased by 20 per cent. over the charges in force on September 30th, 1918.

Dundalk.—Street Lighting Charges.—The Electricity Committee has notified the U.D.C. of an increase in the price of electricity for public lamps from 56s. 6d. to £3 each, as from July 1st, involving an increase of £114 in the estimate for the year. The engineer's estimate is to be considered in regard to a revision of the existing supply tariff generally.

Dundee.—Price Revision.—The charges for power and light have been revised, varying from 50 to 100 per cent., plus 5 per cent., over pre-war rates.

Epsom.—Proposed Price Increase.—The U.D.C. has applied to the B. of T. for consent to increase the minimum charge per quarter for energy from 13s. 4d. to £1, and the charge for each unit beyond 20 to 1s., instead of 8d.

Farnworth.—Year's Working.—The working of the U.D.C.'s electricity undertaking has resulted in a loss on the year of £278, but it is expected that the recent increase in the prices for electricity will remedy this during the current year. During the year 1,087,563 units were generated, compared with 1,194,865 in the previous year. The total capital expenditure is £52,787, of which £29,900 has been repaid.

Gillingham (Kent).—Expert Advice.—The T.C. has engaged Mr. C. H. Wordingham to advice on the present state of the electricity undertaking, and on the policy in respect of it for the future, at a fee of £250.

Hastings.—Proposed E.L. Scheme.—Negotiations are proceeding between the Hastings Corporation and Battle U.D.C regarding a scheme for supplying the latter town with electric light. The Hastings Corporation is prepared to bring a H.T. cable to a central spot in the Abbey town, and distribute at L.T. within a radius of one mile. The Council requires a guaranteed gross revenue of about £1,800 a year, Battle consumers to receive electricity for lighting and power on the same terms and conditions as Hastings consumers, the price to be 9¾d. per unit, and 2¼d. for power, heating, and cooking, to be in force for two years from the termination of the war, after which time the maximum charge would be 8d. The Battle Council is to canvass the town to ascertain the number of consumers likely to be forthcoming.

Hull.—Proposed Extensions.—The Electricity Committee has adopted the scheme for extensions to the electricity undertaking, estimated to cost £123,720.

Kilmallock.—Lighting Costs.—At the request of the Kilmallock E.L. & P. Co., the U.D.C. is to contribute £114 yearly towards the costs and expenses of upkeep to the public lighting system.

London.—Hackney.—The Electricity Committee recommends that it be authorised to supply consumers with electricity for illumination purposes during the four days of the Peace Celebrations at a special rate of £1 per KW. connected, such supplies to be connected to the mains without meters.

Maidenhead.—House Services.—The T.C. has decided in future to give new consumers requiring less than 33 ft. of cable the option of paying the whole cost of the service, or a lump sum of £2 and a minimum charge of 13s. 4d. per quarter. Hitherto up to 30 ft. of cable inside premises nearest to the main has been laid free of charge.

Manchester.—Year's Working.—The loss on the past year's working was caused by a reduction in sales of energy since the Armistice. It was anticipated that, in order to pay the contribution of £33,400 in aid of rates, it would be necessary to draw £11,000 from the reserve fund. The account shows, however, that the reserve fund has been exhausted by withdrawing £12,636 more than was anticipated, that a loss of £14,254 is carried forward, and that no contribution can be paid in aid of rates, against the sum due of £33,400. This shows a total of £60,290 worse than was anticipated, and a loss of £71,290 for the year. In the estimates for the current year the receipts are put at £1,109,000, an increase of £160,100. The expenses are estimated to be more by £138,500, made up of £116,000 for operating charges, £16,500 for debt charges, and £6,000 for income-tax. The surplus is estimated to be £44,000, of which £11,254 is required to liquidate the debit balance brought forward, leaving £29,746 in aid of rates. The amount due, however, in accordance with the decision of the Council at 1 per cent. upon the capital outlay is two years' contributions—namely, £67,893—so that there is an estimated deficiency of £38,147.

Malvern.—Consumers' Rebate.—The U.D.C. has decided that, from the midsummer reading of the meters, consumers above 5,000 units per annum shall be allowed a rebate of 1d. per unit. A canvass of the West Malvern district having proved unsatisfactory, the Council has decided not to extend the mains there, the estimated outlay for which was £4,000.

Nenagh (Tipperary).—E.L. Scheme.—The Nenagh (Co. Tipperary) Gas Consumers' Co. is arranging to install electric lighting plant to light the town.

Normanton.—Proposed E.L. Scheme.—The U.D.C. is to consider the question of an electric lighting scheme.

Richmond (Surrey).—E.L. Charges.—The T.C. did not show favour to a suggestion by the Richmond (Surrey) E. L. and P. Co. that the terms of agreement between the two bodies be revised and a further increase be made in charges to meet expenses due to the war.

The Electricity Committee did not concur in the proposal to grant plenary powers to the representatives of the I.M.E.A. acting on the Joint Industrial Council—Electricity Supply Industry—and to authorise their exercising such powers when negotiating outside the Industrial Council with any body of workers or association not having representation thereon.

Electric Vehicles.—The Health Committee recommends that the tender of the Lancashire Dynamo and Motor Co., amounting to £493, for apparatus capable of charging two electric vehicles at a time, be accepted.

Sheffield.—Price Revision.—The charges for electricity are to be increased as from the June meter readings as follows:—Units charged over 2d. are to be subject to an increase of 25 per cent. instead of 10 per cent., as at present; units charged 2d. and under subject to an increase of 60 per cent. instead of 45 per cent.

South Africa.—Mossel Bay (Cape Province).—The T.C. has given favourable consideration to a scheme for electric lighting which has been put before it by Lieut.-Colonel McKienery, an electrical engineer, on behalf of a syndicate. The company is prepared to commence operations 30 days after the scheme is adopted, and to deposit £5,000 as security. The term suggested for the contract is 21 years, the Council having the option of acquiring the installation at the end of 7, 14, or 21 years.

Johannesburg.—The municipal strike was settled on the following principal terms, viz.:—The Board of Control ceases to exist; no men to be retrenched; Advisory Committees of employés to be elected by the men for the purpose of advising on, and discussing with, the management and Committees all questions relating to wages and conditions of labour. Employment and paying off of men should rest with the respective heads of departments in consultation with the Advisory Committees to be appointed.

Stafford.—Proposed Extensions.—The T.C. has approved a proposal that the capacity of the electricity works be increased by the installation of a 1,000-KW. set, and that a Sterling boiler, with the necessary buildings, be provided at a total estimated cost of £30,000.

Year's Working.—The annual report on the electricity undertaking shows total income of £14,362, an increase of £2,296, and total expenditure, £9,891, an increase of £2,368. After providing £1,000 for depreciation, there remained a balance of £3,470, a decrease of £72. The total net income was £3,548; war charges and income-tax amounted to £4,110, so that the net result was a deficiency of £562.

Stamford.—Price Revision.—The Urban E.S. Co. has decided to apply to the B. of T. for permission to amend its charges, and substitute a maximum charge of 8d. per unit.

Swansea.—Loan Sanction.—The Electricity Committee reported that L.G.B. sanction had been granted for the borrowing of £25,690 for additional plant at the generating station.

Walsall.—Electricity Scheme.—The Standing Orders Committee of the House of Lords has rejected the electricity clauses of the Corporation Bill, the objects of which were to provide an electricity scheme for a wider area.

West Hartlepool.—Proposed New Plant.—The T.C. has approved of application being made to the L.G.B. for sanction to borrow £23,580 for cooling-tower plant and £10,790 for cables. Over 12 months ago the Council sanctioned an agreement with the Cleveland Power Co. under which an additional, as well as a standing, supply of energy was to be obtained from the company, it, on the other hand, taking from Council energy generated by waste heat at periods of low demand.

Worcester.—Proposed New Plant.—The Electricity Committee has brought forward a programme of necessary developments of the electricity undertaking, and has asked the Council for authority to borrow £15,350 for ash handling plant, cables, services, switchgear, and transformers. The matter was adjourned until after the electricity accounts had been submitted. It was stated that increases to the staff and workmen would entail additional expenditure of £3,500 per annum. The Council approved of recommendations increasing the charges for electricity, and it was stated that in all future contracts a labour clause would be inserted.

TRAMWAY AND RAILWAY NOTES.

Birmingham.—Borrowing Powers.—The Corporation has deposited a petition in Parliament asking that the necessary Standing Orders be dispensed with in order to enable it to introduce a late Bill for powers to borrow £659,667. The whole of this money is proposed to be expended on the Corporation's tramway undertaking.

Bournemouth.—Year's Working.—During the past year the Corporation tramways carried 20,769,507 passengers, an increase of 315,000 on the previous year. The total receipts increased by £17,123, and working expenses totalled £73,730, an increase of £11,080. The net balance on the year's working was £31,950. The Tramways Committee recommends that £1,000 be transferred to the working balance, and the remainder to the renewals fund, which will now stand at £66,200, the reserve fund at £6,300, and the working balance at £9,500. The tramway manager reports that the generating station, rolling stock, and overhead equipment have been well maintained. The permanent way in some areas was more than five years overdue for relaying. The total amount of war bonuses and allowances paid was £21,220.

Experiments with the Sorbitic treatment of rails are being carried out on a portion of the permanent way.

Bristol.—Electric Vehicles.—The city engineer, in consultation with the city electrical engineer, recommends that six electric lorries be purchased for the purposes of the Sanitary Committee.

Canada.—Strike.—Tramway and railway employés have joined the general strike at Winnipeg, in which several Unions in Canada are concerned, demanding reductions in hours, and increases in wages.

Continental.—France.—The estimated cost of the electrification of the Midi Railway network, based on official observations in the Pyrenees and neighbouring regions, is put at 60,000,000 fr. A group of hydro electric stations, with a 100,000-H.P. equipment and a storage lake of 16,000,000 cb. m., are among the features of the scheme.

The Compagnie des Tramways Electriques de Marseilles is in danger of winding up, in consequence of the war and the general high cost of materials, salaries, &c. In the last resort, application has been made to the Government for assistance.

Coventry.—Proposed Fare Increase.—The T.C. has applied to the B. of T. for powers to increase fares from 1d. a mile to 1½d. for each existing 1d. stage, which at present averages 1·25 miles. The Warwickshire County Council has represented to the Board that no fare increase should be sanctioned until the tramways have been relaid, and unless a fair payment is made for the use of the main roads.

Proposed Light Railway.—The Warwickshire C.C. has been asked to prepare a scheme for an electric light-railway or motor service from Warwick to Shipton-on-Stour and other places around Stratford-on-Avon. The scheme has been deferred pending the passing of the Ways and Communications Bill.

Glasgow.—Proposed Kearney Railway.—We understand that a scheme has been prepared, and placed before the Lord Provost and City Council, for the installation of the Kearney High-Speed Railway Co.'s tube system in the Glasgow Harbour tunnel under the river Clyde, about one mile below Glasgow Bridge, connecting Finnieston and Mavisbank, and, according to *Modern Transport*, it is confidently anticipated that the proposal will meet with early acceptance.

It is proposed to run one car to and fro; the car would seat 40 passengers, and as the tunnel has a rising gradient of 1 in 3 at each end, it would operate mainly on the switchback principle, with assistance from electric power. A journey each way would be made in two minutes. The Brush Electrical Engineering Co., Ltd., would provide the equipment.

Hebburn-on-Tyne.—Linking-up.—At a meeting of the U.D.C. it was decided that steps be taken to link-up the Gateshead and Jarrow tramway systems, and a deputation appointed to interview the Gateshead and District Electric Tramways Co.

Hull.—Tramway Committee.—The T.C. at a special meeting last week, asked all members of the Corporation Tramways Committee to resign. Another Committee of 14 members was elected to take over the management and control of the tramways. Some of the old members of the Committee were re-elected. Mr. W. J. Mycombe, tramway manager, recently resigned, following an inquiry into the management of the undertaking.

Keighley. — Railless System. — An application for consent to run 'buses on the railless trolley route between Keighley and Oxenhope has been made to the West Riding County Council, but the W.R. Highways Committee recommends that consent be withheld, on the ground that the demand for road making material is greatly in excess of the supply. The scheme was approved in 1916. Keighley's immediate right of appeal to the L.G.B. was waived at that time for the period of the war. Power to run railless trolley cars on the route was obtained six years ago, and the overhead equipment has been standing for the past three years.

Liverpool.—Fare Revision.—The T.C. has decided to increase the tramway fares on the basis of 1½ miles for 1d. The reduction in the hours of labour would mean an increase of £160,000 on the wages bill.

London.—L.C.C.—The Highways Committee reports that it has arranged for the payment to the British Westinghouse Co., Ltd., of the bonus of £1,500 on steam consumption under the terms of its contract in respect of each of the two turbo-generators erected by the company at the Greenwich power station.

The Committee has distributed among employés in the tramway department a coal-saving bonus of £1,614 and £1,077 for the quarters ended September 25th and December 25th respectively.

The average number of tramway cars in use is 1,174 and 114 trailers, but it is anticipated that by the end of this month 70 additional cars will be in use, and steps are being taken to place a further 100 cars in service. At a meeting of the Highways Committee last week, the chairman stated that owing to the through running services the increased fares could not have been put in operation at the same time in the North and South London areas. As far as possible, well-known traffic points were used as fare stages, so that many of the old stages were retained. An average length of stage of 0·75 mile was being adhered to as closely as possible. Under existing conditions the reintroduction of 1½d. and 2½d. fares could not be advised.

The case of the L.C.C. tramways was explained last week to the London M.P.'s who are interesting themselves in the traffic problem. The chairman of the Highways Committee said that the number of passengers carried last year was 636 millions, an increase of 224 millions over 1909, and the working expenses had risen from 6½d. per car-mile in 1914 to an estimated figure of 1s. 4d. now. The net debt on the tramways was £8,477,000, and the capital commitments totalled £1,600,000. Mr. A. L. C. Fell, general manager of the tramways, said that the extensions between Farringdon Street and Blackfrairs, and Gray's Inn Road and Holborn would considerably relieve the congestion at Blackfriars. The increase in fares was not permanent and depended on the cost of labour and materials.

The general manager of the Metropolitan Railway Co. said that his company, which was entirely independent of the Underground combine, had 88 miles of line, 36 of which were electrified. The average return to stockholders last year was 2·08 per cent. In 1913 passengers totalled 115 millions, in 1918 145 millions, and this year (based on the first three months) would number 170 millions. The expenses had grown from £398,000 in 1913 to £707,000 now, a 129 per cent. increase. Statements concerning the new type of six-car train expected by the company to be running on the Inner Circle in August, were made. The new train would, it was expected, complete its station work in less than 25 sec. Each car is to be fitted with five doors on either side, which, instead of sliding will swing outwards. The movement of the train will automatically close them, when they will be held by a safety latch. The cars will be 53 ft. long, and by eliminating the vestibule at either end, and by re-arranging the seats, they will carry 58 instead of 48 persons. Most cars will have cross seats for two persons, and round the entrances single seats are being placed. Strap-hanging will be obviated by placing at the end of the seats, bars against which passengers can lean. An experimental train of this type is now under construction at Birmingham. The construction of deep-level express tubes under the existing lines is said to be under consideration.

Post Office Tube Railway.—The B. of T. has extended the time for the completion of the railways authorised by the P.O. (London) Railway Act, 1913, for one year from August 15th, 1919.

Halfpenny Fares.—M.P.'s for Ealing, Acton, and Hammersmith, have been petitioned to press tramway and omnibus companies to restore halfpenny intermediate fares.

Accidents.—A collision between a tramway-car and a steam tractor occurred last week at the foot of the gradient in Acton market place. The driver was unable to prevent the collision, which completely wrecked the front of the car, carrying away the staircase. No passengers were injured, but traffic was delayed while the line was being cleared.

Owing to the bursting of a water-main at Newington Butts, which forced the wooden blocks and flooded the roadway, there was considerable dislocation of the Tooting, Merton, and Norbury tramway service on Wednesday last week. The service between the Elephant and Castle and Kennington Gate had to be suspended.

The increased fares on the North London C.C tramways came into general use on Monday last. Some of the fares are now nearly three times the pre-war rate.

Manchester.—Car Shortage.—In reply to complaints as to the Corporation tramway service the general manager points out that the services cannot be improved owing to the shortage of cars. The construction of new vehicles is being pushed forward as rapidly as possible, but in addition to the complete suspension of building during the war, there are over a million more people travelling each week than in pre-war days. When the Committee started to build its own vehicles, the manager states, no contracts were sent out, but, in order to improve the services, contract for new cars have been given to Preston.

Northampton.—Electricity Supply.—The T.C. has accepted the offer of the Electric Light and Power Co. to supply energy for the working of the Corporation tramways for a period of five years at 1·4d. per unit if the consumption is 1¼ million units per annum, and at 1·33d. per unit for 1½ million units and upwards. The chairman of the Tramways Committee said that owing to deterioration of plant the cost of energy generated at the municipal power station had become excessively high, and to continue its use would involve a loss of at least £2,921 per annum. This amount could be saved if the company's offer was accepted, and could be further increased if the existing plant was sold and the station used for other purposes.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—It is expected that the Malvern telephone exchange will be transferred to the automatic system at the end of April. Installation of the automatic apparatus is almost complete. The plant is constructed on the Strowger system, which has been installed in the Brighton exchange and in 11 exchanges in Sydney and one each in Perth and Geelong. The next district to be placed under the automatic system will be Collingwood. Three thousand six hundred lines have been installed at Malvern, and the capacity of the plant is 10,000. Ultimately this exchange will be fitted in with a complete automatic network in the metropolitan area.

Automatic Telephones.—The Sheffield Chamber of Commerce has several times addressed itself to the inadequacy of the telephone system, and demanded the modernising of the system. A meeting of the Telephone and Telegraph Advisory Committee was held recently, which was attended by Sir Andrew Ogilvie, Second Secretary of the P.O., the Superintending Engineer, the Local Engineer, the District Manager of Telephones, the Postmaster of Sheffield, and a representative of H.M. Office of Works.

Sir Andrew definitely pledged his department to install a complete automatic telephone exchange system as well as several new exchanges. The scheme will necessitate a new central exchange, and two new sub-exchanges, in addition to three existing exchanges in which there is accommodation for an automatic system. Negotiations are in progress for sites, and it is hoped to place contracts for the buildings immediately. It is estimated that it will take three years to complete the automatic system. Sir Andrew admitted that the present telephone exchange is out of date, and in a bad condition.

The Post Office expects that the observations of the working of automatic telephones in American towns by telephone experts to be sent to the U S should be of great service in connection with the adoption of the system in London.

Cable Delays.—The Pacific Cable Board announce that, owing to the heavy pressure of telegrams to Australasia, the total telegraphic traffic is in excess of the carrying capacity of the Pacific cable, which is at the present moment the only route available. There is now a delay of approximately seven days on messages for Australasia.

There are breakdowns on the Eastern Telegraph Co.'s lines, which are closed to Australasia messages. The only route available is through the Pacific Cable to Canada, and overland to Vancouver. The Pacific Cable is dealing with 14,000 words a day—three times the pre-war traffic. Messages to the Far East are delayed 12 or 13 days.

Canada. — Telephone and telegraph operators have joined the general strike at Winnipeg, in which several Unions in Canada are concerned, demanding reductions in hours and increases in wages.

Telephone Irregularities.—In reply to a question in the House, the Postmaster-General said that records showed that in London the cases of irregular interruption in telephone calls averaged slightly over six per 1,000 calls during the last six months. These figures include cut-offs due to line and apparatus faults, as well as those caused by operators.

Stores provided for war purposes and now available for other purposes will be utilised in all cases in which they are found to be suitable for ordinary telephone work.

Wireless Telegraphy.—During the Atlantic flight from Newfoundland to the Azores, the wireless apparatus on board the American aeroplane N.C. 4 is said to have worked marvellously well. Messages were received over 1,300 miles and transmitted over 730 miles. Destroyers were in constant communication with the aeroplanes by wireless.

Wireless Telephony.—An R.A.F. aeroplane, carrying passengers and mails, flew last week from Kenley, near Croydon, to Paris, at night, in 4 hours 15 minutes. For the first 80 miles—that is, until the machine was well over the Channel—the commander of the squadron at Kenley was in constant telephonic communication with the aeroplane. The speech was said to be so clear that when the receiver was laid on the table in the wireless room, the voice of the pilot could be plainly heard by persons outside the door. The ground staff at Kenley overheard the pilot speaking to the aerodrome at Lymprie, on the Kentish Coast, and later he was heard speaking to Marquise, on the Flanders Coast. This is noteworthy, as the instruments are said to have been designed for a range of 35 miles only, whereas conversation was actually carried out over distances between 80 and 90 miles.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Brisbane.—June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.). Offices of the company at Brisbane.—*Tenders.*

Sydney.—June 9th. City Council. Supply and erection of power-house switchgear. Specifications from Electric Lighting Department, Town Hall, Sydney.*

June 23rd. Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.*

Bray.—June 3rd. U.D.C. Electricity Department. One 200-B.H.P. Diesel engine, direct coupled to 135-K.V.A. single-phase alternator and exciter. (See this issue.)

Bury.—June 6th. Electricity Department. One 6,000-KW. steam turbo-alternator and exciter, with surface condenser and air circulating pumps. (May 16th.)

Heywood. — June 11th. Electricity Committee. One 400-KW. rotary converter, transformer, with switchgear and cable work; 1,500 yd. ·15 sq. in. E.H.T. cable; 1,500 yd. ·05 sq. in. E.H.T. cable; 1,000 yd. of ·10 sq. in., ·05 sq. in., and ·10 sq. in. E.H.T. cable. (See this issue.)

Ilford. — U.D.C. Electricity Department. Supply of 350 yd. L.T. rubber-insulated, and 75 yd. E.H.T., 3-core, paper-insulated, lead-covered cable. (See this issue.)

London.—L.C.C. May 27th. Tramways Department. 2,000 tons of standard steel girder tramway track rails with fastenings, and alternatively, about 4,000 tons of standard track rails, lipless track rails and renewable guard rails. Specification (£2) from the Chief Engineer, County Hall, Spring Gardens.

Manchester.—May 28th. Electricity Committee. Two 4,000-K.V.A., three-phase static transformers for Stuart Street generating station. Mr. F. K. Hughes, Secretary, Electricity Department, Town Hall.

June 4th. Electricity Committee. Supply of cable for 12 months. (May 16th.)

New Zealand.—June 4th. Public Works Department. 1¼ miles of 11,000-volt cable.*

Oldham.—May 27th. Tramways Department. 12 double-deck top covered tramcars, with or without vestibules, complete with trucks; also 12 complete 40-H.P. electrical equipments for the above. (May 16th.)

Tasmania.—Launceston.—July 28th. City Council. Sub-station equipment, battery, reversible booster, switchgear, &c. City Electrical Engineer.

Warrington.—June 4th. Electricity Department. H.T. and L.T. lead-covered cable, motors and transformers. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Australia.—P.M.G.'s Department, Victoria :—

Automatic telephone equipment for the Perth Automatic Exchange, £119.—Automatic Telephones (Aust.), Ltd.

P.M.G.'s Department, N.S.W. :—

Telephone accessories, £422.—Western Electric Co., (Aust.), Ltd.

1,000 earpieces, 200,000 insulated staples, £82.—Laurence & Hanson Electrical Co., Ltd.

2,500 earthclips for water pipe, £177.—Royal Australian Navy Wireless Works.

Victorian Railways :—

Electric lamps, 110-volt, 20-watt, 2s. each; 40-watt, 2s. each.—Australian General Electric Co.

—*Tenders.*

Croydon.—T.C. :—

Alterations and extensions to tramcar inspection pit, Thornton Heath.—G. E. Everitt & Sons, Ltd., £570.

Isle of Thanet.—Joint Hospital Board :—

Maintenance of electric bells and telephones at Haine Hospital.—E. Covenay, Ramsgate, £12 a year.

Rotherham.—T.C. :—

Four double-deck tramcars.—Dick, Kerr & Co., Ltd., £2,190 each; 12 new bodies, without tops.—Dick, Kerr & Co., Ltd., £1,705 each.

Sunderland.—T.C. Accepted :—

L.T. feeder and service cables.—B. I. & Helsby Cables, Ltd.

Vertical boiler.—W. Woodhead.

Taunton.—Electricity Committee :—

500-KW. turbo set, complete with pipework, auxiliaries and accessories.—Messrs. C. A. Parsons & Co., £11,085.

5-ton travelling crane and gantry.—Messrs. Herbert Morris & Co., Ltd., £557.

FORTHCOMING EVENTS.

Royal Society of Arts.—Monday, May 26th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "A New Prime Mover of High Efficiency and British Origin," by Capt. F. E. D. Acland, R.A.

Tuesday, May 27th. At 4.30 p.m. At John Street, Adelphi, W.C. Paper on "Science and Industry in Australia," by Lt.-Col. the Hon. Sir John McCall, Agent-General for Tasmania.

Wednesday, May 28th. At 4.30 p.m. Paper on "Glass Making Before the War," by Mr. H. J. Powell.

Provincial Electric Supply Committee of the United Kingdom.—Tuesday, May 27th. At 2.30 p.m. At the Holborn Restaurant. Annual meeting.

Royal Institution of Great Britain.—Tuesday, May 27th. At 3 p.m. At Albemarle Street, W. Lecture on "Listening Under Water," by Prof. W. H. Bragg, C.B.E., F.R.S.

Industrial Reconstruction Council.—Tuesday, May 27th. At the Institute of Journalists, Tudor Street, E.C. At 5.30 p.m. Discussion on "The Relation of Welfare Work to Scientific Management," to be opened by Miss Voysey.

Wednesday, May 28th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture on "The Only Way to Higher Wages and Shorter Hours," by the Rt. Hon. Lord Leverhulme.

Institution of Electrical Engineers.—Tuesday, May 27th. At 6.30 p.m. At Caxton Hall, Westminster. Joint meeting with the Electrical Contractors' Association and the Association of Supervising Electricians. Discussion on "The Electrical and Engineering Equipment of Modern Small Houses."

Thursday, May 29th. At 2.30 p.m. At the Royal Society of Arts, John Street, Adelphi. Annual general meeting.

Institution of Mechanical Engineers.—Friday, May 30th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Resumed discussion on "The Mechanical Properties of Steel, with some Consideration of the question of Brittleness."

Illuminating Engineering Society.—Friday, May 30th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Discussion on "The Gas-filled Lamp and its Effect on Illuminating Engineering," to be opened by Mr. F. W. Willcox.

London County Council.—Friday, May 30th. At 4 p.m. At the County Hall, Spring Gardens, S.W. Conference on "The Report of the Committee Appointed to Inquire into the Position of Natural Science in the Educational System of Great Britain."

NOTES.

Single-Phase Squirrel-cage Motor with Unity Power Factor.—Test results are given (*Electrical Review*, Chicago) of a ½-H.P. single-phase squirrel cage motor operating at unity power factor. The motor has a two-phase winding, one winding being connected across the line, and the other across the line in series with a condenser of suitable capacity. The adjustment is made so that the current in one winding lags 45° behind the line voltage, and that in the other winding leads 45° in front of the line voltage. The motor is self-starting, has an efficiency of 49 per cent., a starting torque of 55 per cent., and a pull-out torque of 240 per cent. The effect of inserting condensers of various magnitudes is shown in a series of curves in the original article.

A L. & N.W. Special Train.—A special train designed and built at the London and North-Western Railway Carriage Works at Wolverton two years ago, to provide living accommodation for the Commander-in-Chief of the British Army and his staff in France, was described in a recent issue of the *Railway Gazette*. On April 10th, 1917, the company was asked to provide a train of ten vehicles for the purpose referred to above. Five of them left the works on May 5th, and the remaining five on the 12th of the same month, so that the complete train was provided in a month from the date of order. A further request for four additional vehicles was received later, and these were fitted up and sent out on July 20th, 1917. The fitting up and dispatch of a complete train of this description in the short period of time named reflects considerable credit on the company's works organisation. In the kitchen car accommodation is found for the electric lighting plant and the accumulators. A whole coach is utilised as a telegraph and telephone vehicle. The train is electrically lighted by a petrol-driven set, is steam heated by the locomotive when running, and by a boiler fitted in the brake and stores car when standing. The telegraph and telephone car was fitted up with the necessary instruments by the engineering staff of the G.P.O. There is a telephone and bell communication throughout the train, and means are provided and cable carried on the telephone car for connecting up to any telegraph or telephone system in proximity to the train. There is an ample supply of fans and roof ventilators, while all the drop lights are fitted with louvres and gauze with which they can be screened.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Wednesday last week a lecture on the development of wireless telephony by the Royal Air Force during the war was delivered by Major J. Erskine-Murray, R.A.F., before a crowded audience, with the aid of lantern slides and a large collection of apparatus. The lecturer first outlined the great expansion of the art which had taken place since the outbreak of war, showing the intricacy of the measurements and calculations which were involved, and illustrated the difference between the trains of waves produced by the spark discharge, and the continuous-wave system, and various "tonic trains" of waves. He then explained the operation of the transmitters depending for their operation on the valve amplifiers, and demonstrated with the help of apparatus the method of direction-finding, or position-fixing, which had been evolved by the Air Force for use on aircraft, enabling direction to be determined to an accuracy of one or two degrees. With the help of this system an airman can find his way anywhere with certainty, though the atmosphere may be too misty for him to see the ground at all.

The most striking feature of the lecture was the actual reception of wireless telephone messages from an airman in a Nieuport aeroplane, who was cruising about over London for that purpose; by means of powerful amplifying apparatus, the voice of the airman was made audible throughout the large lecture room of the Institution of Civil Engineers, and though articulation suffered owing to the immense degree of magnification employed, his remarks were clearly intelligible. A member of the staff of Major Erskine-Murray spoke to the airman from the lecture room, and informed him that the audience were going to award him a vote of thanks, which they did most heartily; the airman said he heard the clapping, and thanked the meeting. The demonstration was perfectly successful, and of a very striking and impressive character.

On account of Senatore Marconi having to return to Italy in connection with his military duties, the meeting which was to have been held on Tuesday, June 3rd, has been cancelled.

Captain L. B. Turner's paper on "The Oscillatory Valve Relay: a Thermionic Trigger Device," will be read and discussed on Monday, June 30th (instead of Thursday, June 26th).

The annual general meeting of Members, Associate Members and Associates only, will be held at the Royal Society of Arts, John Street, Adelphi, W.C., on Thursday, May 29th, at 2.30 p.m., to receive and consider the accounts for the year ended December 31st, 1918 and the annual report of the Council, and to elect auditors.

On the conclusion of the above meeting there will be held the annual general meeting of the contributors to the Benevolent Fund, to receive the report of the Committee of Management, and the statement of accounts and balance-sheet to December 31st, 1918.

The annual meeting of the North-Eastern Centre was held at Newcastle-upon-Tyne, on May 12th. Mr. A. P. Pyne presiding. The report states that the total membership had increased by 33. A large and varied programme had been dealt with, but visits to works had been difficult to arrange. The attendance at meetings was improving. On the occasion of the president's visit the scheme of reorganising the Institution, with a view to founding a Chartered Institute, was laid before the members. The Tees-side Sub-Section had held six meetings, and one joint meeting with the Parent Section. It had not been possible to hold meetings of the Students' Section. This Centre had been entrusted with the formation of a Research Sub-Committee to deal with the question of the heating of buried H.T. armoured cables. The Sub-Committee had held several meetings, and made one report; further useful work was still in progress. During the session the question of National Electric Power Supply had been constantly under review by the Committee. It was deemed advisable to take strong exception to the letter sent by the B. of T. Reports Joint Committee, setting out the views of the Committee, and conveying the impression that these views were those of the Institution as a whole. Representations made by the Committee to the Council in this connection had been given effect to, and machinery set in motion to obtain the views of the Institution as a whole prior to further action on the part of the Council. The officers were elected as follows:—Chairman: Mr. W. Cross. Vice-Chairmen: Messrs. J. R. Andrews and J. R. Beard. Past Chairmen: Messrs. A. P. Pyne, A. H. Marshall, H. W. Clothier. Committee: Power Supply Undertakings, Messrs. E. Fawssett, R. M. Longman, G. L. Porter, J. W. Jackson, W. F. T. Pinkney, C. Vernier; Manufacturers and Contractors, Messrs. L. H. A. Carr, A. Collins, T. Carter, A. H. Law, J. Rosen; Universities and Technical Colleges, Dr. W. M. Thornton; Consulting Engineers, Mr. R. W. Gregory; Borough Electrical Engineers, Mr. H. S. Ellis; Civil Service and Railways, Messrs. H. Kitchen, C. E. Taylor; Miscellaneous Sections, Dr. A. C. Michie. Hon. Treasurer: Mr. W. T. MacCall. Hon. Secretary: Mr. L. H. A. Carr. Tees-side Assistant Hon. Secretary: Mr. P. S. Thompson. Hon. Auditors: Messrs. C. Turnbull and F. G. C. Baldwin. The accounts showed a balance in hand of £27, while £32 remained to the credit of the Section in the hands of headquarters.

A lecture on "Dielectrics in Electric Fields" was then given by Mr. G. L. Addenbrooke.

Electrical Power Engineers' Association.—A meeting was held at Derby on the 19th inst., and a proposal to form a Derby and district section of the Midland Division was carried unanimously, a temporary Committee being elected. The officers are:—Chairman, Mr. G. H. Lake, Derby; vice-chairman, Mr. Melbourne, Burton; secretary, Mr. P. Gordon Hicatt, Derby; treasurer, Mr. S. W. C. Bradley, Spondon. The Secretary's address is 9, Lorne Street, Derby.

British Engineering Standards Association.—Conference on Limit Gauges for Plain Cylindrical Work.—A conference on the question of limit gauges for general engineering work was held recently by the British Engineering Standards Association at the Institution of Civil Engineers, at which Sir Richard Glazebrook presided. The paramount necessity, from a national point of view, of a standard system of such gauges has been emphasised by the experience of the war. Repetition work is absolutely necessary, and if the manufacturers of the country can be persuaded to adopt a system of limit gauging, not only will the character of their work be improved, but their output will be increased.

During the discussion stress was laid on the necessity for publicity and educational work, and on the importance of securing that any system recommended should be a development of, and not incompatible with, the systems at present in use in the various factories. It was agreed that the hole should be the basis, and that the minimum dimension of the hole should be the nominal size, the tolerances being positive. The general feeling was that four or five qualities of work would be sufficient, and three classes of fit would be needed, *i.e.*, running fits, transition fits, and interference fits.

As regards the basis for laying down tolerances and allowances for running and transition fits, the feeling was expressed that the formula: Allowance $= a + b\sqrt{D}$, a and b being suitable constants and D the diameter, might be accepted provisionally. In applying such a law the tolerance would naturally increase by a series of steps, and it was generally agreed that for most qualities of work the steps should be limited to multiples of two or four 10 thousandths of an inch. Interference or obstruction fits should increase proportionally to the diameter.

A scheme by which, pending the formation of a Sectional Committee, the present Sub-Committee should be reorganised, with the addition of a number of manufacturing engineers, and given the power to appoint panel or small committees of experts to commence the detailed work, has been sanctioned by the Main Committee of the Association, and is being put into operation.

Appointments Vacant.—Engineer for the Hong-Kong Tramways Co.'s power station; commencing salary $400 per month (Hong-Kong currency) + $80 per month house allowance; lecturer in electrical engineering (£350, rising to £400), for the University of Bristol; instructor (£4) in electrical installation for training discharged Service men at the Kingston-on-Thames Technical Institute; foreman mechanician (£250 + £50), for the Federal Malay States Post and Telegraph Department; meter tester (75s.), for the Borough of Salford Electricity Department; Head of the Engineering Department (£300), Assistant in Mechanical Engineering (£250); Assistant in Electrical Engineering (£250), for the St. Helens Municipal Technical School; Engineering Assistant (£400), for the Electrical Engineers' Department, Stoke-on-Trent. See our advertisement pages to-day.

Nitrogen Fixation in Germany.—The factory of Chortzow Kattowitz, Bayr, Reichstickstoffwerke was built towards the end of 1914, and commenced working in 1915. In February, 1918, three furnaces were in working order and in constant use, a fourth was completed but not working, and four more were being constructed. Each furnace turns out on an average 20 tons of carbide in each shift of eight hours The factory is the only one in that district, and was erected solely for the manufacture of nitrogen—chiefly for munitions, the waste (stickstoffabfall) being used as a fertiliser. State aid was given in the form of special machinery and exempted labour. The electric-arc process is used. The gases from the furnace are simply drawn off by draught ventilators fixed at the side of the furnace, and there seems to be no arrangement for rapidly cooling them by artificial means. Limestone and coke are used as absorption agents. The works own land on which the fertiliser is used, where vegetables, cereals, &c., are cultivated; no one particular crop is particularly favoured. The furnace is oval in shape and open at the top about 10 ft. high surrounded by a scaffolding for feeding. It is lined with a metal which can withstand extreme heat, next a lining of steel, then comes the water-cooling chamber, enclosed in fire-brick, finally an exterior steel casing. It is lined at the bottom with carbon blocks, which form one of the poles. The electrodes are at the top fixed on cranes, and can be raised and lowered.

Electricity Supply in Australia.—Following on the report of a committee of experts and the passing of the Electricity Commissioners Act last session, the Government has appointed the Electricity Commission, which consists of Mr. G. Swinburne, Prof. T. R. Lyle, and Mr. A. M'Kinstry. The commission does not include any member of the expert committee. The Premier stated that the Cabinet considered that the position was not sufficiently advanced in Victoria to warrant, at the present stage, the appointment of whole-time commissioners. The duties of these commissioners will consist of the investigation and pushing forward of the Morwell brown-coal scheme, the Kiewa River and other appropriate water schemes, and of framing regulations, by-laws, &c., as to the difficult and complicated problems relating to the standardisation, co-ordination, and interconnection of electrical undertakings in the State. The commissioners will be asked to select the best available hydraulic engineer in Victoria for the purpose of thoroughly investigating the Kiewa and other water schemes, and obtaining data and information for Parliament. As regards Morwell, the work relating to surveys, reports on sites, dimensions, and character of power houses, sub-stations, plant, &c., will have to be directed by the commissioners. For these purposes they will, of course, require an electrical engineer who must devote the whole of his time to the technical and business affairs of the commission and the various power schemes. The gentlemen selected have been chosen for their technical knowledge and business experience. Prof. Lyle is chairman of the Advisory Committee of Science and Industry and chairman of the standardisation committee of the Electrical Association. Mr. A. M'Kinstry is a member of the Institution of Electrical Engineers, and president of the Electrical Association in Victoria, and is general manager in Australia of the British Westinghouse Co. Mr. Swinburne's duties as member of the business board investigating the Defence department will not permit of him, for the next six months, dealing with details of the work of the commission. The attendance fees to be paid to each commissioner are not to exceed £500 a year.—*Melbourne Age.*

A.C. versus D.C. Motors.—During a five months' test period in the machine shop of the Lehigh plant of the Bethlehem Steel Co. 137 A.C. motors showed a perfect service record. During the same period there were 26 total failures among 353 D.C. variable-speed motors, and 39 total failures among 342 D.C. constant-speed motors. These 832 motors had an aggregate rating of 7,195 H.P., making the average motor size 7.2 H.P. The maximum rating was 25 H.P., and the minimum 0.5 H.P. The actual cost of repairs to a group of 200 motors in the same shop was investigated. These motors averaged about 4.3 H.P. each, which is about 40 per cent. less than the average of 7.2 H.P. for the entire shop. There were 27 total failures in this group during the five months, and the failures all occurred in the D.C. motors, of which there were 150. The 50 A.C. motors showed a perfect record. A large percentage of the failures originated in the commutators; where the breakdown did not actually occur at this point the commutator had to be at least repaired. In addition to such repairs or renewals about 40 per cent. of the armatures had to be rewound. In repairing the 27 armatures that failed about 432 hours were spent, involving a total cost of about $475, of which $260 was for labour and $215 for material. At this rate the annual expense would be $1,140. The forgoing maintenance cost is based on 27 failures in one group of motors in five months. However, in that same period there were 65 total motor failures in that shop and 432 machine-tool motor failures in the entire plant. The constant-speed motor failures could be reduced to a negligible quantity by using only A.C. motors for that service. Such a change should reduce the complete motor failures and the total motor maintenance expense by 40 per cent.—*Electrical World.*

Electric Vehicle Trials.—We learn that the Electric Vehicle Section of the Society of Motor Manufacturers and Traders is considering the question of organising a series of trials of electric motor vehicles.

Faraday House Old Students' Association.—The annual dinners of this Association will be resumed at the Holborn Restaurant on Friday, June 20th. with the president—Colonel Hubert C. Sparks, C.M.G., D.S.O., M.C., Croix de Guerre—in the chair. Tickets for the dinner are 10s. 6d. each, exclusive of wine. This is the first dinner since 1914, and in view of the presence in this country of a number of old students from abroad, who have been serving with the Forces, a large attendance is anticipated, and early application for tickets is desirable.

Belgian Engineers Ostracise the Enemy.—At their first meeting since the outbreak of the war, held on January 10th, the members of the Société Belge des Electriciens took the opportunity of refuting seriatim the lying assertions of the famous manifesto of the 93 German professors as to the authors and causes of the war. They emphasised their refutation by announcing their permanent severance of all scientific relations with Germans and their allies. and suppressing all exchanges of scientific papers and reviews.

Wirelessly-Directed Aircraft.—The statement made by Mr. Baker, the American Secretary for War, that a device had been invented in the U.S., whereby an aeroplane could, without a pilot, be made to travel 100 miles and alight near any assigned spot was followed, according to the *Engineer*, by a report from France that a ground-controlled aeroplane had actually flown over a prescribed course exceeding 110 miles in length, and had been landed when required in a certain aerodrome.

Educational.—Merthyr.—Mr. S. Berry has presented £20,000 to the Merthyr Education Authority for the foundation of a technical school. An endowment fund is being raised, towards which Messrs. Guest, Keen & Nettlefold's, Ltd., have contributed £12,000, and the total subscriptions amount to £25,000.

Organising Kinema Operators.—A meeting of kinematograph operators was held on Sunday last, at which Mr. W. J. Webb, London District Secretary of the E.T.U. (who has recently lost his only son in Mesopotamia), stated that a strong Committee had been formed to draw up working proposals for the industry, and the London District Committee of the E.T.U. had instructed him to invite all the owners of kinema theatres in the district to a joint conference to discuss the proposals. Mr. J. F. Wyatt, president of the newly-formed London Central Operators' Branch of the E.T.U., advocated organisation to secure a living wage, and stated that branches had been started at several provincial centres. The proposals include the establishment of a uniform scale of wages and working conditions, a system of training, and an employment exchange for operators.

Engineering Golfing Society.—The Engineering Golfing Society held its first meeting since the spring of 1914, at Walton Heath, on the 20th inst.

Forty-eight members actually took part in the play, the Senior Division playing a medal round in the morning over the old course and a bogey round in the afternoon on the new course. The Junior Division tackled the courses in the reverse order. Fine weather prevailed, and a most enjoyable day was spent.

The President's Challenge Cup (Senior Division) was won by Mr. J. W. Towle, after a tie with Mr. Walter Phillips at 89 net, and the Wilson Challenge Cup (Junior Division) by Mr. A. P. Livesey, after a tie with Mr. W. W. Hughes at 93 net. The Scratch Prize was won by Mr. C. R. D. Pritchett with a score of 91.

In the Bogey Competitions the first prize in the Senior Division fell to Mr. F. Wood (2 down) and the second prize to Mr. J. H. Greathead (4 down). In the Junior Division, Mr. B. J. Hall took first prize and Mr. D. T. Powell the second, after a tie at 3 down.

Electricity in Mining.—Electricity is to be used in prospecting for gold in the Carngham District, Victoria, Australia. The basis of its application is the greater conductivity of a mineral reef as compared with ordinary country. Two electrical terminals are placed on the surface at some distance apart on a spot where a reef is likely to exist. If the current instead of flowing uninterruptedly from pole to pole is deflected, the intervening ground is tested more closely by means of a galvanometer and the position of the disturbing medium located. The country is then explored with a prospecting shaft.

Empire's Resources Exhibition.—It is proposed to hold an exhibition of manufactures and produce of the British Empire. The suggestion was unanimously supported at a representative gathering called by the British Empire League, at the British Empire Club, this week.

Coal for Industrial and Domestic Use.—In reply to a question in the House of Commons, Sir Auckland Geddes, Minister of Reconstruction, said he feared it would be necessary either to reduce the supply of coal to industry and for domestic use, or to limit even more strictly than at present the amount allowed to be exported. It was not possible to give a more definite answer until the effect of the reduced hours of working upon output was known. The output of coal per person employed continued to show a decrease without any shortening of the hours of working.

London Traffic.—As a result of a deputation of London M.P.'s to the Local Government Board, on Monday, Dr. Addison stated that the present condition of things was deplorable, and that he would recommend his colleagues to appoint a Select Committee to inquire into the matter of traffic congestion.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—Stafford Corporation Electricity Committee has recommended that the salary of the electrical engineer be increased from £357 10s. per annum to £550, inclusive of war allowances.

Morecambe T.C. has appointed Mr. Joseph Boyce, electrical engineer and destructor manager of the borough of Todmorden, borough electrical engineer at £250 per annum. There were four applicants for the position.

Stoke Newington B.C. Electric Lighting Committee reports that Mr. Hann has returned from foreign service and resumed his duties as borough electrical engineer.

We are informed that Mr. L. C. Bellamy was traffic manager, not manager, of the Rangoon Tramway & Supply Co., Ltd., as stated in our last issue.

General.—The marriage was celebrated on the 15th inst. at the Eccles Parish Church, between Major F. W. Clark, M.C., late R.E., and Miss Freda Matthews, only daughter of Mr. and Mrs. Matthews, of Eccles. Prior to the outbreak of hostilities, Major Clark was connected with Messrs. Mather and Platt, Ltd. In August, 1914, he enlisted in the Manchester Pals, and was commissioned into the Royal Engineers in June, 1915, being appointed to a field company raised at Doncaster, of which town his father, Mr. W. Clark, J.P., was Mayor in 1912. Major Clark went to France in May, 1916, where he saw continuous active service until demobilised in February this year. He was appointed to the command of the 229th Field Company in September, 1917, was mentioned in dispatches, and received the Military Cross. Upon returning to civil life he joined Messrs. Ward & Guldstone, of Manchester. The bride is the daughter of Mr. F. J. Q. Matthews, electrical engineer to the Vulcan Boiler & General Insurance Co., Ltd., of Manchester.

Prof. C. A. Middleton Smith, of the University of Hong-Kong, expects to reach England early in June.

Mr. W. H. Smedley, audit accountant to the Aldershot Gas, Water & District Lighting Co., has been appointed costs accountant and assistant secretary to the Low Temperature Carbonisation Co., Ltd.

The *Times* states that Mr. George Morgan, C.B.E., I.S.O., late Controller of the Post Office Stores Department, has received the King's permission to wear the Cross of Chevalier of the Order of Leopold.

Mr. E. E. Sharp, A.M.I.E.E., who has been demobilised, is shortly relinquishing his connection with Messrs. Chamberlain & Hookham, but will retain his interest in Venner Time Switches, Ltd. He is also engaging in a new business, of which particulars will be given later on.

Capt. H. Nimmo assumed duty on April 8th, 1919, as District Educational Officer for the A.D.M.S., Woolwich district, under the Army educational scheme.

Mr. Thos. D. Kirkland, of Broughty Ferry, who has been demobilised, has been appointed to succeed Mr. Andrew Henderson as manager of the Stirling and Bridge of Allan Tramways Co.

Mr. H. G. Fraser, chief electrical engineer of the Fife Coal Co., Leven, was entertained by the managerial head office staff of the company, and presented with a wallet of Treasury notes and a case of pipes, together with a case of spoons and sugar tongs for Mrs. Fraser, on the occasion of his leaving to take up the position of Glasgow agent for the firm of Messrs. Fraser & Chalmers.

Mr. H. F. Phillips, of Messrs. H. Fentum Phillips & Co., electrical engineers, of 36, High Street, has been elected a vice-president of the Guildford Chamber of Trade.

The impending retirement of Prof. Gisbert Kapp, of the electrical engineering department of the University of Birmingham, is announced.

Capt. S. Boys, D.S.O., who enlisted in the early days of the war, has relinquished his commission, being permanently unfit, the result of wounds received in action. He has now returned to the Edison Swan Electric Co., Ltd., to take up the position of district manager at its Sheffield depot.

Capt. J. N. Stephens, manager of wiring supplies sales for the British Thomson-Houston Co., has returned to Mazda House after having served for three years with the forces.

On May 2nd a gold watch was presented to Mr. E. W. Hills by the staff of the Edison Swan Electric Co., Ltd., on his leaving, after 24 years' service, to join the Yorkshire Incandescent Electric Lamp Co., Ltd., as works manager.

Mr. R. Ainsworth, M.I.E.E., for many years chief electrical engineer to Messrs. P. R. Jackson & Co., Ltd., Manchester, has taken over the managing directorship of the Manchester Armature Repair Co., Ltd., Ford Lane, Pendleton, Manchester. This business was established in 1906 by the late Lieut. G. H. Wilson, A.M.I.E.E., who unfortunately died recently whilst on active service in East Africa. A limited company has been formed, and Mr. Ainsworth has joined interests with the late Mr. Wilson's family.

Mr. Charles Gordon Grundy, engineer with the Electro-Metals Co., London, who has carried out many important contracts for electric furnaces in various parts of the country, was married on Monday last to Miss Monica Dromgoole, second daughter of Mr. Alfred Dromgoole, St. Helens, who is well known in that town for her exertions on behalf of local charities, and popular with all sections of the townspeople. Mr. Grundy is the eldest son of Mr. Jas. Grundy, St. Helens. After the honeymoon Mr. and Mrs. Grundy will take up their residence at Manchester.

Brig.-Gen. E. H. Hills, C.M.G., D.S.C., F.R.S., and Major-General A. J. de Lotbinière, C.B., C.S.I., C.I.E., have entered into partnership as consulting engineers, with the style of Hills & de Lotbiniere, specialising in the departments of hydro-electric generation and transmission, water supply, and drainage. Brig.-Gen. Hills will contribute specialist scientific knowledge to the partnership, while Major-Gen. de Lotbiniere has had 30 years' experience of civil engineering in India, particularly in connection with water-power schemes. He was successively chief engineer to Mysore, Cashmere, and Bengal before serving in the war, and carried out the Cauvery Falls scheme some 20 years ago. He was subsequently responsible for the Jhelum scheme in Cashmere. Pending the completion of office arrangements, Brig.-Gen. Hills is dealing with inquiries at 1, Campden Hill, W. 8.

Mr. Wm. T. Tallent-Bateman has resigned his position of chief switchgear engineer to the British Westinghouse Co., and is taking up the position of works manager to Messrs. Dorman & Smith, electrical engineers, of Salford. Upon leaving the Westinghouse Co., after a period of 16 years' service, he was presented, on behalf of the staff, by Mr. J. S. Peck, chief electrical engineer of the company, with a pair of very handsome silver three-branch candelabra.

Roll of Honour.—Private J. Shelmerdine, M.M., 9th Manchester Regt., reported missing a year ago, is now officially presumed to have been killed. He was formerly employed at the Ashton-under-Lyme Corporation Electricity Works.

Will.—The late Prof. Geo. Carey Foster, F.R.S., of University College, London, left £66,155 gross.

NEW COMPANIES REGISTERED.

John Birch & Co., Ltd. (155,064).—Private company. Registered May 12th. Capital £240,000 in £1 shares (60,000 pref.). To take over the business of merchants and engineers carried on by a company of same name (incorporated 1893), and to carry on the business of merchants, engineers, contractors, iron and brass founders, steel converters, tool makers, metallurgical and manufacturing chemists, electricians, manufacturers of rolling stock, &c. The subscribers (each with one share) are: G. Redder and F. N. Rossiter, both solicitors, of 35, Coleman Street, E.C. Three of the first directors are to be nominated by the liquidator of the old company (as representing holders of ordinary shares numbered 1 to 45,000), and two are to be nominated by the holders of ordinary shares numbered 45,001 to 90,000. Directors' qualification, £500. No enemy subject may be a director, and three-fourths of the board, including the chairman, must at all times be British subjects, resident in the United Kingdom.

Victor Plating Co., Ltd. (155,050).—Private company. Registered May 10th. Capital £500 in £1 shares. Agreement with Frederick Walker, and to carry on the business of electroplate depositors, mechanical and electrical engineers, &c. The subscribers (each with one share) are: Frederick Walker, 156, Victoria Road, Aston, electro plate depositor; W. Lowe, 112, Wilton Street, Lozells, Birmingham, electro plate depositor; W. H. Young, 115, Church Street, Lozells, Birmingham, electro plate depositor. Table "A" mainly applies. Solicitor: T. W. Pickup, 23, Colmore Row, Birmingham.

Albert Groves & Co., Ltd. (155,121).—Private company. Registered May 14th. Capital £5,000 in £1 shares. To acquire the business of kinematograph outfitters and electricians carried on by A. Groves at Queen Victoria Street, Leeds. The subscribers (each with one share) are: A. Groves, 5, Graveley Court, Woodhouse Street, Leeds, kinematograph outfitter; C. Lishman, Ridge View Terrace, Leeds, picture palace proprietor, F. Lishman, 19, Inglewood Terrace, Leeds, electrical engineer. Directors: A. Groves, C. Lishman and F. Lishman. Registered office: 4, Christopher Road, Woodhouse Street, Leeds.

S. Hinchcliffe, Ltd. (155,077).—Private company. Registered May 12th. Capital £5,000 in £1 shares. To acquire the business of electrical engineers carried on by S. Hinchcliffe at Balfour Street, Oldham. The subscribers (each with one share) are: S. Hinchcliffe, Balfour Street, Oldham, electrical engineer; A. E. Hibbert, 267, Frederick Street, Oldham, manager of cotton mill. First directors: S. Hinchcliffe and A. E. Hibbert. Registered office: 69, Mumps, Oldham.

Bale & Hardy, Ltd. (155,123).—Private company. Registered May 14th. Capital £20,000 in 8,000 7 per cent. preference shares of £1 each, 10,500 10 per cent. ordinary shares of £1 each and 30,000 deferred shares of 1s. Patentees and Government contractors, electricians, mechanical and general engineers, &c. The subscribers (each with one ord. share) are: J. W. Tully, 39, Victoria Street, Westminster, S.W.1, engineer; O. E. Yeo, Dacre House, Arundel Street, W.C., engineer. First directors to be appointed by the subscribers Solicitors: Bruce, Millan & Co., Pomeroy House, 28a, Basinghall Street, E.C.2.

Ballynahinch Electric Light & Power Co., Ltd. (4,704).—Private company. Registered May 7th. Capital £5,000 in £10 shares. To carry on the business indicated by the title. The subscribers (each with one share) are: E. T. Wallace, Ballynahinch, Co Down, merchant; H. H. McAllister, Ballynahinch, Co. Down, merchant; J. A. Thompson, Ballynahinch, Co. Down, bank manager; F. E. Murray, Ballynahinch, Co. Down, merchant; J. Walker, Ballynahinch, Co. Down, chemist. The first directors are not named. Registered office: High Street, Ballynahinch.

John Robertson (Belfast), Ltd. (4,702).—Private company. Registered in Dublin May 7th. Capital £2,000 in £1 shares. Expert magneto repairers and adjusters. The subscribers (each with one share) are. J. Robertson, 42, Berry Street, Belfast, electrical engineer; Mrs. M. Robertson, 34, Delaware Street, Belfast. First director: J. Robertson. Registered office: 42, Berry Street, Belfast.

Norrington & Landon, Ltd. (155,177).—Private company. Registered May 15th. Capital £5,000 in £1 shares. Electrical, mechanical, and general engineers, &c. First directors: G. F. Norrington, 13, Fulshaw Avenue, Wilmslow, Cheshire, electrical engineer, and W. de M. Landon, Green Bank, W. Timperley, Cheshire, electrical engineer. Solicitor: R. A. Edgar, 20, Booth Street, Manchester.

CITY NOTES.

W. T. Glover & Co., Ltd.

Mr. A. L. Ormrod presided at the annual meeting, held at Trafford Park, on May 12th. He referred briefly to the figures given in the report, and said that the report and balance sheet were sufficient evidence of the conservative manner in which the board had dealt with the accounts, and the satisfactory condition of the business. The adoption of the report was seconded by Mr. E. Claremont, and carried. The Chairman then moved a resolution as follows:—"That this meeting approves the action of Mr. A. L. Ormrod in entering into the agreement with Messrs. Vickers, Ltd., and pledges its support to the objects defined therein." This was seconded by Mr. L. B. Atkinson and carried unanimously. In his speech relating to the resolution, the chairman made a full explanation of the action of the board and himself. He had been associated with the company as a director since 1902, and had seen it gradually, but surely, emerge from a condition of chaos to one of prosperity and strength. He and Mr. Cooper took a strong hand in its reorganisation and finance, and with the co-operation of the other directors prevented the loss of the shareholders' money, which at one time appeared almost inevitable. He could not have had a better comrade than Mr. Claremont, the managing director, who was a master of organisation and detail, and possessed of all those qualities requisite to the management of an electrical engineering works. There might be bigger companies, and companies in the same line of business which had made bigger profits, and, indeed, this company might have made bigger profits, but no profit in Glovers had ever been made at the expense of its reputation or its goods. He could truly congratulate Vickers on the bargain that they had made, and on their prospects of controlling this firm. There was no goodwill in the price agreed, and, indeed, over the equivalent cash value of the shares offered in exchange for Glovers there was a considerable surplus of assets. Although the shareholding interest might change, the flag of Glovers in any event would remain flying. The entity continued and the management remained. As to the deal in detail, they were approached *viâ* the Westinghouse Co. by the Metropolitan Carriage, Wagon & Finance Co., which had the controlling interest in the former on behalf of Vickers, Ltd., which was now the controlling factor of the lot. The Westinghouse Co. knew Glovers well. For many years the two firms had had business relations with one another. The Westinghouse Co. was in a position to appreciate the value of Glovers' work and management. Although the magnitude of its business and its transactions far exceeded Glovers', the career of the Westinghouse had been chequered, and it had undergone what, by the grace of God or the co-operation of their directors, they had avoided, viz., reconstruction. At an early stage he stated to the Westinghouse Co. that it must immediately realise it was not approaching a concern that had necessity or motive for selling, that a prelude to any serious conversation on such a matter must be a frank recognition of the value of the company's assets, and the only figure at which any negotiation could be opened must be a liberal one, and not one based on the dividends that had been paid. From the beginning their relations in such discussions had been cordial and frank. At a later stage of the negotiations the representative directors of the Metropolitan Carriage, Wagon & Finance Co. appeared on the scene, and they advanced a proposition materially below the one ultimately agreed with regard to the ordinary shares and with a suggestion that the preference shareholders might be given an equivalent rate to that which they were now receiving in some form of 5 per cent. preference shares of Vickers, Ltd., but when he looked up the value of Vickers 5 per cents. he discovered they were non-cumulative preference shares, and their then value in the Stock Exchange List was below that of Glovers. Personally, he saw no particular reason why Vickers should have desired to acquire the preference shares and not have been content with the control of the ordinary shares. He had, however, no hesitation in advising the preference shareholders to accept the cash offer of 17s. 6d. for a 5 per cent. preference share. The opportunities in these days were many and good of reinvesting the money on a much better basis, and even upon a better preference share, reckoned by the usual standards. The normal rate of a preference share of the highest industrial class to-day was possibly as low as 6 per cent., and ran to 7½ per cent., and at the price which Vickers were prepared to pay the preference shareholders, or such of them as might accept the offer subject to the other conditions, the shares would only yield to them £5 14s. Very many of the company's preference shareholders were also ordinary shareholders. In any event 87½ per cent. for a 5 per cent. preference security which had a substantial amount of debenture stock in front of it was a big price. After all, it was not a Government security, and at such a figure it was approaching that parity. Satisfactory as was the balance-sheet before them, the financial position of Glovers to-day was materially different to that at the date of the balance-sheet. There was at the moment a substantial overdraft of over £40,000. The debentures were becoming due, and their reissue or replacement would have to be speedily provided for. Then their large investment in the Trafford Power and Light Supply Co., Ltd., although sold to the Stretford District Council, was only sold subject to Parliamentary sanction, which had not yet been granted, and, indeed, might not be. As to the ordinary shareholders, the best dividends they had been receiving—he was not speaking of earnings—had been 7½ per cent., including the bonus, and Vickers for many years past had been distributing 12½ per cent., free of tax up to 5s. in the £. In other words, the best total dividend for a year which Glovers' ordinary shareholders had received had been 1s. 6d., less tax, when Vickers' had been receiving 2s. 6d., after the tax had been paid up to 5s. in the £. What Vickers' earnings recently had been, or what they could be taken to be, none of them knew, because the company's balance sheets had yet to be issued after a settlement had been come to with the Government authorities, but he had no doubt that the amount distributed by that company was in all probability far below what it could have paid had its board wished otherwise. If a shareholder took and held his Vickers shares, in exchange he would in all probability receive a dividend approximately 2½ times more than he had been getting in a concern similar to that which he had parted with, in that it had been paying well within the mark of its earnings. The acquisition of Glovers' shares by Vickers provided an increased chance for its management and workpeople. Vickers had behind it wealth, influence, and potentialities of orders. Glovers and all highly technical businesses in this country were faced at the present moment with a future with a very large measure of uncertainty. It was also faced with the necessity of going out for foreign business, of which it had had comparatively little in the past. It was faced with the necessity of increased expenditure both on its staff and on its development, and the possibilities of a large amount of further capital expenditure without the absolute certainty that its holding in the Trafford Power Co. was going to be realised. At best such money could not be available for capital expenditure or other purposes for some time to come. He knew that if this deal should not go through, Vickers were unlikely to bother about the acquisition of any other cable manufacturing company, but were going direct into the cable business, so that all other cable manufacturers and this company would be faced with a most formidable competitor, possessed of great engineering, electrical, and technical knowledge, of great influence, and vast resources. Such a contingency could not fail to have a very important bearing on the profits that might be earned in the future by Glovers and similar concerns. As ordinary shareholders in Glovers, it would pay them best to carry out this arrangement, and he had no doubt it would pay Vickers also. Mr. Ormrod read a letter that had been written to him by their managing director as follows:—

> A few months ago I pointed out to the board that on the withdrawal of Government work and the return to our normal business, which during the war had been entirely neglected, we were in the position of having to maintain a considerably increased output in order to cope with the greatly increased establishment charges, the only alternative being to reduce the establishment charges to their original figure which was obviously quite impracticable owing to the increase in values in all directions. I pointed out that all cable companies would to a large extent be in such a position, and that there would not be sufficient home trade orders to meet these increased outputs, and that the only chance of obtaining sufficient work was from the foreign markets, and that we (Glovers) had little or no foreign connection, and it would take some years to create it, and accordingly the only means by which Glovers could obtain sufficient work to cover their establishment charges would be by joining hands with a house having already foreign representation; and I said the ideal would be for such a house to have such a demand for cables for its own purposes as to absorb the whole of Glovers' output. This ideal I consider has been reached by the proposed amalgamation with Vickers, Ltd.—in fact, it would be difficult to suggest an amalgamation with anybody more suitable. I certainly know of none.

When the circular dated April 30th was sent out he had not reached the formality of an agreement with Vickers, but the agreement had since been signed. He recommended the fulfilment of the agreement, and his co-directors were at one with him. The completion of the sale was to take place on June 30th next.

British Westinghouse Electric & Manufacturing Co., Ltd.

The nineteenth annual meeting was held on Friday last at the Connaught Rooms, Great Queen Street, London, Mr J. Annan Bryce in the chair. In proposing the adoption of the report, the chairman said that since the end of December there had been an issue of one million ordinary shares of £1 each, which had been subscribed and paid for in cash by the Metropolitan Carriage, Wagon and Finance Co. and its nominees, in accordance with its undertaking. The additional capital was required to provide for various needs in connection with the expansion of the business. Holders of preference shares had the option for two years of converting all or any of their holding into the new ordinary shares, and as stated in the recent circular the period of option ran from April 14th last till April 14th, 1921. The item for "sundry creditors and credit balances" showed a diminution of nearly £70,000 as compared with last year. In view of what they considered ample provision made under other heads, the directors had not thought it necessary this year to add to general reserve, especially as they proposed a large addition to the carry forward. Dividend at 8 per cent. took nearly £10,000 more than last year, and the carry forward was increased to £77,000, an increase of £26,000 over last year, but still £12,000 below the carry forward at December 31st, 1916. As the excess profits tax was to be reduced from 80 to 40 per cent. the burden under that head would be lessened in the current year, and it might be hoped that the reduction was the prelude to its abolition. It was disappointing that after the late Chancellor's announcement that he did not see how the tax could be continued after the war, the present Chancellor should excuse its continuance by the statement that he was waiting to see whether a scheme for a graduated tax on all trading profits could be devised. It was pointed out at the time of its original imposition that, as he (the chairman) said then, the tax was not only strangling enterprise, but was in many cases, their own among the number, radically unjust. It must be unjust in all cases such as theirs where a business had not attained full development before the war, because it did not affect other concerns doing similar business, which had at that time already attained development. The tax tended to strangle new enterprises because the rate of interest allowed was inadequate to attract capital. Numerous cases had come under his own personal observation where for that reason capital refused to risk investment in promising ventures, many of them designed to supply the place of commodities formerly imported from Germany, and which in default of production here Germany would, by hook or by crook, again manage to reintroduce into this country. Not only did the tax strangle new enterprise, but it swept away that portion of his profits which a prudent manufacturer applied to the development of his business. The German Government, recognising that danger, abstained till almost the end of the war from imposing a similar tax, with the result that the great German electrical concerns, the Allgemeine, Siemens, and Bergmann were enabled to accumulate vast fighting funds for post-war competition. Nor did any of the other belligerents such as France and Australia and lately India, which imposed an excess profits tax, carry it to the same extreme as our Government did.

The reduction of nearly £60,000 under the two headings "stock and completed work on contracts" in the balance sheet showed that the rate of out-turn and shipment had been speeded up. The gross profit was £52,000, and the net profit £58,000 larger than last year, enabling them to pay not only a larger dividend, but to increase the carry forward. About prospects, it was too early to speak with confidence. Trade was still hampered in various ways by political uncertainties, by Government restrictions, by difficulties in shipment, and in obtaining raw materials, and by labour unrest. The conclusion of peace should improve the position in many respects, notably in respect of political uncertainties and Government restrictions, though the latter would die hard, but the return to normal conditions must be slow. The question of the relations of labour to capital overshadowed all the others, but he believed that their Cassandras painted the picture too black. There were welcome signs that many of the most trusted Labour leaders realised the cardinal fact that the prosperity of the country depended on increased output, and that the idea on which the restriction of output and the use of improved machinery, namely, that there was only a fixed amount of work to go round, was based, was a fallacy. The truth, of course, was that the greater the output the greater was the amount of work to go round. The larger the output, the cheaper was the cost of the article. The cheaper the article, the larger its consumption. As Mr. Gompers told them that was thoroughly understood in America, where, when improved machinery was welcomed by the workmen, the output was twice as high, wages were twice as high, and the conditions of life greatly better. There had, indeed, been a high tariff, but that alone could not explain the facts. There were many signs that the importance of the human side of the relations of employer to employed was obtaining increasing recognition. It was more and more felt that they were all members of one body, and, indeed, the recognition of the truth of that Christian axiom was the main hope for the progress of civilisation, not only in national but international relations. He was happy to say in that connection that the relations of their management to the workmen continued to be, as they had always been, excellent. It had always been the endeavour of the management to foresee and anticipate the emergence of grievances, and the establishment a few years ago of a works committee had greatly helped in the prompt settlement of difficulties. With a view to still further improving the relations with the employés, the Metropolitan Co. had set aside the large number of 100,000 shares for subscription by them, and facilities would be given by way of advance on easy terms to enable the shares to be taken up. From the experience in past years of increased efficiency obtained by the grant of bonuses to members of the staff, he had great hope that advantage might be largely taken by them of that offer of shares. To return to the prospects of the business, he saw reason to think that in their particular industry, and in their particular case, there was no cause for despondency. As he said several years ago, the demand for electrical products was likely to be very large in an era of general reconstruction. Numerous Government reports, emphasised only this week by the introduction of fresh legislation, dilated upon the economy running annually into countless millions to be effected by the development of electrical power in this country and abroad; especially in the countries devastated by war, the field for its use was immense. But competition would be keen, not only from Germany, whose productive machinery, developed to the highest point before the war, had not suffered from it, but from other countries, especially America, which alone of the belligerents had actually made pecuniary gain, and that to a vast amount, out of the war. America was already competing keenly even in the most distant markets, and only by low cost due to greater output could England hope to hold her own. Individually their position was favourable. Their association with the Metropolitan Co. gave them great financial and selling strength, strength which had been within the last few weeks still further increased by the amalgamation of that company with the world-wide organisation of Messrs. Vickers. The new capital just raised would be applied to the extension of present and the creation of fresh manufacturing facilities, as well as to the development of their research and experimental department. As they knew for some time, they had had in operation a system of technical instruction which had obtained the commendation of the Minister of Education, and was serving as a model for similar systems in other factories. They hoped thus to secure such an increase of technical efficiency as would enable them to face, in combination with financial strength, competition no matter whence it came. As regarded the immediate future, he was glad to say that the amount of their orders at the end of last year exceeded by £500,000 those on the books at the end of 1917, while the orders received in the current year showed a gratifying increase. On the whole, he looked to the future of the company with confidence, but before he left general questions, he must tell them of a point which might have a bearing on the future. In connection with the transfer of control from America to England agreements were entered into with regard to division of territories. There had recently been negotiations for a revision of those agreements, with the object of giving them greater freedom of action. One of the conditions of the amended arrangement—at present provisional only—was that the British company should cease to use the name of Westinghouse, their friends wishing to confine the name to themselves. Under present circumstances they were ready to comply with their wish, because they were satisfied that the British company was strong enough to be independent of any adventitious help from a mere personal name. The number of men in work on December 31st, 1918, was 5,328, and of women 1,762, making a total of 7,090. Under arrangements made with the trade unions women were being replaced by returning men, and the number of women employed on the 10th inst. was 700, as compared with the prewar figure of 520. As regarded labour cost, it would interest them to know that the percentage cost of male labour was in 1918 25 per cent., and of female labour 35 per cent. above the same costs respectively in 1917. The average weekly earnings of male and female labour, including that of boys, girls, and men on shifts in 1913 and 1918, were as follows: 1913, males, 29s. 5d., females, 12s. 7d.; 1918, males, 61s. 6d., females, 37s.; so that while male labour had risen a little over 200 per cent., female labour had risen 300 per cent. The change from war to peace conditions was proceeding by degrees, and the position was improving day by day, though it was still difficult to get skilled men to certain trades, which prevented their employing more men in classes of labour where the supply was good. Notwithstanding the general criticism as to the attitude of Labour, they as a firm had very little to complain of. They had been greatly aided in that respect by the beneficial action of the works committee. One happy result of the committee's working had been the diminution of accidents—there was only one fatal one during the year—and the number altogether was small. Having referred in detail to the educational activities of the company and to its record of service in connection with the war (mentioning that of 3,519 men who joined the Forces, 279 had made the great sacrifice), he concluded by referring with regret to the resignation of Mr. Lincoln Chandler, the managing director, in whose place Capt. Hilton had been appointed.

Sir Ernest V. Hiley, K.B.E., seconded the motion.

Replying to Mr. H. W. Birks, the Chairman said that now the excess profits tax was to be reduced the directors would doubtless be able to add a larger sum to reserve. With regard to the proposed change of name, it was not their seeking, but the agreement with the Metropolitan Co. gave them advantages which would more than counterbalance any disadvantages that might result from the company changing its name.

The report was adopted.

Johnson & Phillips, Ltd. The annual meeting was held on May 15th, Mr. W. Claude Johnson presiding. He said that the accounts showed a further considerable improvement. The trading profit for the year, after charging £13,965 for maintenance of buildings, plant, &c., amounted to £80,276, an increase of £10,000. The directors had thought it advisable to write a further £2,500 off patents, which reduced that item to £2,500, and also to transfer a further £10,000 to reserve. Rather more than half of the first mortgage debenture stock had been redeemed and paid for out of profits, and the assets of the company now exceeded the liabilities by £332,987, which showed very clearly that the business was in a thoroughly sound position. The amount of work in hand was very large, and new orders continued to come in in a very satisfactory manner. They included a large percentage of foreign and colonial demands, which was always a good sign. The value of research work was universally admitted. They more than ever realised the necessity for developing and continuing this work. They had established a laboratory devoted entirely to research work in electrical and physical science. Already they had an extensive programme, which was likely to extend over some years. The first fruits of this new development they hoped to exploit very shortly. They were confident it would yield beneficial results to the company. Proceeding to refer to the proposed increase of capital by the issue of 175,000 new ordinary shares, he said it was the intention of the directors to issue the new capital almost at once, and they had made arrangements with a well-known issuing house to purchase the whole of the 175,000 shares from them at a premium. They had stipulated that existing shareholders who were on the register should receive preferential treatment in allotment. He might say that for some years past the board had had in contemplation an issue of new capital in one form or another to cope with the continual expansion of the business. In consequence of the outbreak of war, however, the project had to be postponed. As a result the directors had felt obliged to place considerable sums annually to reserve, out of income, in order to provide the extra capital needed to carry on the business. Since the formation of the company in 1905, fourteen years ago, £95,500 had been set aside out of the profits of the business for depreciation, while during the same period over £95,000 had been expended (and charged against profit and loss account) for the repairs and maintenance of the property. Further, and he was sure they would appreciate the importance of the fact, during those fourteen years over £166,000 had been spent on new plant, machinery, and buildings. On the other hand, the only increase in the working capital of the business, other than that provided by the reserves he had mentioned, had been the issue in 1910 of £50,000 second debentures. Against this, however, a sum of over £80,000 had been spent in the redemption of the first mortgage stock of the company. But the reasons for providing more capital were very apparent also from other items in the balance sheet. Let them look at the item of creditors. The volume of trade they did was so great that they had been forced to work on credit, instead of taking full advantage of the usual trade discounts allowed on their purchases. If he added that during the current year they hoped to largely increase the turnover, it would be apparent to all that by taking advantage of those trade discounts alone a handsome dividend was provided on the new capital. Then they would be able to buy in the cheapest market for cash. Another point of equal interest was the fact that from want of adequate capital they had hitherto to husband their resources most carefully so as to provide the necessary funds out of profits, instead of distributing the same on a more liberal scale. As they saw, they had accumulated big reserves. He might say they were genuine reserves. They were going to put up additional buildings at once and equip them with the most up-to-date machinery to enable them to participate to the fullest extent in the anticipated increase of business. Of course, there were many important manufactures with which they would have to deal.

Subsequently a resolution was unanimously agreed to authorising the increase of capital as referred to by the chairman.

Brush Electrical Engineering Co., Ltd.

At the annual meeting on Monday, Mr. E. Garcke, chairman, said that the gross profit on trading for the past year was £157,000, compared with £89,000 in the preceding year, an increase of £68,000. They proposed a dividend of 18 per cent. on the ordinary stock, being 6 per cent. per annum for the three years of the war period, for which no dividend had been paid. They would thus have paid dividends averaging 6 per cent. per annum for the five war years. The capital and the assets were written down very heavily some years ago, so that the company was now in a very strong financial position. They were engaged during the past year in turning out war material at full pressure. With the signing of the Armistice agreements were arrived at with the various Government Departments in respect of the war contracts which they had on hand, either for cancellation outright or for deliveries to be reduced to the minimum basis that would assist them in carrying on while changing over to their normal manufacturing lines. They had been successful in booking valuable orders, which included tramcars and trucks, motor omnibus bodies, and other rolling stock. They anticipated a good demand in that department for new stock and renewal parts. On the engineering side the demand for their standard productions had been active during the war, and they found themselves immediately called upon for an increased output of the Brush-Ljungström sets, transformers, and other auxiliaries. Further extensions of buildings and plant to cope with the situation were well in hand at Loughborough. The outlook as regarded that section of their business was encouraging. Without increased production the export trade of the country must suffer so long as the cost of material and labour remained on its present scale. Their relations with their workpeople had been harmonious throughout the year. Their prosperity was conditioned by the labour situation and by impending electrical legislation. The best kind of electrical legislation at the present moment would be the repeal of previous Acts, and the appointment of judicial and competent commissioners who would listen impartially to the representatives of divergent views, and then decide what was the best thing to be done in each particular case, due regard being had to general experience. The administrative machinery required must be such as would enable the industry to do its work without political interference.

Submarine Cables Trust, Ltd.—For the year to April 15th revenue amounted to £27,319 and expenses to £1,934, leaving £25,385; £93 was brought forward, making £25,478. After providing £14,268 to meet payment of coupons, £11,144 has been transferred to the redemption fund and £66 carried forward.

Brisbane Electric Tramways Investment Co., Ltd.—Dividend 4s. per share, free of tax, on the ordinary shares, making 8 per cent. for the year; £20,000 to the reserve, and £28,202 carried forward.

Lima Light, Power & Tramways Co.—Net profit £P147,196, plus £P94,360 brought forward. After paying dividends and providing for general amortisation fund reserve, stores, repairs, &c., £P95,063 is to be carried forward.

Electric Construction Co., Ltd.—Final dividend at the rate of 9 per cent. per annum on the ordinary shares, making 7½ per cent. for the year, plus a bonus of 2½ per cent. on the ordinary, less tax.

Altrincham Electric Supply, Ltd.—Dividend of 9s. per share (against 3s. 6d.) on the deferred shares. It is proposed to increase the capital to £100,000 by the creation of 50,000 new shares of £1 each.

Siemens Bros. & Co., Ltd.—Final dividend of 5s. per share, free of tax, making 10 per cent. per annum, free of tax, for the year ended December 31st last.

Edison Swan Electric Co., Ltd.—Interim dividend of 3 per cent. (less tax) in respect of old ordinary shares.

Babcock & Wilcox, Ltd.—Final dividend of 9 per cent., making 15 per cent. for the year.

Vera Cruz Electric Light, Power & Traction, Ltd.—Interim dividend of 5 per cent., less tax.

Alley & Maclellan, Ltd.—After providing for excess profits duty, writing off £12,071 for depreciation of property, plant, machinery, &c., and transferring £20,000 to reserve, a dividend of 6 per cent. for 1918 is to be paid, carrying forward £8,763.

STOCKS AND SHARES.

TUESDAY EVENING

STOCK EXCHANGE business is still remarkably active. Money continues to flow into the markets. Speculation flourishes Investment is on a broad scale. Strength in Consols and the War Loans finds reflection in all other gilt-edged securities. An exception is furnished by London electricity supply shares. This department is weaker in consequence of the second reading of the Government Bill.

Various West End electricity shares have suffered. Westminsters, Chelseas, Kensingtons, and Londons are amongst them. The falls range from 2s. 6d. to 7s. 6d. There is no great pressure to sell, but the market looks for possible realisations on the part of holders, and a few selling orders started the list crumbling, because there is no particular backing for the moment, owing to the uncertainty. The clauses in the Bill that give rise to uneasiness in the minds of the investor were quoted here last week, and although nothing definite is expected to materialise for a long time to come, and although strong opposition will be raised to some of the proposals, the outlook is obscure, and this checks buying even if it does not induce much selling.

Meanwhile, the manufacturing shares continue to show marked strength. What may be poison for supply companies is regarded as stimulant for the manufacturing concerns. Edison Swans have risen to 25s. 9d., and the new shares to 1s. premium. General Electrics maintain their big advance. Electric Constructions keep good at 25s. 6d. The dividend and bonus, making 10 per cent. for the year, are the same as for 1917. English Electrics have hardened to 27s. 9d. British Insulated jumped to 2¼, although in this case the reason is attributed to the large interest the company is stated to hold (or to have held) in Automatic Telephone shares, which have recently enjoyed so substantial an advance, and which are now quoted 37s. 6d. The cable manufacturing issues are also firm. Telegraph Constructions have gone up to 25½, Callenders to 10¼, and other shares in this group, although unchanged nominally, are as hard in tone as they are to buy. Concurrently, Siemens have touched 7, the new being 6⅝, and various of the explosive descriptions improved, Vickers amongst them. Babcock & Wilcox receded to 3¾, a reaction of 5s., upon disappointment that the dividend is maintained at 15 per cent (tax free), without any mention of the long-expected bonus. But some say that this is merely a postponement India-Rubbers are 12s. 6d. up. British Aluminium lost their last week's improvement.

Marconis have jumped to 6 7/16, fresh buying being set in action by the news that the company's claim for compensation will be heard early next month. The preference kept pace at 5¾. Spanish and General have been resurrected, with business round about 16s. Americans fell back to 31s. after being 33s.; guesses at truth hint at an unsympathetic attitude on the part of the U.S. Government towards privately-owned wireless enterprises. Canadian Marconis have gone back from 19s. to 17s. There was a fairly heavy bull account in both Americans and Canadians, and probably the rise brought in the profit-taker.

One of those quick changes for which the market is famous (or notorious) has just taken place in Mexican issues, Government, railway, and utility. According to rumour, the Mexican President has been informed plainly by Great Britain, France, and America that unless immediate steps are taken for quelling internal disturbances in Mexico, the result may be unpleasant for the President. Official confirmation has not been received so far, but it is significant that some of the Mexican securities have risen as much as 10 points during the past week.

The Utility bonds and shares are better, though not to any dramatic degree so far. Rio Tramways bonds further hardened with another rise in the exchange. Reports have come in this week showing what extraordinary effects were produced by the influenza epidemic in Rio; business paralysed, transport almost entirely stopped, and everything held up while the 'flue was at its height. Brazilian Tractions have gained 5 points.

Victoria Falls Power ordinary have gained a trifle at 22s., and the preference at 26s. 3d., on the liveliness in Kaffirs which has been dignified by the name of a boom. That something will be done very shortly to help the gold-producing industry is at the root of the animation. Of the foreign division, British Columbia Electrics made a good showing, and substantial recoveries are to be noted. Anglo-Argentine Trams are rather better. Home Railways continue to give way, Metropolitans and Districts being 1 and ½ lower respectively.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies

	Dividend 1917.	Dividend 1918.	Price May 20, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	10	8	6¾	—	£5 8 16
Charing Cross Ordinary	4	4	3¼	−¼	6 9 1
do. do. do. 4½ Pref.	4½	4½	6½	—	6 18 4
Chelsea	6	8	8¾	−3/16	4 2 9
City of London	8	8	11⅛	+⅛	6 14 6
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 3
do. do. 6 per cent. Pref.	6	6	9⅞	+⅛	6 1 1
Kensington Ordinary	7	6	5¾	−⅛	5 4 4
London Electric	Nil	Nil	1⅜	−⅛	Nil
do. do. 6 per cent. Pref.	6	6	3⅛	—	7 14 10
Metropolitan	4	6	8⅛	—	8 0 0
do. 4½ per cent. Pref.	4½	4½	8½	—	6 18 8
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	5	5	2¾	—	7 5 6
South Metropolitan Pref.	7	7	20/8	—	6 16 7
Westminster Ordinary	9	8	6⅛	−⅛	6 10 8

Telegraphs and Telephones.

	Dividend 1917.	Dividend 1918.	Price May 20, 1919.	Rise or fall.	Yield p.c.
Anglo-Am. T l. Pref.	6	6	99	+½	6 1 0
do. Def.	1½	33/6	22½	—	7 8 0
Chile Telephone	8	8	7⅜	—	5 8 6
Cuba Sub. Ord.	7	7	11¼xd	+¼	*6 4 5
Eastern Extension	8	8	16⅜xd	—	*4 17 9
Eastern Tel. Ord.	8	9	164½xd	—	*4 17 8
Globe Tel. and T. Ord.	7	8	16⅛	—	*4 19 3
do. do. Pref.	6	6	10½	—	5 14 8
Great Northern Tel.	22	22	32	+1½	5 17 6
Indo-European	13	13	55xd	—	5 18 2
Marconi	20	20	6⅜	+⅛	3 2 6
Oriental Telephone Ord.	10	15	2⅜	[illegible]	6 4 9
United R. Plate Tel.	8	8	7⅛	—	*5 1 7
West India and Panama	1/3	1/3	1⅛	—	*4 8 4
Western Telegraph	8	8	17⅛	+½	*4 12 9

Home Rails.

	Dividend 1917.	Dividend 1918.	Price May 20, 1919.	Rise or fall.	Yield p.c.
Central London Ord. Assented	4	4	63½	—	6 6 0
Metropolitan	1	1½	27	−1	4 12 7
do. District	Nil	Nil	24½	−½	Nil
Underground Electric Ordinary	Nil	Nil	3½	—	Nil
do. do. "A"	Nil	Nil	9/3	+3d.	Nil
do. do. Income	4	5	95	−½	*6 5 3

Foreign Trams, &c.

	Dividend 1917.	Dividend 1918.	Price May 20, 1919.	Rise or fall.	Yield p.c.
Adelaide Sup. 6 per cent. Pref.	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref.	5½	Nil	3⅝	+⅛	—
do. do. 2nd Pref.	—	—	3	—	—
do. do. 5 Deb.	6	5	68½	—	7 8 5
Brazil Tractions	—	—	64	+5	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	60½	+½	8 5 4
do. do. Preferred	Nil	Nil	41½	+4	Nil
do. do. Deferred	Nil	Nil	41½	+9	Nil
do. do. Deb.	4½	4½	62	—	6 17 4
Mexico Trams 5 per cent. Bonds	Nil	Nil	60½	+½	Nil
do. 6 per cent. Bonds	Nil	Nil	45½	+2½	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	67	—	—

Manufacturing Companies.

	Dividend 1917.	Dividend 1918.	Price May 20, 1919.	Rise or fall.	Yield p.c.
Babcock & Wilcox	15	15	3⅞	−⅛	3 17 6
British Aluminium Ord.	10	10	1 11/16	−1/16	5 18 6
British Insulated Ord.	25	12½	2¼	+1/16	5 11 1
British Westinghouse Pref.	7½	8	2 11/16	+3/16	5 19 6
Callenders	25	25	10¾	+¼	6 3 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	3¼	—	6 3 1
Edison-Swan, "A"	—	—	1 3/32	+3/32	5 17 0
do. do. 5 per cent. Deb.	4	5	75½	—	6 12 3
Electric Construction	10	10	1 9/32	—	7 16 0
Gen. Elec. Pref.	6	6½	10½	+⅛	6 3 10
do. Ord.	10	10	22	—	*4 11 0
Henley	25	25	2⅜xd	—	5 5 3
do. 4½ Pref.	4½	4½	3⅝	—	6 16 2
India-Rubber	10	10	17¼	+⅝	*5 16 0
Siemens Ord.	—	10	6 7/16	—	*7 4 0
Telegraph Con	20	20	25½	+½	4 13 6

*Dividends paid free of Income Tax

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, May 21st.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	"	£78	..
a Bisulphide of Carbon	"	..	..
a Borax	"	£39	£6 dec.
a Copper Sulphate	"	£42	..
a Potash, Chlorate	per lb.	1/6	3d. dec.
a " Perchlorate	"	1/3	6d. dec.
a Shellac	per cwt.	£16	£1 inc.
a Sulphate of Magnesia	per ton	£16	..
a Sulphur, Sublimed Flowers	"	£28	£3 dec.
a " Lump	"	£20	£3 dec.
a Soda, Chlorate	per lb.	10d.	..
a " Crystals	per ton	170/-	..
a Sodium Bichromate, casks	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	11⅝d.	..
c " Tubes (solid drawn)	"	1/2¼ to 1/2½	¼d. dec.
c " Wire, basis	"	1/-	..
c Copper Tubes (solid drawn)	"	1/3¾	¼d. dec.
g " Bars (best selected)	per ton	£114	..
g " Sheet	"	£114	..
g " Rod	"	£114	..
d " (Electrolytic) Bars	"	£83	£2 inc.
d " " Sheets	"	£161	..
d " " Wire Rods	"	£91	£2 inc.
d " " H.C. Wire	per lb.	11 9/16d.	½d. inc.
f Ebonite Rod	"	5/-	..
f " Sheet	"	2/6	..
n German Silver Wire	"	2/6	..
h Gutta-percha, fine	"	11/-	..
h India-rubber, Para fine	"	2/5½	1d. in.
i Iron Pig (Cleveland warrants)	per ton	Nom.	..
l " Wire, galv. No. 8, P.O. qual.	"	£40	..
g Lead, English Pig	"	..	..
g Mercury	per bot.	Nom.	..
e Mica (in original cases) small	per lb.	9d. to 4/6	..
e " " " medium	"	5/- to 10/-	..
e " " " large	"	12/6 to 25/- & up.	..
d Silicium Bronze Wire	per lb.	1/4	½d. inc.
r Steel, Magnet, in bars	per ton		..
g Tin, Block (English)	"	£235 to £236	£12 inc.
n " Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

Stock Exchange Notice.—The following are to be officially quoted:—

Crompton & Co., Ltd.—76,769 ordinary shares of £1 each, fully-paid (Nos. 1 to 76,769); 133,760 preference shares of £1 each, fully-paid (Nos. 1 to 28,342 and 30,583 to 136,000); and £130,000 6 per cent. first mortgage registered debentures (Nos. 1 to 1,250 and 1,451 to 1,550) (£100 and £50).

Bath Electric Tramways.—The report for the year 1918 states that after charging £10,614 for repairs and renewals, including £3,954 brought forward, after deducting £1,876 for special expenditure, there is an available balance of £24,892, out of which the following amounts have been deducted: £5,628 for interest on 4½ per cent. first mortgage debentures, £1,000 for sinking fund, £502 interest on loan, £432 expenses on issue of debentures in past years, £3,750 for dividend on preference shares, leaving £13,580. From this £7,500 has been transferred to renewals and £6,080 to replacements and contingencies.

Launceston & District Electric Supply Co., Ltd.—During 1918 the revenue receipts were £1,279, as against £1,073 in 1917, and the working expenses £672. Consumers increased from 246 to 265, and lamps connected from 7,698 to 8,661. Motors connected now number 19, with a total of 58 H.P. Gross profit £606, after deducting bank charges and preference dividend, paying 3 per cent. on the ordinary shares, putting £150 to depreciation, writing £50 off preliminary expenses, and putting £75 to reserve. £53 is carried forward.

West India & Panama Telegraph Co., Ltd.—The amount to credit of revenue for 1918 is £120,162, and the expenses have been £91,463, leaving £28,688, plus £3,324 from interest on investments and £5,268 brought forward. £5,000 has been placed to general reserve, and the directors propose to pay final dividends for the year on first and second preference shares at 6s. per share, and on the ordinary shares 6d. per share and a bonus of 3d. per share, both free of tax, carrying forward £3,222. Although traffic receipts show an increase, this has been more than counter-balanced by the increased cost of labour and materials.

British Electric Transformer Co., Ltd.—Dividend of 7 per cent., and 2½ per cent. bonus, on the ordinary shares, making 12½ per cent. for the year; £2,000 to depreciation reserve; £7,500 to reserve; £1,178 for directors' extra remuneration, and £3,964 carried forward.

THE ELECTRIC AUTOMOBILE FOR COMMERCIAL USE.

By FRANK AYTON, M.I.E.E. (Hon. Secretary of the Electric Vehicle Committee of Great Britain.)

(Abstract of paper read before the Association of British Motor and Allied Manufacturers, Ltd.)

My main object in presenting this paper is to establish the view that British automobile manufacturers may with advantage take up the building of electric vehicles, especially those for commercial purposes, as an adjunct to the construction of the petrol types.

As one who, for some years, has studied the question very closely, and who has for a long time been an ardent petrol motorist, I see no possibility of the electric ousting the petrol vehicle in any sphere but that of short-distance, frequent-stop work. Experience indicates that to each particular type, petrol, steam, and electric, belongs a fairly well defined sphere of utility. The manufacturer who can offer to his customers vehicles suited to every class of work will undoubtedly place himself in a position of advantage.

The electric is essentially a moderate speed vehicle, and its radius of action is limited by the mileage which can be obtained from the fully charged battery. This characteristic limits its sphere of useful application, generally speaking, to urban and suburban districts. When stops are frequent, and where busy thoroughfares have to be negotiated, there are other advantageous features, *i.e.*, ease of manipulation, due to the absence of any "change speed" gear, high rate of acceleration, automatic cessation of power consumption when standing, and the self-starting characteristic of its power unit. Still other points of merit include the absence of fire risk, enabling it to be taken into premises without affecting the fire insurance thereon, and simplicity of operation. The most valuable and important features are economy in operating cost and reliability, due to low cost for repairs, longer life usually obtained from tires, economy in power, the initial efficiency does not suffer declension with wear or period of use to anything like the extent it does with petrol or steam vehicles, and to the fact that weather and atmospheric conditions have no bearing upon its efficiency and capability for doing the day's work.

A 3-ton lorry fitted with the usual size of battery will cover from 35 to 40 miles on one charge, given fairly level and good surface roads. In the case of light electric passenger cars, a considerably greater mileage per battery charge is now obtainable. Over give-and-take roads of average quality, 70 or 80 miles per charge is quite common, while authentic records exist of distances of the order of 100 miles, more or less, having been covered.

The petrol vehicle finds its sphere largely in performances which are impossible for the horse; the electric enters into competition with the horse, and will rapidly displace him. I foresee the time when, with the establishment of charging stations at frequent intervals along all our main roads, electric road transport services between towns will be inaugurated for goods in connection with which the time taken for transit is not of first importance. The advent of that development will be materially hastened by the adoption of a system of interchangeable batteries. The Electric Vehicle Committee had the standardisation of battery boxes and means of supporting them under consideration, but came to the conclusion that the time was hardly ripe for action.

It has often been asserted that the electric vehicle is too slow. Quite apart from the limit to its radius of action, this characteristic in itself militates against competition with the petrol vehicle for long-distance work. But in the sphere for which it is proved to be suitable, high maximum speed gives little, if any, advantage. In traffic the rapid acceleration of the electric gives it an appreciable advantage over the petrol type.

The results obtained in Birmingham in the application of electric vans for bread delivery go to prove the fallacy of the contention that the electric is wanting in speed. The first electric 30-cwt. van acquired by the firm was put on to a round that had up to then been covered by a modern type of petrol van of the same size. The work comprises a round of 11½ miles, with some 50 delivery stops, which is covered three times per ordinary week-day and four times on Saturday. Compared with the average time taken by the petrol vehicle to do the trip, a saving of 30 minutes per trip was made by the electric. The weekly cost of electrical energy for this vehicle averaged 13s. 4d., while the cost of petrol for the vehicle previously in use averaged £2 10s. In 1917 Mr. J. A. Priestley, of Sheffield, made some careful tests over a measured mile in order to ascertain the travelling time, with a definite number of stops, of a 20-h.p., 2-ton petrol car of one of the best makes, a 2-ton Edison electric vehicle, and a horse-drawn vehicle consisting of a single horse drawing a four-wheeled covered wagon. Two tests were made, "A" being with a stop every 10 yd., and "B" with a stop every 20 yd. The times taken for covering the distance of one mile were as below :—

	Test "A."	Test "B."
Horse and cart	33.52 mins.	32.40 mins.
Petrol wagon	14.80 mins.	10.85 mins.
Electric wagon	11.33 mins.	9.33 mins.

The greatest development has taken place in the United States, and comparatively few people on this side of the Atlantic appreciate the extent to which electric vehicles are employed in that country. It is computed that the number of electric vehicles of all types in use there is over 70,000. In 1917 the new vehicles sold during the previous year totalled some 8,000, of which approximately 2,500 were of the commercial type. The remainder consisted of about 4,000 cars of the private passenger carrying type, and about 1,500 industrial trucks.

It is hardly likely that the large fleets of electric vehicles have been acquired for any other reason than that their use gives the desired service at the lowest possible cost, and with complete dependability.

In this country the adoption of the electric for commercial purposes has, considering the difficulties due to the war, made fair progress. Actual testimony from users is, perhaps, the best evidence that can be adduced in support of the claims made on behalf of the electric.

I am convinced that it will not be long ere our large cities, particularly London, will be served by electric taxicabs. It is noteworthy that in the very home of the petrol car in the United States, viz., Detroit, electrics on the streets are showing a marked economy over petrol cabs, the operating expenses of the former, including drivers' wages, establishment charges, interest, depreciation, electricity, repairs, garage and tire expenses, averaging only 60 to 66 per cent. of the cost of operating the petrol cabs. The public in Detroit show a distinct preference for the electric cabs, and will often wait a considerable time for the return of an electric cab rather than take a petrol cab standing on the rank. Schemes are afoot to establish electric taxicab fleets in New York and other large cities in the States. With electric taxis built, as they are to-day, to run at maximum speeds of 25 m.p.h., and with a range of action of from 60 to 75 miles on one charge, it must be obvious that there is an opening for their extensive employment. They can be arranged for battery substitution, and in this way may be kept in service for long hours at a stretch.

Within the last few years certain British engineering firms have taken up the manufacture of these machines, and it is satisfactory to be able to say that at the present time commercial electric vehicles are being built in this country which compare most favourably with the best makes from America. The greatest electrical improvement that has taken place is in the battery.

It may be said that between the Ironclad-Exide and the Edison accumulators, from the point of view of reliability and cost of maintenance, there is very little to choose. It must not, however, be assumed that what is known as the ordinary flat plate type of lead-acid accumulator is unsatisfactory, though there have been many failures in connection with it in the past. The flat plate type is not able to withstand the effects of vibration so well as the Ironclad-Exide or the Edison types, and consequently its life is appreciably shorter. I have confidence, however, that British accumulator manufacturers will, in a very short while, be able greatly to improve the flat plate cell, giving it a considerably longer life than it at present possesses.

The usual design of commercial electric vehicle embodies the use of a single centrally-located series wound electric motor driving the rear wheels by a double chain transmission. The usual drive is from the motor spindle to the counter-shaft, by a tooth type silent chain. The driven sprocket on the counter-shaft is combined with the differential. From sprocket wheels fitted to the ends of the counter-shaft, roller type chains transmit the power to the road wheels. This simple arrangement has proved very satisfactory, and is employed in by far the greater number of vehicles constructed in America. Another method is to drive the counter-shaft through bevel gear, the bevel pinion being connected to the motor by means of a connecting-shaft, which, due to its torsional flexibility, gives a cushioning effect in starting, and acts as a flexible shaft. In the case of light delivery vans the live axle drive, with either bevel or worm gear, is very frequently employed, the motor in most instances being mounted directly on the forward end of the propeller shaft casing, this arrangement making it possible to connect the armature to the propeller shaft without the intervention of a universal joint. Some departures from the standard practice embody a front wheel drive, which is giving satisfactory results in service. In this case there are two motors, one to each wheel, the power being transmitted to the latter by a single reduction gear, which consists of a helical tooth pinion meshing with a gear wheel having internal teeth, which is attached to the inside face of the road wheel. In the case of the rear wheel drive a single reduction spur gear between each motor and the driving chain sprocket is employed, an ordinary roller chain transmitting the power from this sprocket to the road wheel.

The two-motor arrangement eliminates the necessity for a differential; it also economises current when use is made of the series parallel system of control. There are a few special designs in which the driving motor is enclosed within the road wheel; the balance gear drive, in which the motor casing is incorporated in the back axle; and the concentric gear drive.

In the design of commercial electric vehicles, it is important to eliminate friction to the greatest possible extent, and to provide for moderate speeds only. As to the most suitable speeds, those given below may be taken as a fairly good guide :—

Carrying capacity.	Speed, m.p.h.
1,000 lb.	12 to 13
2,000 lb.	10 to 11
3,000 lb.	10
2 tons	8 to 9
3 tons	7 to 8
4 tons	6½ to 7½
5 tons	6 to 7
6 tons	6½

The series wound traction motor is of the most robust type, as is evidenced by the low cost of upkeep. It is a very rare thing for an electric vehicle motor to give trouble. A remarkable feature is the manner in which the motor will perform its duty for years with the very minimum of attention.

The electric road vehicle enables a given weight of goods to be moved a given distance in the urban transport service at a cost which, for economy, is not reached by any other method. The automobile motor of to-day is compact, comparatively light in weight, and very efficient in the use of current. The standard motors are wound for 80 volts for use with the lead-plate battery, and for 60 volts for use with the Edison battery. Any departure from the standard of 40 to 44 lead plate cells, or 60 cells of the Edison type, is to be deprecated. The speeds for which electric vehicle motors are usually designed vary from 800 to 1,700 R.P.M., the actual speed in any instance being dependent upon the type of drive employed and the gear ratio selected.

In American automobile motors, the capacity is generally based on continuous operation at full load with a maximum temperature rise of 65 deg. C., and they are rated to carry two and a half times the normal full load for one hour with a maximum temperature rise of 75 deg. C. above the temperature of the surrounding air. The size of motor employed is that which will be loaded to its rated capacity when the vehicle is running at the normal rated speed on a hard level road and carrying the full load for which it is designed. Experience has shown that for commercial electric vehicles the "unsaturated" motor gives the best results, and this type is always employed. The use of the "saturated" type is confined to light passenger cars, where a higher speed on gradients is desired.

In America the large business connected with the manufacture of electric vehicles has been built up by co-operation between the firms constructing the vehicles and the electrical manufacturers. It is certain that automobile builders who are proposing to take up the construction of electrics will find it to their advantage to leave the manufacture of the motors, switchgear, and batteries in the hands of those who are already engaged in such work. Working upon such lines, there ought to be no difficulty in the way of any automobile builder taking up the construction of the electric, seeing that much of the chassis work is very similar to what he is already providing for petrol vehicles.

Discussion.

In the discussion that followed the reading of the paper it was generally agreed that the electric was essentially a short-distance, frequent-stop vehicle. It had its particular spheres of usefulness, and was not in any sense a competitor of the petrol vehicle. Several speakers expressed the opinion that the electric taxi-cab would be shortly re-introduced in this country. Surely if the present petrol cabs could be run at a profit in the very bad state they were in to-day, then the electric cab could be also run at a profit. With regard to pleasure vehicles the conditions were different. In America most towns were self-contained, and the vehicle was in consequence not required to go beyond the radius of the city. On the other hand, in this country pleasure vehicles were often required to travel long distances from town to town.

On the road, electrics seldom required attention, and they were practically weather and fool proof. During the recent snowstorms electrics had negotiated roads and hills quite safely where petrol omnibus traffic was held up. In the garage, however, the electric required constant attention; nothing very serious, but it had to be constant and intelligent attention. It was merely a question of following certain rules and directions, and it was upon the attention received in the garage that the performance of the electric when on the road depended. Electrics were very simple to handle; women had driven large 2½ and 3½-ton vehicles after very little tuition. Repairs could be easily and quickly carried out, whereas repairs to petrol vehicles often involved dismantling the engine, and took much time. The danger of judging electric vehicles by operating costs was pointed out. Such costs could be very misleading at times, because the conditions under which vehicles operated varied so very much. The safest thing to go by was the opinions of actual users. It would be found that in all cases where firms in this country had adopted electrics on a sufficiently large scale the results were favourable; in every case the fleets had been added to.

With regard to batteries, there was very little to choose between the two leading types; good results were obtained with both. A speaker pointed out that there always seemed to be a doubt about the capabilities of a modern high-class battery. The public always seemed to be afraid of batteries, and all makers conveyed the impression that there was some sort of secret about them. There was really no such thing; it was all a matter of ignorance. If the public could be taught exactly what a battery was, and just what it was capable of doing, the whole thing would become perfectly straightforward.

With regard to the high cost of electric vehicles, those imported into this country were naturally expensive on account of high freight. Those manufactured here would continue to be expensive until produced in sufficient quantities to lower the cost of manufacture. To those petrol or steam vehicle manufacturers who contemplated taking up the manufacture of electrics a note of warning was given. Although it was agreed that it would be to their advantage to manufacture such vehicles, they should do so in conjunction with other firms, and not attempt to make everything themselves. For instance, such specialities as control gear, electric motors, and batteries should be left to those firms whose business it was to make and specialise in such things. Electrics had suffered much in the past owing to some defect in a component part of the whole which could have been produced much more satisfactorily by a specialised maker.

LARGE POWER TRANSFORMERS.

At Manchester, on March 11th, Messrs. A. G. Ellis and J. L. Thompson's paper (an abstract of which appeared in our issues of May 9th and 16th) was read and discussed before the North-Western Centre of the Institution of Electrical Engineers.

Mr. H. G. Furlong did not agree that opportunities had not been afforded to manufacturers for making large transformers in this country; there had been, and still were, such opportunities, but manufacturers frightened customers by describing the imaginary difficulties of designing and making large units. There was no reason why three-phase transformers should not be made in single units of the same capacity as turbo-generators. The transformer would occupy less space, the total weight would be much less, and the capital and running costs would be lower than with a group of small sets. It should be more reliable. Transformers above 5,000 K.V.A., 50-period, 3-phase, should certainly be forced-cooled. A thermostat could be fitted to warn the attendant in the main station, or to operate the switch relay and cut the transformer out of circuit. The core and the circular shell-types had great advantages over the shell type, as the coils were in direct contact with the oil. In the core-type it was a simple matter to arrange straight oil ducts of ample size so that they could be easily cleaned without dismantling. The authors' contention that the shrinkage of insulation on a shell-type was less was not convincing. The assumption that the shrinkage was entirely due to pressure was not correct. The electromagnetic inter-action of the primary and secondary coils produced pressure on the insulation due to the repulsive action between the two windings, and this was the principal cause of shrinkage. The compression stresses were in many cases greater than the stresses due to the weight of copper in the core-type transformer. The slightest amount of shrinkage was of great importance, and should in some way be taken care of. Insulation had been one of the greatest problems to transformer manufacturers during the war, but fortunately it had now been practically solved by the larger firms installing their own plant and manufacturing insulation suitable for their requirements. Springs should not under any conditions have to take the electromagnetic strains, but should only take up shrinkage and hold the coils against fixed abutments. The electromagnetic strains should be taken by the fixed abutments; consequently the only satisfactory way of using springs was to divide the coils at the magnetic centre and place the springs there. The safety factors given were quite reasonable. If all engineers would work to the British Standard Rules and not subject their transformers to overloads under any condition, these safety factors could be reduced, the prices lowered, and the design improved. He was surprised the authors had omitted to mention furnace transformers. He had been responsible for the design and manufacture of numerous furnace transformers ranging from 150 to 10,000 K.V.A., some were shell-type, others core-type, and they were equally satisfactory.

Mr. G. D. Sills said that the importance of drying out transformers was not usually recognised by the purchaser, and it was quite impossible to dry out on site as thoroughly as it could be done in vacuum in the works. The amount of air, or rather space, which should be available round transformers was often overlooked. He had seen three sets of transformers, at three different stations, actually placed in pits. There had been dissatisfaction with water cooling, but he thought it had often been because the right material had not been used for the pipes. The proper thing to use was lead alloy, which could be bought in one piece, and could stand up to 250 lb. pressure, which was quite ample. Moreover, comparatively impure water could be used. On the question of stations being in out-of-the-way places, it seemed to him it would be much better to put in smaller self-cooled units. No mention had been made of the building cost. In a large station with modern three-phase transformers a considerable amount could be saved in the building. It seemed to him the authors had made out a very good case for the shell type, but he thought that a better case could be made out for that type with butt joints, because of the ease of assembling; bracing could be done in a much more satisfactory manner than with interlaced joints. The previous speaker's remark about the coils in the core-type being in direct contact with the oil was rather misleading. There was no layer in direct contact with the oil, but in most cases one had to transmit heat through two or three layers to the oil itself. With a well-defined shell-type transformer one could certainly have oil on at least one side for the whole coil—what might be called the pancake coil—and on the heavier coils it could be arranged to have oil on both sides of the coil. If the transformer was properly designed, and the depth of the coil made not more than, say, twice its thickness, the heat could very soon be got rid of. It seemed to him that electrical gear was now becoming a problem of mechanical construction. He agreed that too many transformers were bought without considering their construction. An apparatus had been made in this country, and was now in operation, for testing transformers up to half a million volts; it had actually done up to 475,000, and it was of 200-K.V.A. capacity.

Mr. Cridge explained that his experience was that less than 10 per cent. of transformers were shipped in oil; if that proportion could be increased it would be a very good thing. The railway companies had raised objections lately to shipping transformers in oil, or in tanks without oil, except at owners' risk. The authors had not made quite enough of the superiority of forced-cooled over water-cooled transformers of large size; they did not mention the increased size of transformers which could be put in the same tank. He hoped that the British Engineering Standards specification would be adopted; if every customer adopted it manufacturers would be compelled to follow. Referring to the authors' load curves, he pointed out that somebody should design a meter which would register the kilo-ampere-hours instead of the KW.-hours, in order that such loads might be charged for in the proper way. In his opinion, bracing could sometimes be overdone; with the rectangular shell-type coils serious distortion might take place at the end of such coils. A little freedom in that respect was desirable. The continental practice had been to use butt joints almost exclusively. Constant temperature was not reached until much later than was thought to be the case. One degree rise per hour was sometimes considered to be near enough to the final temperature, but it was not anything like constant. The only cure for sludge was to use a liberal amount of the best possible oil, and the transformer should not be allowed to overheat.

Mr. Watson said that, speaking generally, transformers gave far less trouble than any other apparatus handled in connection with supply problems. The fact that at 25 cycles transformers were 35 per cent. more costly and 40 per cent. heavier than they were at 50 cycles had not been driven home. He imagined it was more likely to become the practice to adopt single-phase rather than three-phase units in very large sizes by reason of the convenience and lower cost in providing spare units for use in an emergency. Three single-phase units would occupy a larger space than one three-phase unit, but in the majority of generating stations he did not think there would be much difficulty in providing that space. It added considerable value to the paper that a comparison of prices was given. In the past it had too often been a fault that different types of apparatus had been discussed without information being given as to costs. Pumps, oil tanks, and circulation arrangements, in connection with large units, led to appreciable expense, and it was not clear from the paper whether that was included or not in the prices given. Something required to be done in regard to the standardisation of sizes of transformers.

Mr. Williams agreed as to the advantage of transporting in oil, but that was not to be recommended for foreign shipment. There appeared to be a discrepancy with regard to the "crocodile" trucks which were said to be available in this country up to 50 tons loading weight. The authors seemed to assume that a transformer in a truck must be transported vertically. He had a strong liking for the shell-type transformer on account of its robustness. Personally, he had a decided preference for the single-phase as against the three-phase unit, particularly when it was of large size. One point which had not been brought out was that if a serious breakdown occurred in a three-phase unit the probability was that it would completely wreck the whole transformer, and the cost of rewinding was considerably greater than it would be with a single-phase unit. The water-cooled transformer of the cooling-coil type was a very poor device. With water cooling it was essential that the water should be at less pressure than the oil, so that if there was any leakage it would be from the oil to the water; he did not see how that could be satisfactorily done with the water coil at the top of the transformer.

Mr. H. T. S. Binns said that most of the points on which he disagreed had been covered by previous speakers. A great claim was made for the robustness of the shell type. A close study of the construction would show that the only means of support for the coils was the crossbar, since the clamps shown under running conditions did not come into play at all. Immediately shrinkage took place these clamps—which the authors particularly drew attention to, but which were not intended for taking up shrinkage—were no longer of any service. He suggested as a test of robustness that the experiment of hanging the transformer by one ring bolt instead of two should be made, when it would be found that very considerable distortion would result. He had seen a transformer weighing 14 tons, three-phase, core-type, hung up by one side only, and no distortion whatever took place. It had been mentioned that external supports with the rectangular shell-type were unnecessary, but he had seen a transformer of this type where the coils had burst and short-circuited.

Mr. J. F. Shipley said that the item of "woman labour" could be omitted from the summary of the paper. Transport restrictions were not mentioned, except the restriction of the import market in materials. He found there was nothing much to grumble about except the packing. Generally it received attention from the chief packer, never from the engineer. If manufacturers would get their engineers to design the packing a great improvement would follow. Shipping transformers in oil, complete, could be done very well when shipping from one big port to another, but where it was necessary to tranship or unload at sea separate packing cases had to be used for everything.

Mr. W. Parry said that some information with regard to transport along the roads on trucks, and also relative to furnace transformers would be useful. The suggestion that lead-alloy pipes could be put in parallel applied to copper pipes as well, getting rid of the joints in a similar way. With regard to failure of large transformers on the Rand, it was found that the pipe used had not been extruded correctly; there were patches in the walls owing to crude water, which had run right through and affected the transformer. That point should be watched. Oil could be circulated along both sides of the coil in the shell type, but not in the core type. Most of such coils were wound two sections together, separated simply by a washer, but the oil had free access to one side of each coil. In order to get the oil on both sides, the sections would have to be split up again into two separate coils, thereby wasting nearly twice as much space in ducts. That was entirely unnecessary, because the conductivity of the copper across that small space was quite sufficient to prevent any temperature drop. The same thing applied to core types of transformers, but there the spaces between the coils were radial; consequently, the sludge could be easily cleaned out, which could not be done on the shell type.

Mr. Ellis, replying to the discussion, said that in connection with the question of the shell-type *versus* the core-type, the discussion of the relative merits was usually prejudiced by the particular views and experience of individual manufacturers and power supply engineers. He had not been wholly converted to the shell type, but in writing the paper the point of view was to get down to an impartial statement of the facts, and that they had really tried to do. The time was opportune for a general and fair statement of all the facts concerning transformer design and operation, and the main object in writing the paper was to bring that under discussion. The prices given in the paper were present-day prices; they were only given for guidance. The prices given with regard to the forced-cooling transformer included the full equipment. Mr. Sills referred to a device which prevented sludge. That controversy had lost much of its interest owing to people realising the importance of having a decent non-sludge oil, and not a cheap variety, such as was probably the reason for the oil-expansion chamber being originally invented. If they had included in the paper everything that everybody had called for they would have written an encyclopædia. He hoped at a future date to be able to deal with other questions. In view of the inter-linking questions which were coming on, they gave at the end of the paper sufficient indications of the general lines on which they should attack those problems. They deliberately left out furnace transformers. The paper was intended to be written from the point of view of a large central station, and the question of furnace transformers merited complete treatment by itself.

Industrial Lighting.—It is estimated that, in the United States alone, accidents due to poor lighting rob industries of the services of more than 100,000 men for an entire year. During recent years, increased quantity of light has been used in industries, but there has not been the same progress in the use of suitable reflectors or other light-directing devices. Nevertheless, the proportion of industrial accidents chargeable to poor lighting has fallen from 25 per cent. in 1910 to 18 or 20 per cent. in 1918. Industrial lighting curtailment as a measure of economy is based on a fallacy, for the resultant decrease in production and increase in accidents far more than counterbalance the saving in energy consumed by lighting.

British Oil.—The oil borings by Messrs. Pearson, Lord Cowdray's firm, near Chesterfield, are progressing. At the Hardstoft No. 1 boring, a depth of 2,800 ft. has been reached, and the indications are regarded as favourable. The next deepest boring is Brimington No. 1, 1,800 ft., and a flow of natural gas gave rise to a rumour that oil had actually been found. Two other borings have been started in Staffordshire.

THE SUPPLY OF ELECTRICITY.

By J. S. HIGHFIELD, M.Inst.C.E., M.I.E.E.

(*Abstract of paper read before the* Royal Society of Arts.)

The recent publicity given to the subject has led the public to look for great reductions in prices and many other benefits to accrue from the Government taking charge of the industry. With the present cost of plant, fuel, and labour no startling reductions in price can be looked for. Having regard to cost of production, electricity is now supplied in all industrial districts and large towns at cheap rates, the figures in the following table being typical of average prices:—

TABLE I.

Name of town.	Maximum load.	Cost per unit exclusive of capital charges.	Average price received per unit.	Percentage of gross profit to capital.
	KW.	d.	d.	d.
Ashton-u.-Lyne...	2,636	0·55	0·85	7·50
Birmingham ...	54,930	0·91	1·28	9·46
Bury	5,128	0·55	0·82	8·10
Glasgow	55,610	0·83	1·21	8·35
Leeds	24.920	0·52	1·04	8·31
Liverpool ...	29,048	0·76	1·51	10·41
Sheffield	57.338	0·48	0·88	13·36
Stalybridge ...	9.000	0·45	0·82	11·37
City of London...	21,000	1·55	2·55	7·01
Cty. of London Co.	18,500	1·42	2·19	7·14
London Co. ...	23,300	0·80	1·06	4·36
South London Co.	1,350	1·12	1·92	6·87
South Met. Co....	9,800	0·96	1·51	8·19

Unfortunately, there is no simple means of measuring the cost of supplying electricity to enable a ready comparison to be made between one method and another or between the costs of one station and another.

Table I shows what wide variations exist in the working cost per unit sold and the average price received for electricity. Any use of either figure for the purpose of comparing the general excellence of these undertakings would be wholly erroneous.

The smaller profits earned by the companies are noticeable. One of the main reasons is, that in nearly all the company areas there is a second competing company, with the result that large unnecessary capital and other costs are involved. In the municipal areas there is no competition. A second reason is the large capital sums spent by the companies on pioneering work.

The reasons for the large variations in the costs and in the selling prices are to be sought in the existence, or otherwise, of competition, in differences in the price of coal, the number of consumers, their average load, and the use made by each consumer of electricity.

The total capital charges usually represent about 50 per cent. of the total cost of supplying a consumer with electricity. The average cost of connecting a consumer, including the service, meter, and proportion of the distribution main, is about £25. The coal bill represents about 25 per cent. of the total charges to the consumer, and the other charges the remaining 25 per cent.

The incidence of the above charges varies with the class of load supplied, as follows:—

Total capital charges ...	... from 30 to 60 per cent.
Coal	... from 55 to 10 per cent.
Other working expenses	... from 15 to 30 per cent.

The first figures represent approximately the ratio for undertakings supplying a small number of large consumers with a high load factor, and the latter figures undertakings supplying a large number of small consumers. Of the total, the items that vary in approximate proportion to the output in Board of Trade units consist in an amount represented by the cost of three-quarters of the coal and stores, with a proportion of the repairs and wages, or, say, 25 per cent. of the total cost of the supply. Consequently, if 100 represents the total cost of working a particular undertaking at a load factor of 20 per cent., and if by reason of the consumers using their supply for longer hours they use twice the number of units, the total cost will be increased to 125. Therefore, the average cost per unit will be reduced by 37 per cent.

Having regard to the fact that the distribution capital represents approximately 50 per cent. of the total capital employed, and that the cost of transformation, distribution and maintenance of meters represents some 20 per cent. of the total cost, it follows that no decrease in the price of bulk supply by super-stations or otherwise can possibly result in a very large reduction in price to the ordinary small consumer. The ordinary consumer can effect for himself a reduction in the price per unit of much larger magnitude by making a better use of the supply.

In an ordinary private house, if the units used for lighting are about 300 per annum, the units used for heating and cooking will be about 3,000 per annum. Taking the price for lighting at 6d. per unit and the price for heating and cooking at 1d. per unit, the average price per unit would be 1.4d.

The recent high prices of coal and other fuel and the difficulty of obtaining supplies have resulted in a great increase in the use of electricity for heating and cooking, and, no doubt, had the apparatus for its use been readily obtainable, this increase would have been greater. There has also been a great increase in the use of electricity for power; the load factor has increased, and, in spite of the fact that new plant, when installed, has cost more than 50 per cent. above pre-war prices, that the price of coal, having regard to quality, has doubled, that wages and other expenses have increased two or three times, the electricity supply undertakings have been able to carry on and to make ends meet with a relatively small increase in price generally not exceeding 50 per cent. and with a smaller increase in the average selling price.

Had plant remained at pre-war prices, there is no doubt that progress in replacing small stations by large turbine stations would have been rapid. I set out in Table II the cost of power stations of small and large sizes. The figures are exclusive of the cost of land and are nearly twice the figures

TABLE II.—Showing Capital and Working Costs for Power Stations Erected and Worked at Present-Day Prices for Materials and Labour.

Plant installed.		Capital cost.	Maximum load.	Capital per kilowatt of load.	Load factor.	Units generated.	Coal consumption.	Running costs.				
								Cost of coal at 20s. per ton.	Other works costs.	12½ per cent. on power station capital.	Total costs.	Per unit generated.
No. of Units.	Size of units, KW.	£	KW.	£	Per cent.	—	lb. per unit gen't'd.	£	£	£	£	d.
2	250	28.100	250	112·4	25	547.500	5·0	1,230	1.070	3,500	5,800	2·54
					50	1,095,000	4·75	2,330	1,100	3,500	6,930	1·52
3	500	55.500	1.000	55·5	25	2,190,000	4·5	4,400	2,600	6,900	13,900	1·52
					50	4,380.000	4·25	8,300	2.700	6.900	17,900	0·98
4	1,000	125,650	3,000	41·88	25	6,570,000	3·5	10,250	5,900	15,700	31,850	1·16
					50	13,140,000	3·25	19,000	6,100	15,700	40,800	0·75
5	2,000	240,000	6,000	40·0	25	13,140,000	3·0	17,600	11,500	30,000	59,100	1·08
					50	26,280,000	2·75	32,200	11,800	30,000	74,000	0·68
6	5,000	535.000	20.000	26·75	25	43.800,000	2·5	48,900	21,000	67,000	136,000	0·75
					50	87,600,000	2·3	89,900	21,500	67,000	178,400	0·49
7	10,000	1,100,000	50.000	22·0	25	109,500,000	2·25	110,000	31,500	137,500	279,000	0·61
					50	219,000,000	2·10	205,000	32,500	137,500	375,000	0·41
6	25.000	2.142,000	100,000	21·42	25	219,000.000	2·0	195.500	53,000	268,000	516,500	0·57
					50	438,000,000	1·8	352,000	55.000	268,000	675,000	0·37

The figures in the above table are merely typical. They may be expected to vary somewhat according to the locality and the site. They include estimated figures for buildings, wharfage, sidings, &c., but are exclusive of cost of land and of providing circulating water.

obtaining before the war. I also show the approximate working expenses; these figures must be taken as typical; local conditions might produce wide variations. The figures show clearly the economy to be gained from the use of large plant.

TABLE III.—Showing the Cost of Transmission Systems at Present-day Prices for Labour, and taking Copper and Lead at £100 and £25 per Ton Respectively.

Size of conductors and pressure.		Useful capacity.	Capital cost per mile run.	Capital cost per KW. per mile run.	Working cost.	
					Per mile run.	Per KW. per annum per mile run.
			Underground System.			
Sq. in.	Volts.	Kilowatts.	£	£	10 per cent. on capital.	£
·075	3,300	320	4,000	12·5	400	1·25
·125	3,000	540	5,000	9·3	500	0·93
·125	11,000	1,800	5,500	3·0	550	0·30
·125	22,000	3,600	6,000	1·7	600	0·17
·125	33,000	5,400	7,000	1·3	700	0·13
			Overhead System.			
Sq. in.	Volts.				12½ per cent. on capital.	
·075	3,300	320	1,300	4·0	162·5	0·51
·125	3,300	540	1,600	3·0	200	0·37
·125	11,000	1,800	2,600	1·45	325	0·18
·125	22,000	3,690	2,900	0·80	350	0·10
·125	33,000	5,400	3,200	0·6	400	0·08

Two cables and six overhead wires are included in each line to work with three-phase alternating current.

In Table III I show the cost of underground and overhead transmission lines, the cost of the latter varying from less than one-half to slightly over one-third that of the former. The figures in the last column show that under the best conditions the cost of transmission for distances exceeding 20 miles is a serious item. It is clear that the increased cost of plant and mains must mean that the superseding of existing plant will be delayed.

Often the argument is advanced that State or municipal ownership results in low prices. Before the war, companies were able to raise loans at rates of interest varying from 3½ to 4½ per cent.; municipalities in general paid from 3 to 3½ per cent., or, say, some 1 per cent. less; but under the terms of the loans they were obliged to provide sinking funds to redeem the loans in about 25 years, involving a sinking fund of from 3 to 3½ per cent. In place of a sinking fund, the companies usually apply to depreciation and reserve an amount equal to about 2 per cent. of the capital; consequently, so far as the loans are concerned, the total annual payment for money so raised is approximately the same as for municipalities.

The companies also raised considerable sums of money by the issue of preference shares entitled to dividends at the rate of from 5 to 6 per cent.; the money so raised thus cost, after allowing for depreciation, perhaps one-half of 1 per cent. more than the money raised by the municipalities. Something like one-half of the total capital of the companies has been raised by the issue of ordinary shares, and average dividends have been paid thereon of approximately 4 to 5 per cent.

The matter may be examined by comparing the gross profit earned by the company and municipal undertakings. The figures, extracted from "Garcke's Manual of Electrical Undertakings," are as follows:—

TABLE IV.—Amounts of Capital Expenditure and Gross Profit in certain Company and Municipal-owned Electricity Undertakings.

Year.	No. of undertakings.	Capital expended.	Gross profit before providing for depreciation.	Percentage of gross profit to capital.
		Company Undertakings.		
		£	£	
1914	98	25,132,662	1,722,396	6·8
1915	95	26,281,952	1,686,389	6·4
1916	93	25,958,683	1,673,552	6·4
1917	111	27,107,746	1,914,634	7·0
		Municipal Undertakings.		
1914	186	45,250,532	3,653,919	8·0
1915	199	49,424,226	3,952,902	8·0
1916	180	49,375,009	3,830,077	7·8
1917	172	49,246,295	4,054,771	8·2

The main reason for the difference in gross profit is that the companies in general supply under more difficult conditions than the municipalities. The latter supply nearly all the large manufacturing towns excepting Newcastle and London, and in the latter there are over all the dense central areas competing companies, and in the county areas of the power companies difficult distribution problems have to be faced.

There is no doubt that had the prices charged to the consumers been increased by even 1 per cent., and had the additional profits been applied to improving methods and apparatus, the cost to-day to the consumer would have been less. Whatever is ultimately decided upon for the future conduct of electricity supply, it is to be hoped that at least the finances of the industry will be arranged so that there will be such a margin over and above the cost of production, including the capital charges, as will provide an ample reserve not only for the replacement of plant as it becomes obsolete, but also for the conduct of large-scale experiments, directed to increasing efficiency and improving methods. The existence of profits and the expenditure of a sufficient sum for the above purposes is the only way to establish the business on a really firm foundation, and is the surest way to provide for the production of electricity at the lowest possible price.

Financial assistance from the State for industry may be, in certain cases, necessary and justifiable, but such assistance should be rendered only when absolutely necessary. Experience shows that electrical supply is a stable industry, and although the margin of profit has been small in the past, in the sense that the ordinary shareholders of companies have received an average dividend of only 4 to 5 per cent., the business is one that should offer a safe investment for capital, and in the future there should be no difficulty in raising dividends to 8 or 10 per cent. The power companies raised large sums of money, and after earning very small profits for some years they are gradually improving their position, as the following figures show:—

Year.	No. of companies.	Capital expended.	Gross profit.	Capital.
				Per cent.
1910	6	6,246,322	249,728	4·0
1913	7	7,461,917	374,684	5·0
1917	8	10,495,454	723,640	6·9

They have now established themselves, and there is no reason why they should not become increasingly prosperous commercial undertakings, able to raise through the ordinary channels the money they require for development.

Again, the larger municipal undertakings showed in the year 1917 an average return on the capital expended of 8 per cent., and in addition to meeting the whole of the interest and sinking fund charges, they were able to set aside for reserve a sum of £414,818 on the total capital sum invested of £49,246,295.

From these figures there does not seem to me to be any strong case for State assistance, so long as the development of electrical supply proceeds along well-trodden lines.

Development should proceed outwards from the towns. With this object a uniform system should be adopted so that, when eventually the call for power increased in the intermediate districts, the supplies could be linked together so as to form a uniform and complete system.

The chief saving of coal is made by changing from an isolated plant to a central electrical supply. The individual plant may use as much as 12 tons of coal per KW. per annum, as against 4 tons at a central power station. Before putting down independent plant, it is to be regretted that consumers often fail to realise that, although the immediate comparison may show some small advantage in its favour, the ultimate advantage is all in favour of the central supply of power, as once the private plant is installed the cost of power cannot be reduced until the plant is finally scrapped at the end of 15 to 20 years; in fact, as the plant gets older the cost of running it tends to increase. Against this fixed cost, the tendency of the central station is to reduce continually its costs; its load is always growing, necessitating the installation of new plant, which is invariably more economical than the old plant. The skill and attention given to the plant tend to increase as the plant increases in size, resulting in a steady decrease in the cost of production and in a lower price to the consumer. Every new customer of a central station reduces the incidence of the standing charges, and enables the date for erecting new and more economical plant to be advanced.

The most satisfactory method of financing a power undertaking is for most of the consumers to have some direct financial interest in its success. The prices for power should be so fixed as to produce an ample return on the capital, so that sufficient amounts can be set aside to provide for the early scrapping of uneconomical plant, for the adoption of the newest methods, for research in the methods of using fuel, and for the payment of, say, 8 to 10 per cent. on the ordinary capital. A company so situated would be able to raise money at the lowest market rate of interest; the fact that its consumers are interested in its prosperity will make them most excellent canvassers, so that the business should increase rapidly; with every increase in business its costs will tend to decrease, and, consequently, its profits will increase, and should be shared with its consumers before the rate of dividend is increased above, say, 8 per cent., and as the dividend increases the proportion of the profits distributed among the consumers by way of a reduction in price should be increased.

It is probable that in the near future further progress will be made in the electrification of railways. Stations should not be put down by railway companies but by the electric supply authorities, and should form part of their main systems.

The depreciation in the currency and the consequent advance in the prices of plant, wages, and material have, from an economic view point, delayed the date for scrapping existing plant, and have made the conservation of capital of the first importance. On the other hand, the increased cost of coal and the necessity for conserving it, are pressing reasons for taking care that future developments make for the maximum of economy. It is clear that the artificial boundaries that have hitherto confined each undertaking to its district should be bridged over. It is almost certain that the plant available to-day will be, from the point of view of economy in coal consumption, obsolete within the next fifteen years. There is the less reason to plunge rashly into huge expenditure far ahead of requirements.

When the Government takes under its wing any enterprise, it should take care that in making laws for its conduct the ordinary principles of business should be observed. The law should enable the business to flourish, instead of making the earning of profit difficult or impossible; it should protect the industry so that ample profit can be earned; large reserves should be encouraged, and increasing profits shared with the customers; thus only can the widest expansion and the lowest prices be attained. If direct State aid is required at all it should be resorted to only when other methods fail.

It is of the utmost importance that the present uncertainty should be removed as soon as possible; it is hampering the industry just at a time when confidence is of the greatest importance. Extensions of plant are called for in every direction, and delay will lead to breakdowns and shortage of supply. Naturally, in the present uncertain position, doubtful if their property is to be transferred to rather nebulous district boards yet to be set up, and, if so, at what price, both companies and municipalities hesitate to embark on new expenditure. Any long delay will do far more harm than the district boards can put right for years.

Discussion.

Mr. **James Devonshire** said he was responsible for the first Parliamentary promotion of a Power Bill, viz., in 1898, when the General Power Distributing Co. endeavoured to obtain powers to supply electricity over a very wide area. The Bill passed through the House of Lords, but failed in the Commons, where it met with a solid phalanx of opposition from the municipalities. However, he did not think that the £10,000 expended was wasted, because two years later there came before Parliament a group of power bills, all of which received Royal Assent. Moreover, he believed the promotion of 1898 was responsible for the appointment of Lord Cross's Committee, which recommended that electricity should be authorised for distribution over wide areas.

Mr. **G. W. Partridge**, as one of Mr. Ferranti's assistants, described how supply was given in the old days, from overhead cables at a pressure of 2,400 volts, with house transformers. Mr. Ferranti was 20 years in front of everybody else. The original 10,000-volt cables were in actual use over a great portion of the London company's system to-day—about 28 miles of these cables. The controversy between alternating and direct current in the early days was so keen that the respective managers would not speak to one another. With regard to the superstations which were so much talked of, for every pound of coal burned it was necessary to have 500 lb. of water for condensing purposes; the question of circulating water was of the greatest importance. If they could make use of the large heaters of which so much was heard, the load factor would be very much improved, and the customers using them could have energy at a very low rate. During the war certain countries, such as Italy and Switzerland, found it practically impossible to obtain coal even at £10 or £12 per ton; the Swiss were so short of coal that they had to make use of these large heaters, and at the present time he understood that there were no fewer than 47 different types of these heaters in use or being completed.

Mr. **L. L. Robinson** said that his Council, upon his advice, had departed from the old and stupid municipal habit of condemning everything that a company did. The Hackney Borough Council had linked its power station with that of the North Metropolitan Power Co. with the view of obtaining the greatest advantage out of the two systems for the purpose of munitions manufacture in the north-east of London. That was done by running a cable from a sub-station in the north of Hackney to a sub-station supplied by the North Metropolitan Co. in Stoke Newington. That cable had been used throughout the war, and it was being used constantly to-day, for keeping the loads on the respective works at economical figures. Hackney now never ran its works unless there was a load sufficient for a big turbine, and the whole week-end was dealt with by the company. The saving had been most striking. Before they linked up, Hackney was using 3 lb. of coal per unit, but now it was less than 2½ lb.

Mr. **W. L. Madgen** said that one of the most serious difficulties with which the electrical industry had had to contend in the past was the competition of private generating plant. Up to the time of the war the number of private plants which were being installed had gradually diminished, but the uncertainty as to legislation affecting the industry was not only having an influence upon extensions of the large power stations of the country, but it was also unsettling the minds of the owners of large works, with the result that there had been a very large increase in the orders for private plant. He was informed that of the electrical plant now on order, one-third was for private installations. Notwithstanding the greatest pressure being brought upon the authorities to do something quickly, months had gone by, and still there were no signs of action. Meanwhile the industry was suffering very severely.

Mr. **P. D. Tuckett** said he could not quite agree with Mr. Madgen as to the position with regard to private plant. His own impression was that the tendency to install private plant was still diminishing where the power companies were in a position and willing to supply. At the same time, in the present uncertain state of legislation, the supply industry did not know where it was, and hesitated to spend large sums of money in pushing the sale of power among large manufacturers.

Mr. **C. A. Baker** said that in the discussion on the recent paper at the Royal Society of Arts by Sir Dugald Clerk, a comparison was made between cooking by gas and cooking by electricity. In such comparisons it was important that electricity should have fair play. The speaker in question said that 100 units used in a modern electric cooker were equivalent to 1,000 cubic feet of gas in an old-fashioned gas cooker. He had with him some figures from one of the L.C.C. cooking schools in which gas and electric cookers were side by side, and the staff were free to use either as they thought fit. Thus the figures were unbiased. The gas required to cook a dinner consisting of 4 lb. 1 oz. of beef, boiled potatoes, greens, and an apple pie cost 1.26d., whilst electricity to do the same cost 1.4d. With gas cooking the joint was reduced in weight by 12½ oz., and with electricity it was reduced by 7½ oz. The total cost of cooking by gas worked out at 9.86d. and by electricity 6.55d., and the comparison was that 39 units of electricity were the equivalent of 1,000 cu. ft. of gas, or 100 units the equivalent of 2,580 cu. ft. of gas.

Mr. **G. L. Addenbrooke** said that as one of the old pioneers he was alarmed at the attitude which the public was taking up towards the whole question of electricity. There seemed to be a sort of idea that if the Government took over electricity supply every farmer within five miles of a town could have electric light in his farm buildings, motors, &c., and that every cottager in a remote district could also have electricity. There was no doubt, however, that the more the question was gone into the more it was seen that that would not be so, owing to the economical limits of distribution. Another point was that the erection of super-stations was entirely controlled by condensing-water facilities. If great advances took place which would do away with the need for these immense quantities of condensing water, in 20 years they would have all these costly super-stations lying in the wrong places, and a fresh start would have to be made. If the Bill were passed, it would take two or three years to prepare the plans, &c., and the stations would take a long time to complete, so that the industry would be in a state of uncertainty for the next five years, just at the time when reconstruction was very important, and when it was desirable that we should pull ourselves together as quickly as could be done. He hoped that sounder and more conservative counsels would prevail in high quarters in the future than seemed to have been the case in the past.

Mr. **F. W. Jennings** said that the advantage of using private plant when there was a large quantity of steam required for manufacturing purposes, had not been brought out very clearly. He was familiar with many private plants which had taken the place of supply from a public source in connection with which the coal bill for the factory had not been altered at all from that which was previously required for generating steam for factory purposes. Therefore, the only cost of the electricity was the interest on capital and depreciation. If that was developed a little more some of the smaller public supply stations might be used to better advantage than they were at present. Although the efficiency of a power station might only be 20 per cent., the combined efficiency, if the latent heat in the exhaust steam was made use of, was something like 60 per cent.

The **Chairman** (Mr. A. A. Campbell Swinton) said it was a surprising thing that electricity should have made the advance it had having regard to the difficulties it had had to contend with. All these difficulties had been due to political considerations. If the industry had had a perfectly free hand and the politicians had not been brought into the matter he was sure it would have been in a vastly superior position to-day than it was. If the authorities would only appoint technical people to attend to these matters and keep them out of the hands of the politicians, he was sure they would all be thankful.

Mr. **Highfield**, replying to the discussion, said the only deduction to be drawn from Sir Dugald Clerk's paper was that if the country was to save coal, the sooner electricity was got rid of and gas used instead the better. The answer to such a suggestion was that electricity was being used more and more every day for heating and cooking. The difficulties which would arise if new authorities were set up to purchase existing power stations and transmission lines could hardly, he thought, have been realised. Many of the existing smaller plants, which were erected when plant was much cheaper than it was to-day, were doing efficient service and supplying the consumer with cheaper energy than would be the case if they were scrapped under a national system and modern plant installed in their place at present-day prices. The difficulties of condensing water, which had been referred to, would be got over by putting power stations afloat, and in that connection use might be made of some of the German battleships. The difficulty of coaling would be greatly reduced, as colliers could be brought alongside, and ash handling became perfectly easy.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

An Electromobile Tipping Truck.

Storage battery industrial trucks suitable for use in warehouses, works, platforms, &c., are now coming into general use, and the following particulars of a truck fitted with a side tipping hopper, and made by Electromobile (Leeds), Ltd., Prospect Works, Otley, Leeds, may therefore be of interest. Our illustration (fig. 1) shows an A-type truck, the steel hopper having a capacity of 54 cu. ft. and the load being 25 cwt., that was supplied for carrying coal. The hopper, of course, tips both sides. The driving motor is of the well-known traction type, and the controller provides three positions for either direction, and is of drum type. It is contained in a metal protecting case, and the copper contacts, which are readily renewable, are so arranged that sparking is reduced to a minimum. Provision is made for the adjustment of the fingers. The controller is interlocked with the pedal contracting band brake, which acts on the propeller shaft, and is expanded clear of the drum as the driver mounts the platform and automatically applied as he leaves it, the controller handle returning to the neutral position. Steering is by lever with vertical movement, and the drive is by worm gear in conjunction with a full floating rear axle. Dust-proof housing is provided for the gears, which operate continually in a bath of oil; the worm is made of special alloy steel, and the worm wheel from phosphor bronze. The worm is mounted on ball bearings, of journal and thrust type, the differential carrying the worm wheel being mounted on similar bearings. Tinker taper roller bearings carry the truck wheels. The wiring consists of English V.I.R. cable protected where possible by steel tubing and fittings. A fuse affords protection from misuse, and at the same time provides a simple form of safety key for preventing the truck being used by unauthorised persons. The standard battery equipment for this truck is 16 cells, I.M.V.5 Ironclad Exide, assembled in two trays clamped into position under the platform. This truck attains a maximum speed of 7 m.p.h. with a standard battery on a smooth level floor in either direction. It can be manœuvred in cramped positions at a speed of one or less m.p.h. The weight of A-type trucks is 1,900 lb.; length, 8 ft.; width, 3 ft. 4 in.; clearance, 4 in.; and the steering radius, 7 ft. It is stated that in some works these trucks are negotiating short grades of 1 in 6, and that on fairly level floors as many as six 1-ton trailers can occasionally be dealt with.

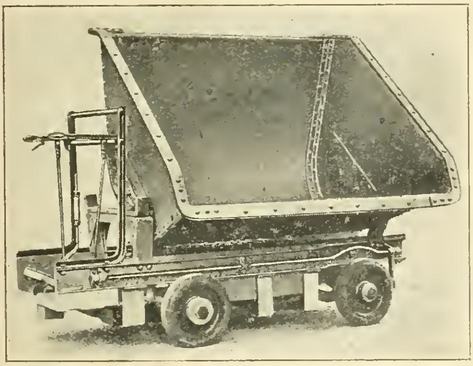


Fig. 1.—Electric Tipping-Hopper Truck.

This firm manufactures all types of road vehicles, from ½ to 7 tons capacity, and also passenger cars.

High-Pressure Discharge Apparatus for Wireless Telegraphy.

This ingenious device, invented by Mr. W. Hamilton Wilson, embraces a new combination of principles. After 18 months of exhaustive mathematical and experimental research it was put forward in 1914 for use in wireless telegraph transmitters for war purposes, and until the close of the war it rendered valuable service, many hundreds having been used by the War Office, Admiralty, and Royal Air Force under arduous active service conditions. Publicity during the war was carefully avoided, and public attention was not drawn to the invention until its mention in a lecture before the Institution of Electrical Engineers on April 3rd, 1919, by Lieut.-Colonel Cusins, R.E., on "The Development of Army Wireless during the War."

Fig. 2 shows the complete apparatus, and fig. 3 shows the electrical connections in one form of the invention.

When the signalling key (9) is depressed and the motor-driven interrupter (4) closes the circuit, for the first time, a charging current passes from the supply source (3) through the primary of the spark coil (2) to the condenser (7). The conditions of the circuits are made such that this charging current is oscillatory in character, and the timing of the motor interrupter can be made such that the circuit is interrupted when the charging current through the *supply source* is at, or near, zero value, and hence there is little or no energy stored inductively in the circuits to produce a spark at the interrupter contacts at "break"; a simple interrupter without oil, gas, or spirit is all that is necessary. Further, since the break is made to occur when the oscillatory current is passing through its first zero, the condenser (7) is charged to approximately *twice* the voltage of the supply source, owing to its having been over-charged by the energy which was stored inductively in the primary (2) of the spark coil. A small magnetising current will have passed through the inductive winding (8) during the time when the interrupter was closed, but owing to the relatively high inductance of this winding and the exceedingly short time of "make" the energy stored thus is quite negligible. When interruption occurs, however, the charge in condenser (7) oscillates through the inductance across its terminals, so that after the end of the first half period of this oscillatory discharge the condenser has become charged to the reverse sign.

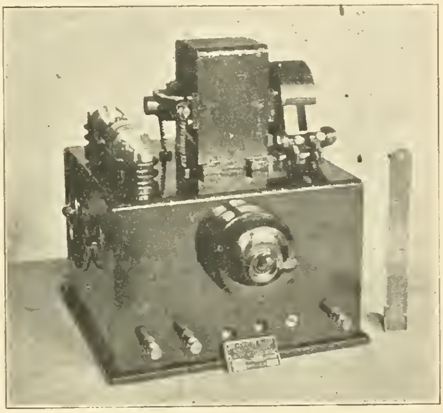


Fig. 2.—Wilson High-pressure Discharger.

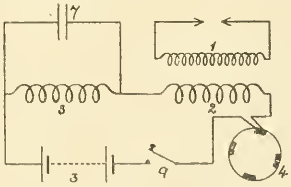


Fig. 3.—Diagram of Connections.

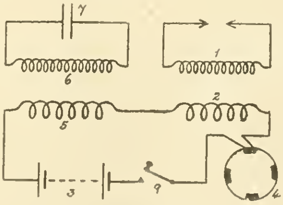


Fig. 4.—Alternative Connections.

The losses occurring during this reversal of charge are made small, so that the voltage of the reverse charge is still approximately twice that of the supply source, and the interrupter is timed to close the circuit for the second time at the moment when the reverse charge is a maximum.

Hence, it will be seen that immediately the circuit is reclosed there is a voltage of approximately three times that of the supply acting round the circuit (due to the condenser voltage being added to that of the supply). This results in a greatly increased amplitude of the oscillatory current through the supply during the time when the circuit is closed for the second time; the condenser is discharging during the first quarter period of this current, and recharging in the opposite direction to a still higher pressure during the second quarter period of the oscillatory supply current, this direction being the same as at the end of the first "make" period.

Consequently, when the interrupter breaks the circuit a second time, namely, when the supply current is again passing through zero, the condenser will be charged to a voltage which may be approximately four times that of the supply, and this building-up or resonating effect will go on increasing until a discharge begins to pass at the terminals of the secondary (1) of the spark coil, or until the increasing losses in the system bring about a condition of equilibrium.

The spark coil behaves like a transformer—in fact, a closed-core transformer may conveniently be used in its place—and as the maximum pressure is impressed on its terminals at the instant when the interrupter closes the circuit, it follows that the secondary discharge takes place at that time. This may be shown, experimentally, to be the case.

For wireless transmitting purposes, the secondary of the spark coil is joined in the usual way to the high-pressure condenser of the high-frequency oscillating circuit.

In order that the condenser (7) may not be inconveniently large, and for other reasons, it is preferable to place this condenser across a suitable secondary winding having a large number of turns of what is termed a "buffer transformer." The most suitable manner of doing this is shown in fig. 4. The general principles given above apply also in this arrangement, but proof of the identity requires experimental or mathematical treatment.

Fig. 5 represents experimentally-obtained curves of current for fig. 4 when used with a condenser for producing high-frequency oscillations.

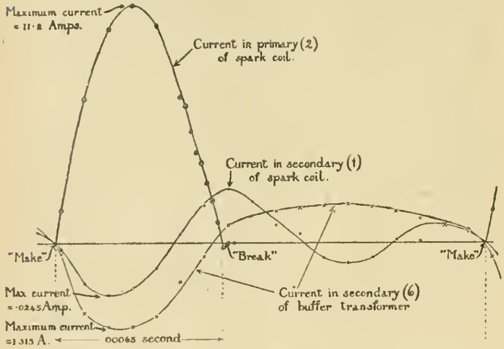


FIG. 5.—CURRENT CURVES.

The interrupter disk is rotated by a small direct-current motor at the correct speed. The brushes are easily renewable, and the disks have a long life owing to the freedom from injurious sparking. The sets can be made for any power input, within reasonable limits, that may be required, and for any supply pressure up to 500 volts. The maximum power input can be as readily arranged for low supply pressures, even down to 25 volts, as for the higher pressures.

Sets can be supplied to work at any given spark frequency, from 100 sparks per second to 1,000 per second. Standard sets operate at a spark frequency of 650 per second, which frequency takes advantage of the most sensitive telephone frequency. The spark gives a clear musical note, and enables reception to be carried on under conditions which would otherwise be impossible. It is claimed that the efficiency is exceedingly high, and may, under suitable conditions, exceed 75 per cent.

The patentee and sole manufacturer is Mr. W. Hamilton Wilson, of 4, Bank Broadway, Kingston Hill, Surrey.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

11,123. CONTROLLING AND REGULATING SYSTEMS FOR DYNAMOS OR MOTOR-STARTING SYSTEMS. W. J. Rickets. May 5th.

11,130. MACHINE FOR STARTING INTERNAL-COMBUSTION ENGINES, ELECTRIC MOTORS, &c. A. Danks. May 5th.

11,140. APPARATUS FOR MINE SIGNALLING, &c. J. R. L. Allott & E. Dean. May 5th.

11,168. PROCESS FOR ELECTRO-DEPOSITIOS OF COPPER ZINC ALLOY. S. O. Cowper-Coles May 5th.

11,188. APPARATUS FOR INDICATING OPERATION OF IGNITION IN INTERNAL-COMBUSTION ENGINES. M. A. Leblanc. May 5th. (France, February 5th, 1918.)

11,192. ELECTRICAL RESISTANCE CONTROLS. A. H. Silcock & Tilling-Stevens, Ltd. May 5th.

11,201. RECEIVERS FOR WIRELESS TELEGRAPHY. H J. Round. May 5th.

11,202. THERMIONIC TRANSMITTING DEVICES FOR WIRELESS TELEGRAPHY AND TELEPHONY. H. J. Round. May 5th.

11,206. GALVANIC BATTERIES. G. Oldham & J. Oldham. May 5th.

11,209. CONTINUOUS-CURRENT COMPRESSOR. E. A. E. Birk. May 5th. (Denmark, May 6th, 1918.)

11,234. ELECTRICITY STORAGE COILS. S. W. R. Potter. May 6th.

11,240. ELECTRIC CYCLE WHEEL ATTACHMENT. R. Cave. May 6th.

11,248. APPARATUS FOR HEATING LIQUIDS BY ELECTRIC RESISTANCE OR GAS. L J. Simon. May 6th.

11,279. PORTABLE ELECTRIC PIANO-PLAYER. R. J Martin May 6th.

11,291. SWITCHES. K. C. Bass. May 6th.

11,303. ELECTRICALLY-HEATED SOLDERING IRONS. Soc. Calor May 6th. (France, May 6th, 1918.)

11,304. LAMP FITTINGS. A. H. Midgley & Vandervell & Co. May 6th.

11,312. PROCESS FOR MANUFACTURING PURE ELECTROLYTIC COPPER FROM CEMENT COPPER. A. G. Sundberg & T. E. Thomasson. May 6th.

11,327. WIRELESS TELEGRAPHY. H. J. Round & G. M Wright May 6th.

11,332. ELECTROPLATING. C. A. Owen. May 6th

11,338. RENEWAL OF FILAMENTS IN METAL-FILAMENT ELECTRIC LAMPS. S. Coxon and W. A. Williams. May 7th.

11,347. ELECTRICAL WATER-HEATING APPARATUS. J. F. Barr. May 7th.

11,348. ELECTRICAL WATER-HEATING ELEMENTS. J. F Barr. May 7th.

11,387. ELECTRIC CONDUCTORS. A. G. Thornton. May 7th.

11,396. ELECTRIC WARMING AND VENTILATING APPARATUS. P. J. Ogle and H. Scott. May 7th.

11,397. ELECTRIC INCANDESCENT LAMPS. Renew Electric Lamp Co. & F. Harrison. May 7th.

11,408. SPARKING PLUG TESTER. H. Singer. May 7th.

11,427. CABLES FOR ELECTRICAL MACHINES. Electro-Agricultur Aktiebolaget. May 7th. (Sweden, June 7th, 1918.)

11,433. ELECTRICITY MOTOR METERS. J. Harris. May 7th.

11,436. ELECTROLYTIC GAS GENERATORS. I. H. Levin. May 7th. (U.S.A., May 22nd, 1917.)

11,460. OBTAINING SINGLE-PHASE ALTERNATING CURRENTS FROM EXISTING THREE-PHASE SYSTEMS. A. M. Taylor. May 8th.

11,466. ELECTRIC MUFFLE FURNACES. A. Imbery. May 8th.

11,480. MAGNETO-ELECTRIC MACHINE. E. Chawner & T. Wain. May 8th

11,483. SPARKING PLUGS FOR INTERNAL-COMBUSTION ENGINES. C. K. Shepherd. May 8th.

11,492. WATER COOLER AND ELECTRODE ECONOMISER FOR ELECTRIC FURNACES. F. G. Bell & L. T. Brearley. May 8th.

11,507. ELECTROLYTIC TREATMENT OF LIQUID GRANULATED OR SOLID SUBSTANCES. J. Colquhoun & J. T. Niblett. May 8th.

11,512. PROCESS FOR PRODUCING HARD RELIEF PLATE FROM DRAWING, PHOTOGRAPH, &c., FOR PREPARING ELECTROTYPED AND STEREOTYPED PLATES, RUBBER STAMPS, &c. A. E. Harris & A. Ward. May 8th.

11,514 & 11,515. SELECTIVE INDICATION, &c., SYSTEMS FOR OPERATION BY ALTERNATING OR PULSATING ELECTRIC CURRENTS. F. M. Lewis. May 8th.

11,523. SPARKING PLUGS, &c., FOR INTERNAL-COMBUSTION ENGINES. H. E. Dakin, Ltd., & F. H. Norris. May 8th.

11,536. INCANDESCENT ELECTRIC LAMPS. R. J. Burke. May 8th.

11,538. DYNAMO-ELECTRIC MACHINES. M. Chassin. May 8th. (France, May 8th. 1918.)

11,540. ELECTRICAL RESISTANCES. M. Perree. May 8th.

11,544. MAGNETO-ELECTRIC MACHINES. S. Evershed & Evershed & Vignoles. May 8th.

11,551. ELECTRIC LAMPS FOR MINERS. E. Lemaire. May 8th.

11,554. AUTOMATIC TELEPHONE LINE-FINDER SYSTEMS. W. Cross (D. S. Hulfish.) May 8th.

11,570. PROJECTOR ARC LAMPS. Johnson & Phillips & G. C. Pearson. May 8th.

11,578. HIGH-POWER THERMIONIC VALVES. S. R. Mullard. May 8th.

11,600. IGNITION FOR INTERNAL-COMBUSTION ENGINES. A. Lofthouse. May 9th.

11,648. ELECTRIC SIGNAL LIGHTS FOR MARINE AND AERIAL NAVIGATION. H. L. M. J. Benard. May 9th.

11,660. ELECTRIC SWITCHES. British Thomson-Houston Co. & E. B. Wedmore. May 9th.

11,661. SYSTEMS OF RADIO-COMMUNICATION. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 9th.

11,666. ELECTRIC SWITCHES. H. K. Ansingh & British Westinghouse Electric & Manufacturing Co. May 9th.

11,679. ELECTRICAL RECEIVING APPARATUS. F. G. Creed & Creed & Co. May 9th.

11,682. ELECTRIC TRACTION MOTORS, &c. W. E. Ireland. May 9th.

11,687. MANUFACTURE OF INCANDESCENCE ELECTRIC LAMPS. F. Harrison. May 9th.

11,694. ELECTRIC ACCUMULATORS. E. Lemaire. May 9th.

11,741. WIRING TEST. E. H. Moline. May 10th.

11,759. ELECTRIC LAMPHOLDERS, &c. B.E. Co. & B. G. Harrison. May 10th.

11,762. RAY FILTER FOR CUTTING OUT HEAT RAY OF ARC LAMPS, &c. W. Mason & A. G. Newbury. May 10th.

11,767. ELECTRIC HEATING APPARATUS. H. J. C. Forrester (Burgess). May 10th.

11,789. ELECTRIC FUSES. J. T. Burden, W. J. Hawes & H. R. Rivers-Moore. May 10th.

11,800. ELECTRIC AND INCANDESCENCE LAMPS. S. Harrison. May 10th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

9,182. "Method and apparatus for directing artillery fire on moving objects.' J. S. WILSON & W. E. DALBY. June 29th, 1916. (125,402.)

9,736. "Device for signalling secrets or otherwise by night or day for military or other purposes." R. A. HOUSTON. July 11th, 1916. (125,423.)

10,303. "Telegraph systems." AUTOMATIC TELEPHONE MANUFACTURING CO., R. WOODLAND & S. R. SMITH. July 21st, 1916. (125,434.)

11,014. "Screening or jamming systems for telegraph, telephone and other electric signalling systems." WESTERN ELECTRIC CO., G. H. NASH AND R. A. MACK. August 4th, 1916. (125,452.)

11,052. "Electrical signalling or indicating apparatus especially applicable for signalling orders and numerical data." E. A. GRAHAM. August 4th, 1916. (125,454.)

12,033. "Apparatus for wireless telegraphy." MARCONI'S WIRELESS TELEGRAPH CO. & J. ST. V. PLETTS. August 24th, 1916. (125,478.)

12,090. "Telegraph systems and apparatus therefor." AUTOMATIC TELEPHONE MANUFACTURING CO. & S. R. SMITH. August 26th, 1916. (125,480.)

1918.

5,810. "Negative plate substitutes for radio-photography." E. BURNETT. September 18th, 1918. (125,490.)

6,785. "Electric time switches." M. A. ABRAHAMSON, H. E. TVERMOES AND L. CHRISTAINSEN. April 22nd, 1918. (125,514.)

6,875. "Electric arc furnaces." F. H. A. WIELGOLASKI. April 24th, 1918. (125,516.)

7,957. "Control of power absorbed in electric furnaces." C. C. GOW AND D. F. CAMPBELL. May 11th, 1918. (125,522.)

9,104. "Electric motors." H. A. WHITESIDE. June 3rd, 1918. (125,531.)

9,582. "Incandescent electric lampholders or sockets." B. M. DRAKE AND DRAKE & GORHAM. June 11th, 1918. (125,533.)

9,592. "Method of controlling electric power transmission." H. B. EWBANK. June 11th, 1918. (125,534.)

13,130. "Railway signalling systems." MCKENZIE, HOLLAND & WESTINGHOUSE POWER SIGNAL CO. December 15th, 1917. (121,584.)

16,179. "Electric heat regulating switches." A. A. BUCK. March 11th, 1918. (124,185.)

THE

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. *Established 1872.*

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE :—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

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Cheques and Postal Orders (on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "London City and Midland Bank, Newgate Street Branch."

TO "ELECTRICAL REVIEW" READERS.

We regret that recently a number of our readers have experienced difficulty in securing copies of The ELECTRICAL REVIEW. The reason for their disappointment is that our circulation is continuing to increase so rapidly that it is impossible for us to guarantee that any casual copies will be available after the hour of publication. In order to make sure of receiving one's copy regularly as issued, a definite order should be placed with a newsagent, or subscription should be sent direct to the Publishers, ELECTRICAL REVIEW, LTD., 4, Ludgate Hill, London, E.C. 4.

ELECTRICITY SUPPLY AND THE I.M.E.A.

THE Incorporated Municipal Electrical Association has lost no time in considering the Electricity (Supply) Bill and in putting forward a series of resolutions and amendments, of which we give particulars elsewhere in this issue. "Subject to such alterations and amendments" as it recommends, the Association considers the Bill acceptable to local authorities.

The tendency of the changes suggested is in the direction of strengthening the powers of the Electricity Commissioners and of the local authorities in certain respects, restricting the rights and privileges of companies, improving the provision for compensation to officials adversely affected, and keeping the supply of electricity out of the hands of the Ministry of Ways and Communications. A new clause is drafted, empowering District Boards and local authorities to pay subscriptions and expenses in connection with Associations and conferences, and thus removing a disability under which municipal undertakings have long suffered; this clause might well be extended to authorise the payment of contributions in support of such beneficial objects as those of the Electrical Development Association. The Association roundly declares that public ownership and control of power stations and main transmission lines are desirable in the national interest. That a measure of public control is indispensable will be generally admitted, but that public ownership would necessarily prove equally satisfactory is open to question; what we have seen of State ownership, before and during the war, is by no means calculated to excite our enthusiasm in favour of its extension to electricity supply. However, it cannot be denied that many of the municipal electrical undertakings have shown excellent results in spite of the restrictions under which they have laboured, and if we may regard the District Electricity Boards as larger editions of the same order, we may hope for good results from them.

We regret, however, that the Association, in defiance of the views of some of its most prominent members, adheres to its determination to exclude, if possible, the companies from the participation in that public control to which, as undertakers authorised by statute, they are justly entitled. Are we to understand that companies (and their shareholders) are not part of the "public"? that they have no rights? and that it is their moral duty, "in the national interest," to commit hara-kiri or something of that sort? If there had been no company undertakings to blaze a track through the forest of obstruction and disappointment in the early days, there certainly never would have been any municipal electrical undertakings or any I.M.E.A. to-day, and we cannot help feeling that the Association takes a narrow view of this subject, unworthy of its past.

We cordially endorse the contention that the provision for compensation to displaced officials is altogether too nebulous and inadequate to serve its purpose; in this connection we may draw attention to the statement of the Electrical Power Engineers' Association, published elsewhere in this issue, that already the shadow of the Bill is falling on its members, and that some of them are likely to suffer injury before it even becomes an Act. The provision for compensation should therefore be made retrospective.

Another notable feature of the I.M.E.A.'s proposals, is that the payment of members of District Boards shall not be adopted. This is a very debatable question, which we cannot now discuss at length; but we may point out that the duties of the Boards will be very onerous—much more so than those of Committee-men—and will make heavy demands on the time of the members, some of whom will have to travel considerable distances to attend the meetings; that the responsibilities will be much more serious than in the case of most of the existing municipal undertakings: and that it is very important that only good men of business shall take part in the conduct of the Board's affairs. It is but reasonable that some remuneration should be given, and we suggest that it should take the form of a fixed fee per meeting attended—certainly not that of a fixed salary, the effect of which has been demonstrated in the case of the House of Commons. Moreover, the magnitude of the fee should vary from year to year in some way depending upon the success of the undertaking. There is nothing more conducive to careless management or reckless expenditure than the feeling that one's own pocket will not suffer therefrom.

The fact that Sir John Snell, a Past-President of the Association, will be the Chief Electricity Commissioner has been patent to all who are interested in the electrical industry for a long time; it is now public property, and we tender our hearty congratulations to him on his appointment to that distinguished and exceedingly responsible post.

Naval Ratings.

A GOOD deal has been said and written about the re-employment of officers and men who joined the Forces for the period of the war; but nothing has been heard of a class of man who have served the country for a much longer time, but whose occupation is now at an end—namely, the demobilised time-expired and pensioner ratings of the Royal Navy.

In the ordinary course these men, who leave the service after 12 or 21 years, are released in small batches, and are absorbed unnoticed in the labour market; but the war has held them in the Service, and peace is setting them adrift in large numbers. The splendid services that they have rendered are beyond all praise; we all know how they, and the Service to which they belong, were Britain's surest bulwark in her hour of direst need. But what is not so fully realised is that the ex-navy man is a highly-skilled artisan, a valuable asset to the industrial world, a man who can turn his hand to almost anything: these men are electricians, mechanics, firemen, of long experience and proved efficiency. Many of them have risen to non-commissioned rank, and can fill responsible posts, involving the charge of men. They want work comparable to the standard they have attained in the Service, commensurate with their real worth. Employers who are seeking skilled, steady, disciplined men can find them by writing to the Navy Employment Agency, 25, Victoria Street (South Block), S.W. 1.

The I.E.E. Report.

THE annual report of the Institution of Electrical Engineers shows a very satisfactory session's work; the Council and Committees have held no fewer than 191 meetings, a figure which compares well with the highest previous record (159 in 1914), the membership once more exceeds 7,000 (there was a heavy drop during the war, the lowest point being 6,613 in 1917), and the papers read have uniformly attained a high standard of quality. The status of the former "Local Sections" has been greatly improved, many new departures have been made which promise to bear very valuable fruit, and the list of projects which are actually in hand is an imposing one. Even the Benevolent Fund has at last begun to receive attention from the members, and the accounts of the Institution are in a very satisfactory condition. Our congratulations are certainly due to the Council, and especially to the indefatigable President, Mr. C. H. Wordingham, on a record of achievement and promise for the future never before equalled.

We note with interest that the Army Council sent a Commission, on which the Institution was represented, to France to inspect and report upon the electric power supply arrangements in the war areas, which presented a lengthy report; further, that a Committee has been appointed by the Army Council to report upon the future functions and organisation of the Corps of Royal Engineers. We are glad to see that the military authorities are taking steps to increase the technical efficiency of that most honourable Corps, which did such splendid work during the war, in spite of the difficulties under which it laboured.

We commence in this issue a *résumé* of the important address delivered by the President to the Territorial Centres during the session; pressure on time and space compel us to defer comment till a later opportunity, but we recommend our readers to study it *in extenso*, as it is full of interesting matter, and embodies a scheme for the development of the Institution, which is of the utmost importance to all electrical engineers.

The annual meeting was to be held yesterday at the unfortunate hour of 2.30 p.m., which practically disfranchises the great majority of the members, and deprives them of their only opportunity to discuss the affairs of the Institution. Why this mistake, which has given rise to so much bitterness of feeling in the past, has been repeated we are at a loss to divine. It is aggravated on this occasion by a notice, received on the day we go to press, that a meeting to discuss the Electricity Supply Bill will be held at 4 p.m. We cannot think that this procedure is well-advised.

The Control of Electricity Supply in Germany.

THE Verein Deutscher Ingenieure and the Verband Deutscher Elektrotechniker held a joint meeting in Berlin on April 12th, when representatives of the Republican Ministry of Economy, and of other authorities, were also present, to discuss the question of the future regulation of the national electricity supply industry. According to statements placed before the assembly, even the Government has reached no definitely formulated decisions in this direction, although the draft of a national electricity supply Bill may be expected in the near future. A consensus of opinion prevailed that the aim of legislative control should lie in the removal of the great multiplicity of works scattered about the country for the production and distribution of energy, although opposing views were expressed as to the manner in which this object might be achieved. On the one hand, it was contended that compulsory State regulation should take place, and the interconnection of the different works be vested in the hands of the State. The adoption of this course, however, was opposed by Dr. Passavant, representing the Association of Electricity Works, and by Herr Heneke, manager of the Rhenish-Westphalian Electricity Works, of Essen. The latter pointed out that the amalgamation of individual works was not accompanied by economic advantages under all circumstances and in every case, and that State working in particular brought about serious disadvantages. He proposed, therefore, that the electricity supply industry should be transferred to self-administering bodies formed on the basis of voluntary combination, and perhaps endowed by the State with certain public legal privileges; and a union of these bodies in a national committee might be further taken into consideration.

With regard to the financial effects of a reorganisation of the supply industry, the general opinion of those present was that a national electricity monopoly would not yield any considerable revenue to the State, and that special financial results were also not to be expected from a participation by the State in the undertakings entrusted with the supply of electricity in any form whatever. As to the question of electricity supply forming an object of taxation, Herr Raumer, who represented the Electro-Federation, stated that electric power was a competitive article, and the KW.-hour possessed an entirely different economic value according to the special circumstances of consumers. As a consequence, a uniform taxation according to the consumption in KW.-hours should be rejected on account of its widely varying effects. In general, a special electricity tax should also be repudiated because it would stop a really great development in the supply of light and power, and for this reason it was necessary to avoid placing a financial burden on the production and transmission of power. If, however, taxation must come into consideration, it was contended that this should be applied to the sources of power, as in the case of the tax on the production of coal. The conference did not adopt any resolutions on the problem, as the deliberations were solely intended further to clear up opinion on the subject, and thus afford information for the benefit of the Ministry of Economy.

THE ELECTRICAL EQUIPMENT OF H.M. FACTORY, GRETNA.

By A. S. CROSS.

H.M. Factory, Gretna, as all the world knows, was built in 1915-16-17 to supply Great Britain and her Allies with cordite, and is the largest of the many munition factories built by the Government during the war. It is really an aggregate of many factories, the outputs of which combine to provide the requisites for making cordite. Compared with pre-war standards, the ether plant, the sulphuric acid and nitric acid works, the glycerine distillery and the cotton treating plant would each be a very large factory, but all of these were but incidental items in the complete explosives works, and even all these combined cover a very small fraction of the total area of the factory.

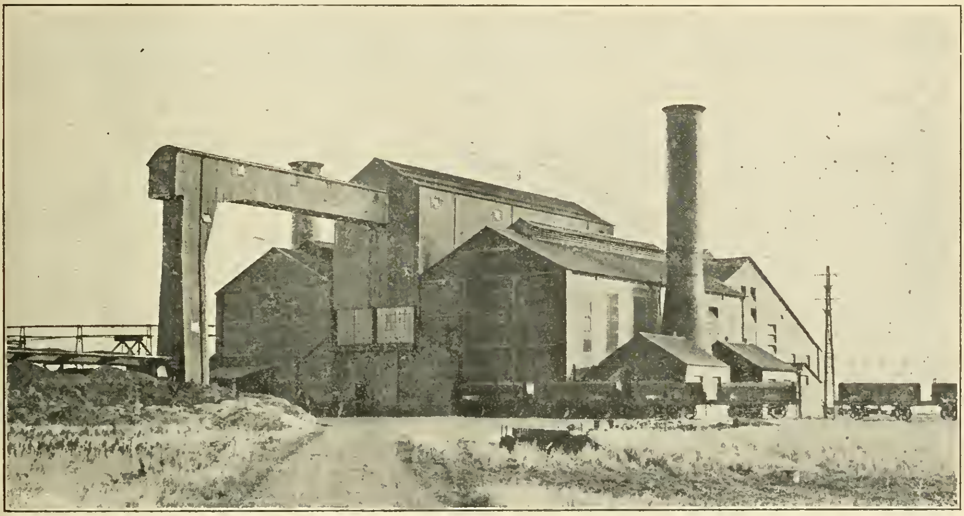
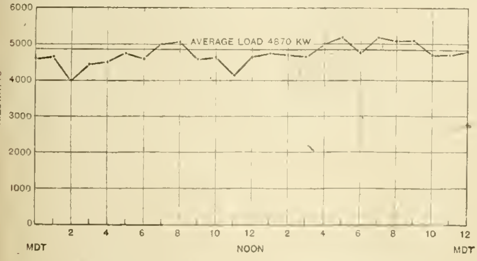


Fig 1.—Exterior of Power Station, Gretna.

Apart from the actual factory buildings were the two townships, one at Gretna, near the centre of the site, and the other at East Riggs, at its eastern end, providing accommodation for about 16,000 people, and including churches, kinemas, clubs and recreation rooms, schools, many shops, post offices, fire stations, central kitchens and bakeries, laundries, and almost everything else required for the welfare of the inhabitants, including police stations and barracks for both men and women police.



Units generated, 116,900; Coal per unit, 2·49 lb.;
Steam per unit 14·3 lb.; Station units, 6,120.

Fig. 2.—Load Diagram, January 29th, 1918.

Practically the whole of the machinery in the factory is electrically driven, and electric lighting is used throughout, so that the electrical installation, as a whole, is probably the most extensive that has ever been carried out as one complete system, although, no doubt, many larger systems exist. Any description of the installation must, in the circumstances, be very brief, but some account of the work may be of interest.

The distribution of the load in the area made the question of the situation of the generating plant one of some difficulty. There is a very heavy load for the pumping plant, which supplies the whole of the factory and townships with water, at Longtown, at the extreme eastern end; the cordite area next to this, going west, has also a fairly heavy load; but apart from the Gretna township, the remainder of the heavy load is all at the extreme eastern end, where is the greatest concentration of buildings, including all the acid plant and the cotton treatment buildings, the last of which provide a very heavy power load. The relative advantages of a single central station and of two separate stations, interconnected, at the two ends of the area were carefully investigated; eventually the single plant was selected, and the site was fixed near the Solway, about a mile south-west of Gretna township. It was intended to connect up the station with the Carlisle supply, but this scheme was eventually abandoned.

The general arrangement, operating details, and results of running of the power house and H.T. transmission system are given briefly in the following notes:—

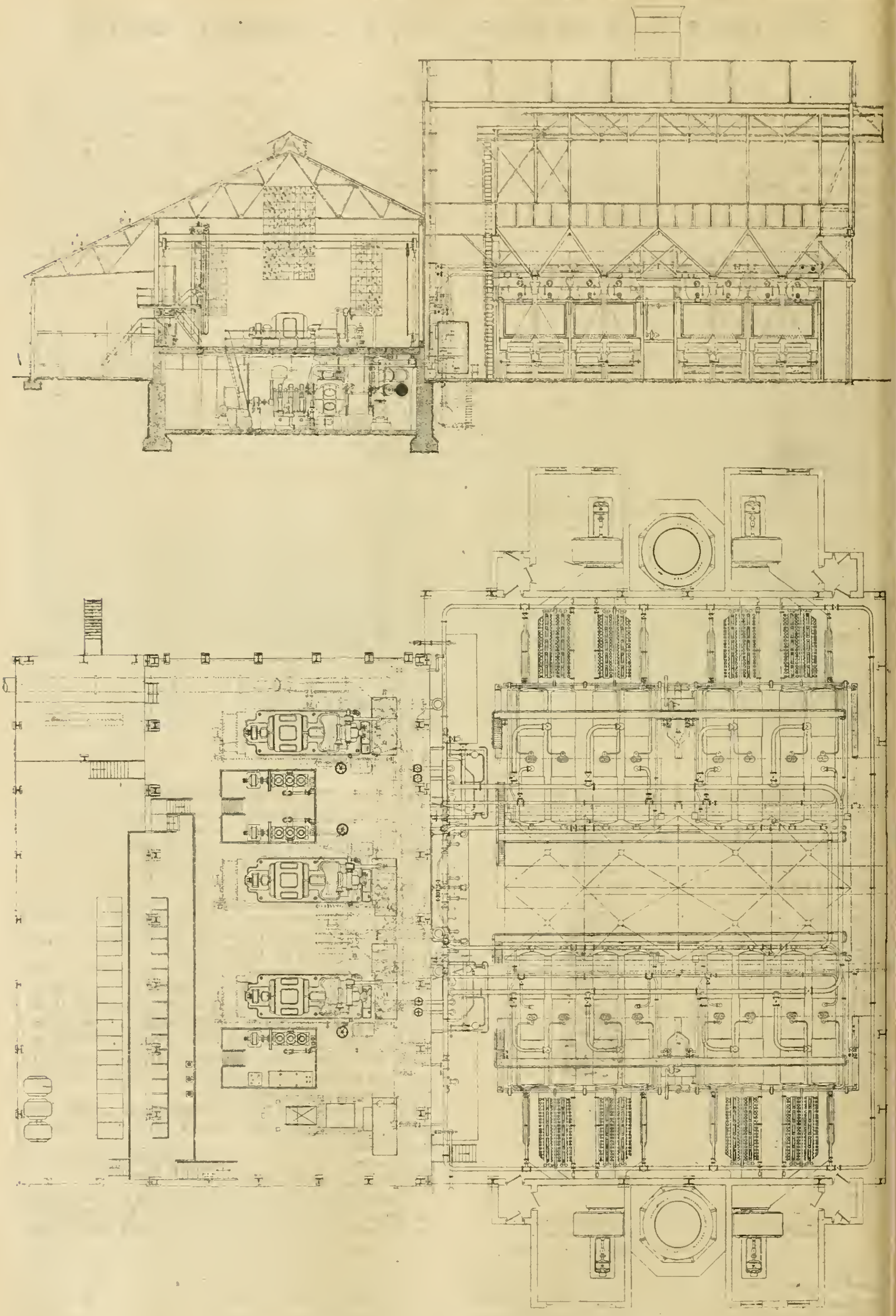
Buildings.—The general lay-out of the station is shown in figs. 3 & 4. It consists of a boiler house measuring 107 ft. 3 in. by 87 ft. 3 in., and a turbine house 95 ft. 6 in. by 50 ft. 6 in., the axes of the two being at right angles to one another. The structure below ground level is of concrete, while that above is of steel, brick-panelled. The roof is of corrugated iron, a matchboard lining being added to obviate condensation drip.

The turbine-house floor is composed of girders, brick-arched, and concreted, the surface being "Doloment" of a red shade.

Two steel chimneys, 72 ft. high and 8 ft. in diameter, are provided, one for each group of four boilers.

Coal Storage, &c.—The coal, which is all rail-borne, is discharged from a height of 16 ft. direct from wagons into an external bunker, which has a capacity of 450 tons, and from thence it is fed by gravity through an automatic filler into the buckets of an electrically-driven Babcock & Wilcox conveyor, having a capacity of 40 tons per hour. At the end of this bunker the conveyor buckets rise vertically, and are then carried over horizontally to be tipped automatically into the inside storage bunkers, which have a capacity of 450 tons, at the point where the coal is required. All the coal passes over a weighbridge shortly before it is dumped into the external coal bunker.

Boiler House.—The boilers are of the Babcock and



Figs. 3 & 4.—Elevation and Plan of Power Station at Gretna.

Wilcox land type, being arranged in groups of two, four at each side of the boiler house. They are designed for 195 lb. per sq. in., and 550° F. steam temperature, the heating surface of each boiler being 5,346 sq. ft., and of the integral superheater 1,320 sq. ft.

The grates are of the Babcock endless-chain type, the area of each grate being 70 sq. ft., or 140 sq. ft. per boiler.

The ash is automatically discharged at the rear of the grate into hoppers from which, once every shift, it is fed by gravity into hand trucks, which are electrically tipped into railway wagons, some 12 to 15 tons being normally handled per day. Each boiler has its own 200-tube Green economiser built on to it. The products of combustion enter at a temperature of 470°/530° F., to be reduced to 280°/320° F. on entering the stacks.

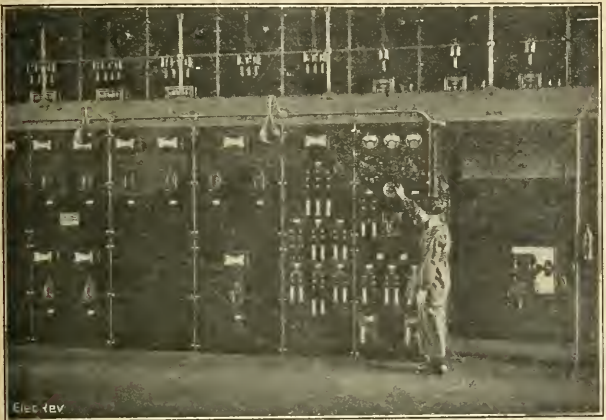


Fig. 5.—Part of Main and Auxiliary Switchboards.

The temperature of the boiler feed is raised from 77° F. to 194° F., at which it enters the boilers. The hot-well temperature of 77 F. is raised to 115° F. by a by-pass from the delivery side of the economisers.

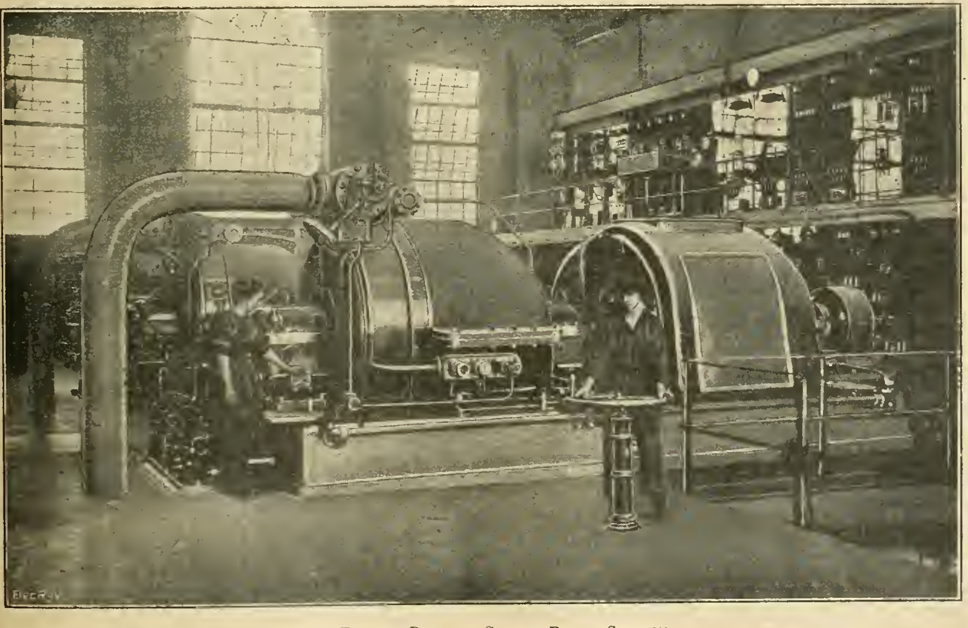


Fig. 6.—Turbine-Room at Gretna Power Station.

Each pair of boilers has its own induced-draught fan, which is capable of maintaining a draught of from 0·5 to 2·3 in. water gauge at the fan inlet. It was usual to work at 1·5 in. at the fan, and 0·7 in. at the boiler, which corresponds to a motor output of 30 h.p., and a fan speed of 332 r.p.m.

The stokers, as well as the economiser scrapers, are electrically driven through counter-shafting suitably arranged.

The boilers are fed by three Weir pumps (one of which is a spare) arranged along the west wall at the end of the firing floor.

Two feed-water storage tanks are provided, one being at each side of the feed pumps. The turbines deliver their condensate through Lea recorders into these tanks, while the make-up is got from the works water supply system. As this water only contains 2° permanent hardness, with temporary hardness nil, no water treatment plant was installed.

Piping.—The steam- and feed-water piping is arranged on the ring system. The supply to the turbines is taken from steam receivers, which form part of the steam ring. The piping systems are sufficiently sectionalised to localise trouble should it occur.

All valves are readily accessible, while each turbine has its own atmospheric exhaust pipe and automatic water-sealed relief valve.

Turbine House.—The turbo-alternators are four in number, three being of 3,000 kw., and one of 1,500 kw. capacity at 0·75 power factor; each set is further capable of carrying a 20 per cent. over-load for two hours.

The turbines are of the B.T.H. mixed Curtis type, designed to run at 3,000 r.p.m. The alternators are star-wound for 6,600 volts, three-phase, 50 cycles, the stator end windings being firmly held to provide against trouble due to short circuit.

The general arrangement of the sets is shown in figs. 3 and 4. It will be seen that the exciters are direct coupled; they are wound for 110 volts.

The 3,000-kw. units have a steam consumption, excluding auxiliaries, of 14·2 lb. per kw.-hour at full load, when supplied with steam at 185 lb. per sq. in., and 500° F. at the turbine stop valve, and exhausting into a 28-in. vacuum, which is reached with a cooling-water inlet temperature of 75° F.

Each turbine has its own surface condenser, by Messrs. Cole, Marchent & Morley, those belonging to the 3,000-kw. units having an area of 6,300 sq. ft. arranged on the two-flow principle.

An Edwards type, three-throw, air pump, combined with condensate pump, and a circulating-water pump, by the Rees Roturbo Co., both electrically driven, complete the condensing equipment of each set.

The alternator cooling air is passed through a wet filter before use.

Switchgear.—The H.T. switchgear is of the B.T.H. standard cell type, duplicate bus-bars being provided. The oil switches are remote controlled through levers manipulated from the switch platform. The general arrangement of the switchboard is shown in figs. 3 and 4.

The isolating switches are interlocked with the oil switches, and with their respective service doors, in such a manner as to prevent accidents.

A separate panel is provided for each of four generators, six feeders, three transformers, and two Tirrill regulators. The generators and auxiliary transformers are arranged with the Merz-Price balanced system of protection, while the four principal feeders have Merz-Hunter split-conductor protection. All circuits are fitted, in addition, with time overload trips, as well as the usual accessories.

The protective gear mentioned for transformers and feeders has proved very reliable, in that it has isolated satisfactorily on numerous occasions without interrupting the supply over alternative routes.

An accumulator battery, having a capacity of 126 amp.-hours at 110 volts, is provided for tripping the oil switches and for a few emergency lights.

Auxiliary Switchboard.— Current for the station auxiliaries is provided by three 500-K.V.A., 6,600/440-volt, mesh-star, Ferranti, oil-cooled, core-type transformers, two of which are always in circuit.

This power is controlled by a B.T.H. board, placed below the platform serving the main operating panels. Separate leads are run to each of the circulating water and air pumps, and to each side of the boiler house, where the current is further subdivided through a Parmiter-Hope "Fluvent" pattern ironclad-fuse distribution board. The 440-volt L.T. switches are all of the oil-immersed type, with trips in all three phases.

General.—The alternator neutrals are separately earthed through 83-ohm resistances. The alternator excitation is controlled by means of hand-wheels and pedestals conveniently placed on the switch gallery, from which the attendant has an uninterrupted view of the turbine house.

The H.T. switchgear, it will be noticed, is isolated in an annexe, separated from the power house proper by the main wall of the building.

The internal H.T. cable connections are in lead-covered, paper-insulated cable; the L.T. in rubber-covered wire.

The jumpers on to the overhead lines are paper-insulated, lead-covered, served, tape-armoured, three-core cable.

The power and boiler house structures are designed with a view to allowing a 50 per cent. extension, should the need arise.

A 15-ton hand-operated travelling crane runs the whole length of the turbine house.

As a supply of cooling water from the Solway was not obtainable, a 148-ft. by 76-ft. spray cooling pond, to Messrs. Harrison, Son & Jobson's design, had to be installed. It is guaranteed to cool 840,000 gallons per hour, from 90 to 75° F., with a wet-bulb temperature of 55° F. Valves are arranged in the system in such a manner that the active area can be made to suit the station load. It has been found necessary to change the pond water at frequent intervals to avoid condenser scale, which would in time result from excessive concentration.

The water from the pond is taken into the power house through a 30-in. cast-iron pipe, to which the various circulating-water pumps are connected. On leaving the condensers the water again enters a common pipe-line, to be sprayed through some 589 nozzles at a pressure equivalent to a 18-ft. head over the pond area.

(To be continued.)

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Annual Report.

The annual report of the Institution states that the membership at April 1st, 1919, amounted to 7,023, an increase of 356 on last year's figure; it consisted of eight Hon. Members, 1,524 Members, 3,833 Associate Members, 519 Graduates, 680 Students, and 459 Associates. Of 99 members deceased during the year, 34 gave their lives for their country. During the past 12 months there have been 27 ordinary, 4 informal, and 23 Council meetings; with the addition of meetings of Committees and Conferences, the total number of meetings was 191, comparing with 153 in 1918, 148 in 1917, and 117 in 1916. Before the war the highest number was 159, in 1913-14. There have also been 57 meetings of Territorial Centres. The Students' Section held 8 meetings in London, and the Students' Section of the North-Western Centre also held 8 meetings. Premiums for papers were awarded by the Council as follows:—Institution Premium (£25), Prof. Miles Walker; Ayrton Premium (£10), R. S. Whipple; John Hopkinson (£10), P. Hunter-Brown; Kelvin (£10), S. F. Barclay and S. P. Smith; Paris (£10), R. Knox; extra premiums (£10 each), E. P. Cumberbatch and Lt.-Col. W. A. J. O'Meara. No awards have been made of the David Hughes and Salomons Scholarships. Particulars regarding the Paul Scholarship, to be devoted to instrument-making work, are given.

In view of the success of the Tees-Side Sub-Centre, a Territorial Sub-Centre has been established at Sheffield, and others will be formed at Aberdeen, Leicester, and Preston.

The rules regarding examinations for Associate Membership are temporarily suspended.

The number of members who have served in the Navy or Army since the outbreak of war is 2,021.

The Army Council appointed a Commission to inspect and report upon the arrangements for the supply of electric power in the war areas in France and on future policy in regard to such matters, and on the invitation of the Army Council the Council appointed the President (Mr. C. H. Wordingham) to represent the Institution on the Commission. The Commission spent 10 days in France, examining witnesses, and inspecting various establishments and sites, and presented a lengthy report. The President was similarly nominated to give evidence before a Committee appointed by the Army Council to report upon the future functions and organisation of the Corps of Royal Engineers, presided over by Sir Henry Rawlinson, G.C.B.

The Electrical Appointments Board, which has been established as a separate organisation, has decided that, owing to the limited number of vacancies, only members who have served in H.M. Forces can be dealt with at present; 230 names have been registered under this heading.

The draft Regulations for the Electrical Equipment of Ships have been completed, and will be published shortly; several shipbuilding firms have already applied for copies of the preliminiary draft, and are using it. The British Engineering Standards Association will issue certain standard specifications, which are referred to in the Regulations, about the same time as the latter. In the Model General Conditions for Contracts, the Council has altered Clause 24 for contracts made since 1918 so that the amounts of the instalments of the retention money (Clause 23 (2)) will be changed from 10 and 10 per cent. to 15 and 5 per cent.

The Councils of the Institution and the B.E.A.M.A. have agreed that in future all researches initiated by them shall be carried out by the Electrical Research Committee, which is composed of 7 members from each body, and has appointed Mr. E. B. Wedmore as Director of Research.

The report of the Patent Law Committee was adopted by the Council in June last, and later by the representatives of 30 technical societies.

A Committee has been appointed to report on regulations for overhead power lines, with a view to reducing the unnecessarily high cost, and securing the safety of the public by cheaper methods of construction; the British Engineering Standards Association will prepare specifications for such items of overhead construction as may require them.

The Council has set up a Committee for the purpose of securing technical co-operation between this country and the Dominions and Colonies, and foreign countries, for the exchange of experience and information as to engineering practice.

The Committee of representatives of various interested bodies, appointed by the Council to consider the question of an Electrical Proving House, has prepared a detailed scheme, and the matter is receiving consideration.

The Council took steps to deter the Prime Minister from placing electricity supply under the Ministry of Ways and Communications. A special Committee has been appointed by the Council to formulate a plan to obtain the opinion of members of the Institution on the Supply of Electricity Bill.

The official recognition of the Electrical Power Engineers' Association as the protective association for technical staffs, and the establishment of the Electrical Development Association as the result of the work of the Committee appointed by the Council in 1918, are dealt with in the Report.

On December 31st, 1918, the capital account of the Benevolent Fund stood at £5,709, and the accumulated income at

£1,249. In 1918 the receipts were £259, and 19 grants were made, amounting to £250. A recent appeal to members for support has had a gratifying result, the number of subscribers from January 1st to April 15th this year being 570, and the amount subscribed £422, as compared with 104 subscribers and £155 in the same period last year.

The annual accounts show a margin to the good on the revenue account of £1,271, compared with £2,090 in 1917, a decrease of £819. The assets stand at £134,675, and the liabilities at £42,926, leaving a balance to the good of £91,749, an improvement of £6,969, compared with 1917.

Address to the Territorial Centres.

By C. H. WORDINGHAM, C.B.E., President.

[During the session the President has visited and addressed all the Territorial centres. The following is an abstract of the *verbatim* report in the *Journal* for April.]

One of the most conspicuous things we did last session was to improve the status and extend the responsibilities and possibilities of what were then called local sections. Very much more responsibility is now given to the Committees of the Centres, and they are taken fully into the confidence of the Council. In the past the chairman was bound down by promise of secrecy not to tell his committee what passed at the Council meetings, and in consequence was often placed in a most invidious position. That condition has now been done away with, and the chairman is at liberty to communicate the whole of the minutes of the Council to all the members of his committee.

The question of the electrical proving house has now advanced to the stage of a definite scheme having been formulated.

There are one or two questions outstanding which will have to be settled before we can make any real progress. One of these is whether the proving house should test only goods of British (that is to say of Imperial) origin, or whether it should also be prepared to test imported goods and to certify whether they do or do not comply with British standard specifications. It has been suggested that we might have reciprocity in the matter.

In certain quarters we are told support will not be forthcoming unless some arrangements can be made to enforce the use of articles only which have passed the proving house. That is a very difficult matter to arrange, and my own personal view is this—let us get the proving house started and all these other matters will very rapidly settle themselves. I am convinced that once it is on its feet manufacturers and all concerned will find it is of such enormous benefit that they will not hesitate to make use of it. I do not believe in considering every possible difficulty that may arise beforehand. It is far better to get the thing started and deal with the difficulties as and when they arise.

Another important step taken last session was the formation of the Electrical Development Association. I am confident that this association, if properly worked, will have a most important bearing on the industry in the future.

A very important committee was set up last session in connection with the question of patent law, and, under the chairmanship of Mr. Mordey, it produced an admirable report, which was adopted at a conference called by the Institution of Mechanical Engineers. There is reason to hope that full weight will be given to the views expressed in a new Bill which is about to be drafted.

Last session the Council determined to set up what is known as the Appointments Board. This session the Board has actually been appointed, and it is now at work. It will only deal with those who are out of employment, and will endeavour to bring them in contact with employers who are seeking assistants. It will be run exclusively by members of the Institution for members of all grades.

The Institution has formed a branch of the Royal Society of Medicine known as the Association of Radiography and Electrotherapy, a joint committee to deal with the question of providing efficient lay helpers in connection with X-ray and electrotherapeutical work.

Recently a committee, which I think will be very important, has been set up by the Institution, known as the Technical Co-operation Committee, to deal with all questions affecting the Institution which arise from foreign countries. We hope foreign countries will set up committees of their own on similar lines.

At present we are not doing very much as an Institution abroad. In Canada the American Institute has to a very great extent already captured the field, and anything that we do must be more or less in competition with them. It would be lamentable were a similar position to develop in Australia and New Zealand, or in India. We ought to take a very broad view of the matter, and recognise that we cannot expect these great Dominions to be considered as territorial centres, on the same footing as a comparatively small section of the British Isles. We must recognise their national aspirations, and my present view is that each of these Dominions should have its own Engineering Institution, and our members should in some way be affiliated, as a section of this Institution, to what I may call the National Institution. In those countries in which the total number of engineers is small there might be one National Institution for all kinds of engineers; in others there might be enough electrical engineers to justify a National Electrical Institution. In either case our members in the Overseas Dominions while remaining members of our own Institution, and meeting together, should in some way be affiliated to that Overseas National Institution, so that Canadians or Australians or whoever they were would feel that they were not joining a purely English Institution, but that they were joining a Canadian or Australian Institution closely interlinked with our own British Institution of Electrical Engineers. I think it is the duty of our Institution to foster in that way the interests of electrical engineers all over the British Empire, and I think that the matter should be taken in hand forthwith.

What certainly entailed on me personally by far the greatest amount of work last session was the forming of a protective association for power station engineers. Towards the latter end of last year the Council were informed that very strenuous efforts were being made by the Electrical Trades Union to bring within its membership not only workmen but engineers of all ranks up to and including chief engineers of central stations. The Government practically insist upon all industries being organised. The Whitley Report most unfortunately recognises only two classes: workmen and employers. The brains of manufacturing works and of all technical industries are left out altogether. It is a gross injustice and a most extraordinary oversight. You cannot have the technical staffs in the workmen's union. The Council were informed that there were some half-dozen associations intended to be protective associations, but all very much on a par with one another. Having regard to the facts as they were presented to the Council, the Council said: The only way we can reconcile these half-dozen associations is by the Institution starting an altogether new one under its auspices which the members of these other associations can join without any loss of dignity. The only object of the Council was to provide a representative protective association which every one of its members could join. They had no other object in view. When the mass meetings came to be held, however, very violent opposition was experienced from one of these half-dozen bodies, namely, the Electrical Power Engineers' Association. It became quite clear that this association had far out-distanced all the others, and was in fact vastly more important than the remaining ones in respect of numbers and of the support which it had received from the power station men concerned. Further, they had a most important asset in that they were constituted before the outbreak of war as a trade union. In order to act effectually you must be a trade union, whether you like it or not. As soon as the facts were found to be different from the facts which were put before the Council, on which facts they had acted, the Institution recognised the E.P.E.A. as *the* protective association for engineers engaged in the power station industry. And there the matter stands at the present moment.

Now as the Institution has dealt with power station members it has an equal duty to those other members who are engaged in the manufacturing industry, and something ought to be done for them. There is already in existence a society known as the Society of Technical Engineers. There has been a great deal of secrecy about this society, and very little if anything has been published. As a matter of fact, I have been in touch with members of this society practically since its inauguration. For some reason there has been in the past a strong feeling of hostility towards all the old institutions—electrical, civil, and mechanical—on the part of this new society. The society is not purely electrical, it embraces all branches of engineering, and for that reason it has been quite impossible for our own Institution to approach the society because we should have laid ourselves open to a very well-merited snub. Therefore nothing has been done officially, but unofficially I have endeavoured to get in touch with the movement; I am very glad to think that a much better feeling is growing up towards the Institution, and I look forward to co-operation with the society before very long.

There is a good deal to be said for the line they have taken. It has been pointed out to me that in many of the large works you have staffs belonging to quite different branches, and it is important that all the members of the staff of one firm should be members of the same and only one protective association. The matter is urgent, and we should get a single protective association for the whole of our members in whatever branch of electrical work they practice.

It appears to me it might be possible to extend the Electrical Power Engineers' Association so as to include all electrical engineers and to embody it in the Society of Technical Engineers. The E.P.E.A. is very young and it has many young men within it. It may in the earlier stages act indiscreetly at times. It should not be condemned for that; rather should every effort be made to secure that the governance of that body is effected by men who will have plenty of common sense and moderation, and will run it on proper lines; but whatever they do, try to meet them, and do not try to set up competitive organisations which can only end in failure, for any competition must tend to destroy the usefulness of all those who are competing. After all, what we have to fight is a common enemy.

With regard to the E.T.U., we do not even want to fight them. I should like to see some rapprochement between the union and the E.P.E.A. Hitherto they have been at loggerheads because the E.T.U. has been endeavouring to bring within its ranks those who, properly speaking, ought never to be there. If only these two bodies could agree upon a line of demarcation then there is no reason why one should not be helpful to the other. So long as the E.T.U. endeavour to force engineers into their ranks, so long must they be regarded in a hostile spirit by the engineers, who never can possibly in any numbers, I should hope, enter that union; not because there is anything derogatory in their doing so, but because there is an essential difference between manual work and technical and scientific work.

The next matter which I think ought to receive attention is the doing of something more by the Institution for its junior members. There is a tremendous gap between the students' meetings and the general meetings of the Institution in London and at the territorial centres. I hold most strongly that all technical discussions should be held under the auspices of the Institution. The protective associations should confine their attention to the objects for which they were founded. I think it would be a very great mistake if they were to start reading papers on technical subjects, as has been proposed, but, in saying that, when I was consulted on the matter, I met with the retort that it is essential that these younger men should have the opportunity of reading papers and taking part in discussions, that they were not qualified to join in the main meetings either as authors of papers or in discussions, and if they did not have facilities they would never get the practice which was necessary to enable them to become competent authors and able to discuss papers of the general meetings. That is entirely true, and it is certainly the duty of the Institution to provide those facilities. I felt so strongly about this that I brought the matter before the Council at its first meeting this session, and I am hopeful there will be set up a committee drawn from the junior members of the Institution above the grade of students, but still not very far advanced in the profession, who will arrange for the reading and discussion of papers by men of their own rank.*

At the present time undoubtedly power-station papers greatly preponderate, but they are of very little interest to the telegraph and telephone section. We might very well have a committee for telegraphic work and let the telegraph men organise their own meetings and conduct their own discussions. There is a crying need for good work to be done in connection with wireless telegraphy.† The fact that we have not attended to these lesser known branches has led in the past to the formation of special societies. There ought to be no need for that; they ought to be dealt with by appropriate sections of the Institution.

I should like to commend to you the provision of a worthy, conspicuous, useful, and lasting memorial to those of our members who have fallen in the war. There has been set up a committee which has already held meetings, and has carefully considered the lines which such a memorial should take. I hope that no capital sum will be carried forward in perpetuity, but that the whole of the money collected will be spread over the lifetime of those who are in receipt of the help and no further. The memorial should be of active use to those who have suffered in their own persons or in the persons of their immediate dependents during the war.

I should like also to see the Institution out of its own funds publish a book containing a short biography of every one of its members who has fallen, together with a portrait.

In the brief review I have given you I think two facts stand out. The first is that in several instances papers read before the Institution have led to definite action being taken; that is a gratifying result. The second is that such action has been taken in concert with other bodies. The Institution, as it has been said, has been the umbrella under which a number of other bodies have met. On some six or eight occasions during last session joint meetings of that kind took place. I think this taking the lead has been a most useful and important development of the Institution's work.

In my inaugural address I laid a good deal of emphasis on the obtaining by the Institution of a Charter, and a Charter Committee was set up last session. The committee met once and reported. It was quite clear when the meeting began that the members of the committee thought that what they were expected to do was to draw up a scheme in the form of a Royal Charter having the same effect and the same objects as the scheme which is now embodied in our present Memorandum and Articles of Association, but I ventured to unfold to that committee something of what was in my mind as to the future activities of the Institution, and I am bound to say they were rather taken aback, and the report which they made to the Council was a very reasonable one indeed, namely, in effect that before they were asked to draw up a Charter it would be just as well if they knew what the Charter was to cover—in other words, before they drew up the specification it was necessary for them to know what they wanted. I feel most strongly that I have no right to go to the Council and ask them to draft a Charter on certain lines unless I am able to say that I have what I may call a mandate from the general body of members that the scheme I put before the Council is the scheme the members want. So, entirely on my own responsibility—I want to make quite clear that the Council is in no way responsible for the scheme I am putting forward—I have drawn up a scheme which will serve as a peg on which to hang a discussion, and I am addressing each of the territorial centres in order to bring this scheme before as many individual members of the Institution as possible. That scheme does not profess to be perfect nor complete, but it is sufficient I think to enable members to express a general opinion and to give a guide as to what they want the Institution to be. There are some of the elder members of the Institution who think that the members wish it to be merely a scientific and technical body for the discussion of papers on engineering subjects. The impression which I have received, rightly or wrongly, is that the majority of the members want something very different. They all want that, but they also want the Institution to develop the commercial side of the industry. At this stage I suggest that members should ask me questions concerning the scheme, but I do not ask them to discuss it. When I have been to all the Centres a full report of the address will be published in the *Journal* and in the Press, and after that publication has taken place, each Centre, I hope, will see its way to call a meeting specially to discuss the scheme. The Council is only there to carry out the wishes of the general body of members, and they do not want to force any scheme upon the members; they merely want to do what the members wish.

(*To be continued.*)

NATIONAL ELECTRICITY SUPPLY.

At a special general meeting of the Incorporated Municipal Electrical Association on Friday, May 16th, in London, it was agreed that the Electricity Supply Bill should be amended in accordance with the general resolutions and leading principles set forth below, and detailed amendments were suggested for this purpose. The resolutions have been forwarded to the members of the House of Commons.

General Resolutions and Leading Principles.

That the members of the Association are of opinion that in the national interest generating stations and main transmission lines should be publicly owned and controlled.

Clause 1.—That the Commissioners shall be whole-time officers having no other interests whatever than the special duties which it is proposed to confer upon them under the Bill.

Clause 3.—That the Commissioners should be given more freedom of action (by deleting the words "subject to the approval of the Board of Trade").

Clause 5.—That the Local Authority representation on the District Boards shall be in the majority (and the representatives of companies excluded).

Clause 5 (3).—That the District Boards should appoint their own chairmen, and that the reference to remuneration of members of the Board be deleted.

Clause 5.—That provision be made for the appointment, &c., of officers and servants by the District Boards, as provided for the Commissioners' staff in Clause 1.

Clause 7.—That if part of an undertaking be acquired by a District Board the whole undertaking be taken over if the owner so desires.

Clause 7 (2).—That the method to be adopted for computing depreciation and sinking fund charges and for the payment of local authorities, companies, or persons should be the same, and that special consideration should be given to all cases where capital costs have been provided for out of revenue moneys (Sub-section 2*a* to be modified accordingly, and Sub-section 2*b* deleted, except the proviso).

Clause 9.—(Proviso, authorising consumers to combine to establish a generating station for special purposes, to be deleted).

Clause 11.—That unremunerative areas developed on national grounds should be developed at the national expense.

Clause 12 (2*a*).—(Similar proviso to be inserted, applying to company undertakings.)

Clause 13.—(Amendment extending the clause to other authorised undertakers besides the District Boards.)

Clause 15.—That the Commissioners should be enabled to review agreements relating to the user of water.

Clause 16.—That the powers of a District Board should not be transferable except by special order. (Power to lease undertaking to be deleted.)

Clause 17.—That the compensation clause is unsatisfactory as regards the time limit of five years, the absence of a scale of compensation, and its non-applicability to the officers and servants of undertakings which have not vested in the District Boards.

Clause 24.—That the industry will be severely handicapped unless powers are given to the District Boards and all authorised undertakers to sell appliances on ordinary and hire-purchase terms.

Clause 26.—That expenditure incurred for the purposes of standardisation should be defrayed out of a special fund established on a district or national basis.

Clause 29 (3).—That auditors employed should be professional auditors.

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* This committee is now in being, and three informal meetings have already been held.

† The Wireless Sectional Committee is now in being, and two meetings arranged by it have already been held.

Clause 35.—That the transfer of undertakings or portions thereof to the District Boards should be exempt from stamp duty.

Clause 39.—(Authority to make rules, &c., to be confined to the Commissioners, deleting Board of Trade.)

Clause 44.—That the control of the electrical industry should be placed under that Government Department which most nearly represents all industry and commerce, viz., the proposed Ministry of Commerce or the Board of Trade, the Board of Trade in either case being the appropriate department at the present time. (Clause transferring powers to Ministry of Ways and Communications to be deleted.)

New Clause.—That association for the interchange of information, experience, and ideas is advantageous, indeed necessary; enabling facilities in the case of local authorities should be provided. (Payment of subscriptions to associations, and expenses of attendance at conferences.)

Subject to such alterations and amendments, the Incorporated Municipal Electrical Association considers that the Bill is acceptable to local authorities.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Base Rate and Bonus.

It would appear that a considerable amount of caution is necessary before accepting a post where a fixed sum is named for remuneration inclusive of all bonuses to date. In nine cases out of ten the applicant never troubles to inquire what is the basal salary and what is bonus, the result being that after accepting the post he realises, when too late, that in all probability he has a lower basal salary than he had in the job which he vacated. This "catch-penny" type of advertising ought to be stopped, and in its place a plain statement given as to what is base rate and what is bonus.

Caught in the Net.

May 24th, 1919.

Posts for Demobilised Engineers.

The methods of some of our Government departments make a business man feel tired. If demobilised engineers seeking occupation will write to me, giving, on separate sheet, particulars of qualifications and experience, I will see what I can do in the way of helping them to secure positions.

W. Stanley Shaw (Capt.),
Territorial Force Reserve.

7, Addison Road, Bedford Park, W. 4, *May 25th*, 1919.

The "demobbed" received a further shock at the hands of the Committee at West Ham. No ex-Service man amongst the three selected to appear before the Council. All three in good posts at present.

The Council consists mainly of Labour members, and the meeting was held a few hours after the demonstration near the House of Commons. I enclose card.

Demobbed.

Electricity and the Model Home.

I have just returned from the Model Homes Exhibition, being held at the Central Hall, Westminster, and did not see any electrical exhibits, though our enterprising friends of the gas industry were well to the fore. It seems a great pity this is so, for the exhibition is being attended by people from all over the country who are interested in housing, and when it is remembered that £300,000,000 are to be spent in the next few years on new houses alone, the importance of this sphere of activity should not be lost sight of, but, rather, should be energetically followed up by the electrical industry.

Ernest T. Williams.

London, N.W., *May 22nd*, 1919.

[We cordially agree with Mr. Williams that, of all things, electricity should have been adequately represented at the Model Homes Exhibition. That it was not must be ascribed largely to lack of organisation in the electrical industry. But it will not happen again. Our Electrical Development Association, newly born, is not yet in a position to take effective action—but it is moving, and we shall soon see results.

It has taken three years for Mr. Williams's scheme for the reorganisation of electricity supply to bear fruit in legislative action, but the Electrical Development Association will move more quickly than the Government. Our colleagues in Wales have already shown the way, as will be seen elsewhere in this issue.—Eds. Elec. Rev.]

The E.P.E.A. Award.

Your correspondent "Wessex" asks, in reference to Mr. Harding's colleague, "How can the award apply?" There are many of us who would be exceptionally grateful if "Wessex" would inform us when, where, and how it is applied. For a space of six weeks I have been asking through your columns if anyone has really seen one of the fortunate individuals who have obtained the award, or if any person or persons can vouch that they have either seen or had speech with one of these very remarkable phenomena.

All the satisfaction received so far is a reply from Bath, which omits to state definitely that the increased salary, *plus* the lump sum due from March 31st, 1918, has been received. In to-day's issue (May 23rd) we have, in another letter, a copy of the protest of some persons referred to as the A.S.E., and the E.T.U., against some rather irregular doings at Southampton.

We have no record that another body, known as the E.P.E.A., has made any public protest on the same matter, though the irregularity in question affects the members of the E.P.E.A. to a far greater extent than the members of the other bodies mentioned. Is this fact due to funk, neglect, or to a feeling that it would be *infra dig.* to refer to such delicate matters, and by so doing to wound the tender feelings of some chief engineer or committee-man?

One would have thought that the affair at Southampton would have been of prime interest to the E.P.E.A.; but then, one also thought that business was really intended when the 20 per cent. + £90 award was declared as the Association's firm policy, which it would carry at all costs.

Perhaps, however, one is a little hard on the E.P.E.A.; perhaps insufficient time has been allowed to our officials to permit them to follow the E.T.U. at a respectful distance, either in the matter of the phantom award or that of the cushy little berth at Southampton. No doubt in a few months' time we may get one-tenth of what we ask for, and no doubt our next annual report will contain a note on Southampton to the effect that "Your Council and Executive Committee had their attention called to this matter, and its gravity almost demanded a word of protest. We are glad to report, however, that wiser and calmer counsel prevailed, and our corporate indignation was fully expressed by an extreme and dignified silence."

Mr. Harding is quite right in asking if this award is backed by any authority, or whether it is simply a pious opinion expressed by a pseudo-authority for the comfort and encouragement of a crowd who most emphatically "Don't want to fight," and will be jingoed if they do.

Connaught T. Smith.

May 26th, 1919.

With reference to recent correspondence on the above Association and its "awards," might I venture to add one word further? The E.T.U. provides a section for station engineers, and I would strongly advise all shift engineers and stations engineers and others now of the E.P.E.A. who are dissatisfied with the *promised* award not to adopt the Asquith attitude of "Wait and see," but to communicate with the nearest delegate or secretary of the E.T.U., and first obtain particulars of the Station Engineers' Section, second join up, third fight on, and last, but not least, obtain the victory assured to all E.T.U. members, for I believe the E.P.E.A. to favour the Wilson theory of "more notes," but no tangible result other than waste of paper and ink. The award, I am afraid, is like the old saying of to-morrow—it never comes.

Change-Over.

May 25th, 1919.

Pure v. Vulcanised Rubber for Flex.

Having had several friendly arguments with other engineers on the question of superiority, in use, of either double-pure-rubber-covered flexible wire or double-vulcanised, I should be interested to hear the opinion of your readers. From my own experience, I consider that whilst vulcanised flexible has the advantage of higher intrinsic resistance at the outset, it rapidly deteriorates, especially when used with counter-weight fittings, electric irons, and other portable apparatus. In my opinion, the better material to use is pure rubber. I am aware that vulcanised flexibles are more usually specified by consultants, but I think without due consideration to the results in use.

J. Robinson.

May 22nd, 1919.

[The I.E.E. Wiring Rules distinctly favour pure rubber.—Eds. Elec. Rev.]

Flexible Copper Tubing.—Rubber tubing does not fulfil all the conditions of a satisfactory elastic gas connection. The Metal Gas Hose Co., of Erie, Pa., has produced metal tubing which is said to meet some of the requirements which rubber tubing fails to satisfy. It is made of seamless, soft-annealed copper, in lengths from 12 to 36 in., and in ¾-in. diameters. It is sufficiently flexible to make it readily adaptable to portable appliances, yet durable to a degree that justifies the manufacturers in recommending it for permanent installations. The cost of such tubing is by no means prohibitive.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Automatic Valves for Motor-driven Air Compressors.

Heretofore, in driving motor-driven air compressors, no efficient and inexpensive method has been found that would automatically unload the compressor before starting and stopping the driving motor, and thereby reduce the wear and tear of the plant. Further, when the consumption of air is small relatively to the capacity of the compressor, it would be economical automatically to stop the motor when the pressure in the receiver rises to a certain predetermined maximum, and start it again when the pressure falls to a predetermined minimum. On the other hand, when the consumption of air approximates to the full capacity of the compressor, it would be preferable to run the motor constantly, unloading and loading the compressor at the maximum and minimum pressures respectively.

The above results may now be obtained by the use of the patented magnetic air valve of the British Thomson-Houston Co., Ltd., of Rugby, in conjunction with their automatic starting gear.

The magnetic air valve ensures that the air compressor is unloaded before current is switched on to the motor, as well as throughout the starting period, the load being thrown on only when the motor has reached its normal speed. This considerably reduces the current required at starting, and permits a starting gear of lower capacity to be used than would otherwise be necessary. The valve operates similarly when stopping the motor, unloading the compressor before current is switched off. This enables the compressor and motor to slow down gradually, and prevents undue strains on the heavy moving parts.

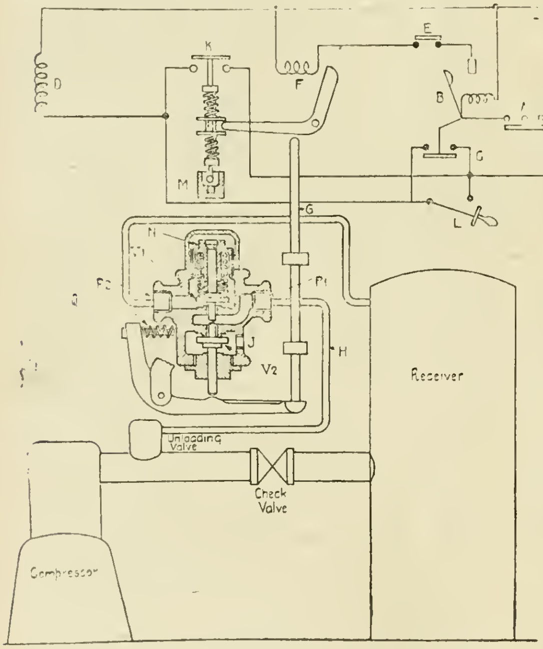

Fig. 1.—Diagram of B.T.H. Magnetic Air Valve for Air Compressors.

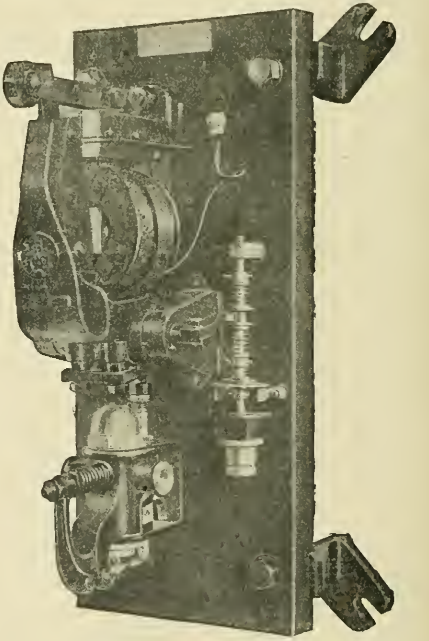

Fig. 2.—B.T.H. Magnetic Air Valve.

In order to run the compressor continuously, a small switch is closed, the load then being automatically removed when the air pressure rises to the maximum, and thrown on when it falls to the minimum.

In whichever manner it is determined to operate the compressor, either intermittently or continuously, no further attention is required after closing the main switch, the subsequent operations being entirely automatic.

Apart from the economy of current and compressed air, the smooth working of the compressor due to the absence of severe strain at starting and stopping conduces to a minimum of wear and tear on the compressor, the life of which should be considerably lengthened and repairs reduced to a minimum.

The essential parts are a pressure governor, contactor starting gear, magnetic pilot valve, time lag device, and lever switch. A main unloading valve and a non-return (or check) valve are also required, placed on the delivery side of the compressor, these being part of the compressor equipment.

The magnetic air valve is a combination of an electromagnet of the contactor type, a two-way valve, and a small switch controlled by a dashpot. These parts are such as have been commonly used on B.T.H. contactor panels, or in steam locomotive practice, and have demonstrated their reliability in actual use for years. They are supported on a slate base with corner feet for bolting to a vertical surface.

The diagram (fig. 1) shows the compressor at rest and the receiver fully charged; valve V^1 being open admits air from the receiver to the unloading valve, thereby opening the compressor cylinder to atmosphere.

When the demand for air is such that the pressure in the receiver falls to a predetermined minimum, the pressure governor switch A closes; this energises and closes the auxiliary contactor B, and and interlock C attached thereto. Current then passes by way of interlock C to the main coil D of the automatic starting gear and starts the motor.

The starting contactors are omitted from the diagram for the sake of clearness. Each contactor operates under current-limit control, *i.e.*, the second contactor cannot close until the starting current, which had risen when the first contactor closed, has fallen to a predetermined figure, and so on during the complete operation of starting. As yet the pilot valve solenoid F is not energised, its circuit being interrupted by the interlock E attached to the last main contactor; the valve V^1 of the pilot valve therefore remains open, and air passes from the receiver to the unloading valve.

At the same time as the last contactor closes, cutting out the last section of the resistance, the motor having then attained full speed, the interlock E closes, current then passing to the pilot valve solenoid F which closes, thereby forcing down the rod G, closing the upper valve V^1 and cutting off the supply of air from the receiver. At the same time the valve V^2 opens, and the air contained in the unloading valve is free to pass through the pipe H, the lower valve V^2, and out at the opening J. The unloading valve now closes, loading up the compressor; it will be seen that the load is not applied until the motor is up to speed. The closing of the pilot valve solenoid F also closes the interlock K in parallel with the interlock C.

When the demand for air decreases and the pressure in the receiver rises to the predetermined maximum, the pressure governor switch A opens, thus opening the auxiliary contactor B and the interlock C; the pilot valve solenoid F is therefore de-energised, the rod G is forced upwards by means of the spring Q, the lower valve V^2 closes, and the upper valve V^1 opens. Air from the receiver then passes once more through the valve V^1 to the unloading valve, which opens, thereby unloading the compressor.

During this period the main contactors are not affected, being kept closed by the interlock K, the movement of which is delayed by the dashpot M. After a predetermined period of time has expired, this interlock opens, tripping the main contactors and stopping the motor. It will be noted that the motor is not stopped until the compressor has been unloaded.

By closing the lever switch L the compressor will run continuously, the pressure governor A then having no effect on the main contactors D, but only on the unloading valve through the operation of the pilot valve, the compressor being loaded or unloaded at the minimum and maximum pressures respectively.

When large multi-stage compressors are used, involving the use of intercoolers and much piping, the continuous loading and unloading of the compressor means a considerable loss of compressed air. In these cases it is recommended that two air valves be used instead of one, the first air valve operating on the air intake side of the compressor, and the second one on the delivery side. As an interval of time elapses between the operation of the two air valves, *i.e.*, between the closing of the intake and the opening of delivery, the compressed air contained in the system is allowed to be forced through to the receiver before unloading takes place, so that when the delivery side is opened to atmosphere, it is practically at atmospheric pressure.

B.T.H. magnetic air valves are made for pressures up to 300 lb. per sq. in., an adjustable spring being provided for adjusting to the pressure required. They are made in two types for A.C. and D.C. circuits respectively, and to suit voltages up to 550. Magnetic air valves are supplied either as separate units, or may be combined with a pressure governor on the same base.

"Simplex" Heaters.

Messrs. SIMPLEX CONDUITS, LTD., Garrison Lane, Birmingham, have just placed upon the market two new designs of lightly-loaded heaters, suitable for portable and auxiliary heating. Both types are supplied complete with flexible cord and lampholder adapter. The reflector type, known as the Plexsim "Firette," is loaded to 600 watts, but the conical element being highly radiant, the heat emitted is much greater than would be expected from so low a loading, making this particular pattern suitable for use in cold rooms where the heater can be placed in proximity to the person desiring warmth.

FIGS. 3 & 4.—SIMPLEX "FIRETTE" AND "ONEBAR" FIRES.

The cabin type, known as the Plexsim "Onebar" fire, consists of a robust cylindrical iron case with open perforation on one side, in the interior of which is a Plexsim luminous fire-bar, loaded to 500 watts. The heater is very strong, and will stand rough usage; the bar being suspended on springs is practically unbreakable through shock. It is particularly suitable for ships' cabins, small offices, cubicles, crane cabins, and the like positions; but it is also useful for domestic purposes, the position of the luminous bar being adjustable so that it can be arranged for fixing to wall or floor, and it is also useful as a portable heater.

French Standardisation of Electrical Machinery.—With a view to standardising as much as possible general practice in relation to the construction of electric generator sets, the French Chamber of Electric Power Machinery Constructors and the Steam Turbine Manufacturers have published rules and data relating to the design and manufacture of these machines. The most important data are included in an article in the *Revue Générale de l'Electricité* of April 5th, 1919 The technical section includes formulæ, data, diagrams, and tables dealing with the standard definitions of the power notation used, and the figures corresponding to these definitions for turbo-alternators of 50 periods, from 350 KW. to 25,000 KW., and also for turbo-dynamos are given. The commercial section of the article consists of a very complete selling specification. The explanatory notes at the end amplify a number of the sections which may not be sufficiently clear to all readers.

LEGAL.

KING *v.* CITY OF LONDON ELECTRIC LIGHTING CO., LTD.

IN the City of London Court, on Tuesday last week, before Mr. Registrar Wild, a claim was made by Mr. A. P. King, 10, Pancras Lane, against the City of London Electric Lighting Co., Ltd., for the balance of money belonging to the plaintiff in the possession of the defendants and lent to them. The claim was not disputed. The defendant company's representative said the case was one in which he submitted costs should not be recovered by the plaintiff. Every effort and endeavour on the defendant company's part had been made to refund the balance due to Mr. King. The defendants' witness said the money was waiting for him at their office, and he did not give them the opportunity of finding him at his office during the recognised business hours.

The REGISTRAR pointed out that a debtor must seek out a creditor. He could not deprive the plaintiff of his costs except for some cause, and the plaintiff was only exercising the right he had in going to Court. Directly the money was due the person could sue for it. In making an order for the defendants to pay within 14 days, he declined to treat them differently to other debtors.

A MINER FINED.

AT Bishop Auckland Petty Sessions, last week, Frederick Jackson, a miner, was charged under the Coal Mines Act with conduct likely to endanger life.

On behalf of the prosecutors, Messrs. Bolckow, Vaughan and Co., it was stated that while in Westerton Colliery accused pushed in an electric switch and turned on the current where boys were working. One apprentice was severely injured by shock. Jackson had no authority to touch the switch, above which was a notice stating that men were working on the line at the time.

A fine of £5 was imposed.

OSRAM ROBERTSON LAMP WORKS, LTD., *v.* CRYSELCO, LTD.

IN the Chancery Division, on May 23rd, before Mr. Justice Younger, the Osram Robertson Lamp Works, Ltd., moved for judgment in their action against Cryselco, Ltd.

Counsel for petitioners said this was a motion for judgment by consent in a patent action.

The defendants appeared by counsel and consented, and his Lordship made the order.

WOOD *v.* CONNOLLY BROS., LTD.

IN the Chancery Division, on May 23rd, Mr. Justice Younger had before him a motion in this debenture holders' action.

MR. CLANSON, K.C., said a receiver was appointed, and an order for sale made, some five years ago, but the war intervened, and the sale could not be effected. Throughout the war, however, a very lucrative business had been carried on for the Ministry of Munitions by the company, under Messrs. James and William Connolly, acting under the receiver. It was now alleged by plaintiff that one of these gentlemen was employing a person named Flannery to come at surreptitious hours and copy drawings with a view to using them in such a way as would not be to the interests of the debenture holders. He therefore asked for an injunction against all three to restrain this being done.

MR. ARCHER said what the Messrs. Connolly had done they conceived they had a perfect right to do. Their desire was to act perfectly honestly and straightforwardly throughout. He would give an undertaking not to take away or make or use any such plans or designs.

On this undertaking the motion stood over.

A DUBLIN TRAMWAY WORKERS' AWARD.

MR. JUSTICE MOORE, in the King's Bench Division of the High Court of Ireland, Dublin, ordered notice of motion to be served on the Amalgamated Association of Tramways and Vehicle Workers' Federation in the matter of an arbitration between the Dublin United (Electric) Tramways Co. and their workers, the question arising on an application to have the arbitration made a rule of Court.

Counsel for the Tramways Co. explained that Sir Plunket Barton, in an award of last October, [illegible] the tramway workers 23s. over pre-war wages, and that after the Temporary Wages Court granted an increase from 23s. to 28s., also altering the payment on time basis from a 7-day to a 6-day week. This latter alteration being as the Tramway Co. was advised, *ultra vires*, they made the present application as a preliminary to asking that the award as to the time basis be set aside.

German Institute for Weak-current Technology.—An institute for weak-current technology (in distinction to heavy-current technology), with a professorial chair, has been formed in connection with the Dresden Polytechnik. The curriculum will include telegraphy, telephony, wireless telegraphy, and the theory of instruments, measurements, and transmission lines.—*E.T.Z.*

THE ELECTRICAL EQUIPMENT OF THE NEW MODDER CIRCULAR-SHAFT SECTION.

From the description of the plant of the New Modder Circular Shaft Section in *S.A. Mining Journal and Engineering Record*, we take the following account of the electrical equipment. The power supply to the circular-shaft plant is taken from the Rand Mines Power Supply Co., Ltd. Two independent sets of overhead lines are brought into the sub-station through isolated high-tension switches. The power is delivered at 40,000 volts and transformed down to 2,000 and 500 volts for supply to the motors. The 500 volts is again transformed down to 200 volts at suitable points for lighting purposes. The supply to the mine is controlled by 22 feeder switch panels; six for the 500-volt supply and sixteen for the 2,000-volt supply. The 2,000-volt end of the switch house is divided into two distinct sections, the main bus bars being connected by heavy links, each section being independently fed from the Power Co. The 5,000-H.P. Ward-Leonard winder, air compressors, ventilating fan, underground pumps, winders, and winches are supplied with power from one section, while the whole of the surface works are supplied from the other section, thus enabling the mine officials to close down either section without interfering with the other. All cables are of the 3-core, paper-insulated, lead-sheathed and steel-armoured type. Steel tape armouring is used for surface cables, and steel wire armouring for the shaft cables. The copper section varies from 0.25 sq. in., the largest, to .025 sq. in., the smallest used. Feed cables connect the main switch-house switch panels with four distributing link houses, each to control a section of the plant. Each link house is divided into three sections, each one to control either the 2,000-volts, 500-volts, or 200-volts lighting supply. The power is supplied from each link house to the motors in that particular section of the works by cables leading through local link cages to switch boards controlling complete sections or single switch panels controlling isolated motors. A single-section cage contains six links, two cable end boxes and bus-bar.

With the exception of the two 2,000-H.P., D.C. motors on the main winding engine, all the motors are A.C., three-phase, 500-volts up to 50 H.P., and 2,000-volts from 50 to 5,000 H.P. The motors are of both the slip-ring and squirrel-cage (short-circuited rotor) types. The squirrel-cage type of motor has been taken more advantage of than previously, and in every instance where the starting torque required was within the limits of the short-circuited rotor the squirrel-cage motor was used. When possible, former or semi-former wound coils are used, especially impregnated to prevent moisture penetrating the windings. Both ends of the stator windings are brought out to terminal boxes mounted on the stator frame; this is not only beneficial for testing, but permits of the motor being used with right-hand or left-hand cable leads when moved from one position to another. In the case of slip-ring motors a heavy type of brush gear is adopted, and all brushes are fixed above the horizontal centre line of the rotor. In many instances brush raising and short-circuiting gear has been avoided to save maintenance, by adopting an iron-clad short-circuiting switch mounted upon the outside of the stator frame. When motors are mounted upon stagings, special rigid construction has been resorted to, to prevent vibration. In the case of slip-ring motors, the usual three-phase liquid starter with dipping blades is used. But with the squirrel-cage motor the auto-transformer type of starter is used, connected to the motor by suitable tappings to give the required voltage reduction.

Great care was taken to place the sub-stations at the centre of the load, and the K.V.A. feet to the reduction works centre is equal to the K.V.A. feet at the winder room load centre. Power is distributed in bulk to the various link houses and then sub-distributed to the various link cage centres. Each main link house is arranged so that by means of indicating apparatus and change-over links, various sections may be connected to various cables. There are no inter-connecting cables used. All switch cables, links, &c., are numbered, lettered or tagged in such a manner that by means of standard distribution prints which are placed at all supply points, the operator is able to see at a glance the source of supply and trace out any cable or other connection to enable him to operate with safety. All shaft cables are of the 3,300-volt class, and all surface cables are of the 2,200-volt class. All lighting cables are also of the 2,200-volt class. Each feeder panel and main motor control panel has been equipped with test panels, so that check meters may be inserted when required. All main supply feeds are in duplicate, the cables being so arranged (wherever possible) that the supply to one point is carried over two cables, both of which are normally loaded, but if one cable should develop a fault, the other cable can in most cases carry the load with a 90 deg. F. temperature rise.

The supply to the mine is metered at the sub-station; each independent feed from the Power Co. is measured separately by three independent meters, viz., the consumer's meter, the Power Co.'s meter, and a joint meter, the average being taken of the three readings, provided the accuracy of each meter is within 2 per cent. of the mean accuracy of the three meters.

BUSINESS NOTES.

Catalogues Wanted.—Messrs. Oxley, Lawrence and Co., Ltd., of 60/61, Blackfriars Road, London, S.E. 1, desire to receive copies of trade catalogues.

Mr. Frank A. Meggitt having recently commenced business as an electrical engineer and contractor at 18, Brunt's Street, Mansfield, will be glad to receive trade catalogues.

Machine Tools, Wood-working Machinery, and Treadle-lathes Orders.—The Ministry of Munitions has suspended, as from May 23rd, the operation of the following Orders:—Machine Tool and Power Machinery Order, 1916, Wood-working Machinery Order, 1917, and the Treadle-lathes Order, 1918.

Import Restrictions.—The President of the Board of Trade, after duly considering the recommendations of the Consultative Council on Imports, has given the following further directions in regard to the Prohibition of Imports:—

The restrictions on the importation of the following articles are to be removed:—Aluminium powder, paints and enamels (from July 1st).

The importation of the following articles is to be licensed only exceptionally, as and when required:—Blow lamps, metal parts of lamps.

Industrial Administration.—Mr. Edward T. Elbourne, author of "Factory Administration and Accounts," will give during June and July, at Winchester House, Old Broad Street, E.C., three courses of eight lectures on Factory Organisation (Wednesdays, 6 p.m., commencing June 4th), Labour Administration (Thursdays, 6 p.m., commencing June 5th), and Factory Costing (Fridays, 6 p.m., commencing June 6th). A discussion will follow each lecture. The fee is one guinea for each course. A syllabus can be had on application by post to Messrs. Brindley & Elbourne, 110, Victoria Street, Westminster, S.W. 1.

The Germans and Russian Business.—The Germans continue to have their eyes fixed on possibilities in Russia. According to a German newspaper, the Russian-German Financial Syndicate is being formed in Berlin for the promotion of financial undertakings in Russia. The promoters and managers are Dr. Friedlich (Russian General Radio Telegraphy Co. and the Russagan Telephone and Telegraph Connections Co.), Exporter Beyer, of Rostow on the Don, and Consul Bienemann, of the Union Bank of Moscow, whilst Councillor of Justice Tiktin, of Berlin, is to be the secretary.

The Lead Market.—In their report, dated May 24th, Messrs. James Forster & Co. state:—

> On Tuesday afternoon the price of controlled lead was reduced 20s. per ton to £24 nett *ex* warehouse. There may be good reason for the reduction, but it is certainly not known to the trade or the market, and . . . it has naturally shaken confidence and caused the withdrawal of inquiries which were about, both from the home trade and for export.
>
> On the very day of the reduction the market was firm, with actual buyers for June shipment lead at £24 10s., and no sellers under £24 15s. . . . The trade and brokers are nonplussed at the action of the Controllers.

Messrs. G. Cawson & Co., in their report under the same date, say:—

> After opening steady at £24 10s. to £24 15s., with business done at £24 10s. May, June and September, the market was upset on 20th inst. by the Control suddenly reducing their price for warehouse lead to £24. This reduction coming when the trade had apparently settled down to the price of £25, and were coming forward to supply their requirements at this figure, naturally destroyed confidence, and, instead of encouraging business, had just the reverse effect. Consumers are now less keen to buy, and argue that if Control take £24 to-day, they may, perhaps, take £23, or even £22 next week With such a prospect before them, they cannot be induced to buy except for actual requirements. America is now quite out of the market, and the price there considerably above the London parity. Germany, however, is reported to have sold a fair quantity to Holland at cheap prices—this is a fresh competition, which cuts out the London trade. We are afraid that the outlook at present is not very encouraging. Arrivals are again fairly heavy, and stocks may, perhaps, show a further increase. Australia, too, shows some uneasiness with her store of probably 80,000 tons. Relief can only come from improved trade, or considerable reduction in production.

Official Receivership in Bankruptcy.—The Board of Trade has appointed Mr. Arthur Harold Ward to be Official Receiver in Bankruptcy for the districts of Exeter, Barnstaple, and Taunton as from June 2nd, in succession to Mr. Arthur Edward Ward, resigned.

The Overseas Trade Department and British Advertising Abroad.—H.M. Commercial Counsellor at Rome has called attention to the great number of trade advertisements in the Italian Press inserted by foreign exporters other than British, as compared with the practically complete absence of any notices regarding British goods. It is suggested that this matter should receive careful consideration from manufacturers and merchants in the United Kingdom. *The Board of Trade Journal* states that lists of advertising agencies and of suitable Italian newspapers can be furnished by the Department of Overseas Trade, who will be glad to help any British firm who may have difficulty in connection with the publication of their advertisements. The *Journal* further states that the "Department of Overseas Trade is prepared to indicate to high-class British firms an exceptional opportunity of advertising in Turkish, Arabic, and Persian-speaking countries by means of a fortnightly illustrated paper. Advertisements can be accepted for whole, half, or quarter pages. Pictorial advertisements of a striking type (photogravures) are recommended."

The Kinematograph Trade.—In their report for the year ended January 31st, 1919, the directors of Cinematograph Theatres, Ltd., state that though the "Picture House" continues to grow in public favour, running costs are much heavier. There is a substantial increase on last year's profits, and the total dividend for the year is 20 per cent. Out of the available profit balance £12,500 is put to depreciation of properties, £7,500 to depreciation of plant. £15,000 to reserve for postponed repairs and renewals. and £15,000 to general reserve. After paying the dividend referred to above, £25,134 is carried forward. After exhaustive examination of the subject, the directors consider that to maintain the company's present predominant position in the kinema trade it is desirable in most cases to build theatres and cafés in future on a larger scale. For this purpose properties have been purchased at Edinburgh, Nottingham, Plymouth and Hull, and negotiations are proceeding elsewhere. The capital is to be increased from £400,000 to £1,000,000. This important concern is well known to the electrical trade. and its enlarged operations are. therefore, of particular interest. As a matter of fact, the company purchases some 2,000,000 KW.-hours per year from various supply authorities, and, of course, buys considerable quantities of electrical plant, equipment, accessories, &c. Mr. R. Grierson, now demobilised, is back in harness again as chief engineer of the undertaking.

Boys' Welfare Association.—Prince Albert, as President of this Association, attended a general meeting of the members held at the Central Hall on May 22nd. to discuss the enlargement of the scope of the Association. On the motion of Sir W. Beardmore, it was resolved that the objects of the Association be extended to benefit, if so desired, all persons employed in industry, and Sir William referred to the unsettlement in the Labour world as a now outstanding problem of Industry, the solution of which obviously lay in the revival of the old friendly relations between masters and men. Democracy was justifiably claiming a greater share in the affairs of the nation; but it still needed guidance. and it could best get that amongst its industrial surroundings. The Association was established as the outcome of a conviction on the part of the members of the Council that the wise upbringing of the boys was the most important matter to be undertaken, and that to ensure its success the work must be directed by Industry itself. The Association had been warmly taken up by many of the leading firms of the country. and, in spite of the disadvantages and uncertainty of the present day, had made wonderful progress. There was at present, however, a danger of employers becoming confused between the various claims of the many agencies which had now taken up welfare work. Many employers, also, had come to the conclusion that it would be better for all workers to be dealt with together and not separately. Further, there was little doubt the non-acceptance of the responsibility for the work by the employers themselves would lead to its being taken up by the State, with the inevitable chilling out of the human element. The Council, therefore, after careful deliberation. had recommended the policy embodied in the resolution. Sir George Carter, K.B.E. (Cammell, Laird & Co., Ltd.), having seconded, and the Rev. R. R. Hyde, the director of the Association, having explained the manner in which it was proposed to give effect to the resolution, it was put to the meeting and carried unanimously.

Under the amended constitution. the Association will in future be known as "The Industrial Welfare Society."

Spanish Companies.—The Basque Motores, Ltd., has been formed at Bilbao by James Keid and Sebastian Luis Carcaux y Sturgeon for the manufacture and sale or letting on hire of all kinds of motors, also of internal combustion motors. Capital 50,000 pesetas.

The Spanish company which has been formed to make and sell the specialities of Messrs. Babcock & Wilcox, Ltd., in Spain, has placed orders in England for the greater part of the machinery to be installed, to the estimated amount of 3,500,000 pesetas. It has also entered into commercial agreements with the British Mannesmann Tube Co., Ltd., G. & J. Weir. Ltd., and Lassen, Sons & Menzies, giving it exclusive rights for the sale and manufacture of the specialities of these firms in Spain and Portugal.—*La Energia Electrica.*

Spanish Railway Construction Work.—In the report for 1918, presented at the yearly meeting in March last. of the Metropolitano Alfonso XIII—the underground railway now under construction in Madrid—it is pointed out that, with a view to keeping its character essentially Spanish, almost the whole of the construction material had been bought in Spain; only those articles were acquired abroad which were impossible of acquisition in Spain. These last included copper, coach bogies, and electric motors with their steering apparatus.

The Industrial League.—On the roll of membership of this League there are now between 300 and 400 firms, many managers, foremen, shop stewards, and workmen. By means of meetings, literature, &c., it is working assiduously for industrial harmony, and it has been successful in bringing into closer touch, and therefore better understanding, many employers and employed. Firms in the electrical industry who have not yet joined the organisation should apply to the Secretary, Mr. John Ames, at the offices, 66, Victoria Street, London. S.W. 1. for pamphlets setting forth its objects, and for copies of the *Journal* of the League.

Strike at Turin.—The whole of the nickel working and mechanical works of Turin have been brought to a standstill by a strike of the heads of the technical departments. Some 40,000 workmen are affected. The technicians ask an increase on their salaries corresponding to the advance granted to the workmen.

Letters from the Forces.—According to announcement by the War Office, letters are no longer to be addressed B.E.F. The British Forces in France or Flanders are to be addressed—"British Troops in France," and those with the British Army of the Rhine —"British Army of the Rhine." The "British Salonika Force" now the "Army of the Black Sea."

French Companies.—Under the style of the Electro-Construction a company has been formed at Paris, with a capital of 225,000 fr., for the exploitation of a speed-changing gear applicable to electric motors, suppressing belt transmission, &c.

The Société Grenobloise de Fournitures Industrielles d'Electriques has been formed at Grenoble. with 60,000 fr. capital, with objects as stated in its title.

Monin, Guillard et Jaloustre is the title of a newly established company devoted to the manufacture of instruments and apparatus of precision of all kinds. mechanical, physical, electrical, chemical and medical. Its capital is 300,000 fr., and its offices are at Paris.

The Société Française Radio-Electrique have increased their capital from 1,500,000 fr. to 7,000,000 fr.

The Société de Chauffage Electrique Domestique et Industriel is the title of a concern just started in Paris, with a capital of 140,000,000 fr., its objects being the making of, and trading in. electric apparatus, especially those for heating purposes.

Conference of British Manufacturers.—The National Union of Manufacturers is holding a conference of British Manufacturers to-day (Friday) at 2.15 p.m., in the Central Hall. Westminster. to make definite and urgent representations to the Government that the present widespread unemployment, with the vast sums which are being paid for unemployment pay, is largely due to the uncertainty as to the future economic policy of the country, and the absence of any definite steps for the prevention of dumping and the protection of key or essential industries in fulfilment of the promise made by the Government at the General Election.

Sir Edward Carson, M.P., will address the meeting, and the following will also speak:—Mr. George Balfour, M.P., Mr. Neville Chamberlain, M.P., Sir Richard Cooper. Bart., M.P., and Mr. Alexander Johnston, J.P. The chair will be taken by Mr. George Terrell, M.P., president of the National Union of Manufacturers. It will be exclusively a manufacturers' conference.

Machinery and Plant for Disposal.—By order of the Disposal Board Ministry of Munitions, the Controller of Plant and Machinery is inviting offers for machinery and plant (including generators, dynamos, and motors), at the R.E. Experimental Station, Wembley. Full particulars are given in our advertisement pages to-day.

International Exhibition at Bombay.—According to *Indian Engineering* a movement has been set on foot for holding an International Industrial Exhibition on a grand scale in Bombay next year.

British Westinghouse War Relief.—In a letter recently circulated, the Committee governing the Westinghouse War Relief Fund express their great appreciation and thanks to all contributors for the voluntary support given throughout the period of the war. Up to the end of December, 1918, nearly £66,000 had been subscribed, approximately two-thirds by the employés, and one-third by the company. The period of regular contributions from wage or salary is now about to finish, and it is satisfactory to learn that a balance remains sufficient to cover for a period of at least 10 years the relief of the disabled and the dependants of those who have made the supreme sacrifice. There are 207 relatives and 382 children of deceased workers, in addition to many disabled soldiers and sailors for whom responsibility has been incurred.

Importation of Rubber-Covered Wire into Australia.—The Commonwealth Government has issued a proclamation prohibiting the importation of rubber-covered wire, unless it complies with certain specifications and conditions. To each coil of wire must be affixed a label setting out the manufacturer's name and address, the length of wire in the coil, the date of manufacture, the gauge of conductors, and the insulation resistance. The conditions of tests that the different grades of wire must comply with are set out in the proclamation. The proclamation is published in the Commonwealth *Gazette*, dated April 3rd, and the regulations come into force on July 1st next.—*Industrial Australian and Mining Standard.*

Commenting on the matter, the *Melbourne Age* for April 4th says:—"For some time it has been required by the Customs authorities that all imported rubber-covered wire cable must bear certain specified marks, and must conform to the standards implied by those marks. The Minister of Customs stated yesterday that certain exporters from at least one country decided that they would not mark their cables with any token of standard, and, as a result, cables were being imported into Australia which were unsafe. This had led to the fusing of wires in some cases, and to outbreaks of fire. In consequence, a new Customs proclamation had been issued forbidding the importation of cables unless they bore specified marks revealing their standard of quality, while such cables must comply with the standards so indicated."

The 44-Hour Week.—The ballot taken by the Federation of Engineering and Shipbuilding Trades on the question of a 44-hour week without reduction of wages, closed on Saturday. There is believed to be a very large majority in favour of opening negotiations for the introduction of the shorter week by the autumn or winter.—*Times.*

Book Notices.—"Science Abstracts" A and B. Vol. XXII, Part 4. No. 256. London E. & F. N. Spon. Price 1s. 6d each post free.

"Electrical Development and "Town Planning Reconstruction problems Nos 24 and 25. of the Ministry of Reconstruction series of Grey pamphlets London H M Stationery Office Price 2d each

"General Plan of the Water-Power Survey of the Japanese Government (Translated.) Tokyo: Bureau of Electrical Exploitation, Department of Communications.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXXVIII. No. 5. May, 1919. New York: The Institute. Price $1.

"Book-keeping and Cost Accounting for Factories." By W. Kent. London: Chapman & Hall, Ltd. Price 18s. 6d. net.

Trade Announcements.—Messrs. Wood & Cairns, Ltd., have removed their Glasgow branch to more commodious premises at 65. Waterloo Street. Telephone No.: Central 1465.

Mr. R. G. Cooper. A.M.I.E.E., for many years district engineer to the General Electric Co., Ltd. (South Wales branch), is leaving to join Mr. C. King, of 37, Westgate Street, Cardiff. as electrical and mechanical engineers' and manufacturers' agents (Cooper and King).

Messrs. Thacker. Bell & Co., Ltd., announce that Mr. R. S. Thacker has resigned from the directorate; this will in no wise affect their general business as electrical, mechanical. and machine-tool engineers. merchants and exporters.

The Electrical Alloy Co. notify that they will handle all export business from their general offices and mills. Morristown, New Jersey. U.S.A.

Mr. Harry A. Miller has commenced business as an electrical engineer at 16. Dumbarton Road, Stirling.

Restoration of Pre-War Practices.—The text of the new "Restoration of Pre-War Practices (No. 3) Bill" is now published. The Bill was read a first time in the House of Commons on Monday. It will be found in the *Times* for May 27th. This is the third form in which the Bill has been drawn up, and it is now an agreed measure embodying, it is understood. a settlement arrived at between the Government. the employers, and the Unions.

According to the *Daily Telegraph*. the measure is a very simple one. "It simply decrees the complete and unqualified restoration of these pre-war privileges two months after the signing of Peace, and if. after the lapse of a week. the privileges have not been restored, the workman can institute legal proceedings against the employer. The Bill does away with the notice to the employer to restore, with the majority vote, and with all the other small provisions which were made in the first Bill. It is now understood to be entirely satisfactory to both the men and the employers, and should be passed before Whitsuntide."

Trade Associations and Combinations.—The Committee on Trusts which was appointed in February. 1918, by the Minister of Reconstruction, to consider what action, if any, might be necessary to safeguard the public interest in view of the probable extension of trade organisations and combinations, has now issued its report (Cd. 9236, 6d., H.M. Stationery Office). It contains a great deal of instructive information and a number of conclusions and recommendations, to which we may refer later. The secretary (Mr. John Hilton. of the Garton Foundation) made a separate "Study of Trade Organisations and Combinations in the United Kingdom" for the purposes of the Committee, and this is published together with the general report, as well as notes on "The Law Relating to Combinations." prepared by Sir John Macdonell. Mr. Percy Ashley has contributed to the proceedings a Memorandum on Industrial Combinations

Liquidations and Dissolutions.—Vactite Wire Co., Ltd.—Winding up voluntarily for reconstruction purposes. Liquidator. Mr. L. J. Yeoman. who is authorised to enter into an agreement for the sale and transfer to the new company. Meeting of creditors June 5th. at 20. Copthall Avenue, London, E.C.

Consolidated Diesel Engine Manufacturers. Ltd.—Meeting called for June 3rd. at Winchester House. Old Broad Street. E.C., to hear a report from the liquidator and to declare a second return to the contributories.

Asbestos Manufactures Co., Ltd.—Meeting June 27th. at 36, Victoria Street, S.W., to hear an account of the winding-up from the liquidator. Mr. W. C. Tyler.

Dussek Bitumen Co. Sherman Street, Bromley-by-Bow.—Messrs. A. E. H Dussek and A. S. Dussek have dissolved partnership. Debts will be attended to by Mr. A. E. H. Dussek, who will continue the business.

Bankruptcy Proceedings.—W. J. McCombe, tramway manager. Kingston-upon-Hull.—Trustee appointed May 24th. Mr. W. G. Hall. Union and Smith's Bank Chambers. Silver Street, Hull.

I.M.E.A. and Electrical Imports.—The Incorporated Municipal Electrical Association has circularised its members under date May 22nd. asking them to furnish this week for the use of the Director of the Board of Trade Department of Import Restrictions, information as to instruments. apparatus, or plant that it is desired should be imported between now and the end of September, 1919. Particulars stating requirements as concisely as possible have to be sent to Mr. T. Roles. Electricity Department. Town Hall, Bradford.

French and Belgian Industrial Reconstruction.—America proposes to supply £15,000,000 worth of machine tools to France and Belgium for re-equipment of factories.—*Times*.

The Overseas Trade Committee.—In the House of Commons, last Monday in reply to a member who asked who were the members of the Committee appointed to determine the relations between the Consular and Diplomatic Services and the Department of Overseas Trade. and what were their terms of reference, Mr. Cecil Harmsworth stated that the Committee appointed by the War Cabinet had the following terms of reference:—"To examine the question of Government machinery for dealing with trade and commerce." The members of the Committee are Viscount Cave (chairman), Sir Horace C. Munro, K.C.B., Mr. F. Dudley Docker, C.B., and Mr. Kenneth Lee.

Non-Ferrous Metals Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for May 27th.

The Mineral Deposits of Spitzbergen.—From the Northern Exploration Co., Ltd., of 62, London Wall, E.C. 2, we have received a brochure entitled "The Gate to the Northern Markets of Europe," in which the coal, iron, and other mineral resources of Spitzbergen are very fully described. The company owns claims extending over about 2,000 sq. miles, containing, it is stated. by far the richest mineral deposits in Western Spitzbergen. It is claimed that the only way in which the Northern European markets can be regained by Great Britain is by the rapid development of these deposits. A 16-page inset shows examples of the many varieties of marble of which there are large deposits available on Marble Island.

LIGHTING AND POWER NOTES.

Australia.—Newcastle.—The T.C. has arranged for a loan of £20.000 from the Commonwealth Bank of Australia for extensions to the electricity undertaking.

Tasmania.—The Government is negotiating with the Mount Lyell Co. with the view of providing Zeehan with electricity from Lake Margaret station. The company will probably install a transmission line to Zeehan, and subsequently continue it to Rosebery. This proposal takes the place of the Government's King River hydro-electric scheme.

Ballynahinch (Co. Down).—Street Lighting.—Application has been made to the L.G.B. for permission to light the streets with electricity. A considerable number of the shops and private houses have been wired in anticipation.

Bray (Co. Wicklow).—Loan.—The U.D.C. has accepted the offer of the Hibernian Bank of a loan of £5.300, at 4½ per cent., to be repaid in 15 or 20 years, for the improvement of the electricity undertaking.

Bury.—Year's Working.—The Electricity Committee reports a loss of £1,983 on the working of the undertaking for the past year.

Price Increase.—The electricity charges are to be increased by a further 30 per cent.

Clacton-on-Sea.—Power Charges.—The Chamber of Commerce has asked the U.D.C. to reduce the power charges for electricity, in order to attract industries to the town.

Continental.—Austria.—The Vice-Chancellor, last week, defined the Government's socialisation plan as including the socialisation of the coal, electricity, wood, and iron industries, thereby giving the State control over the two greatest power sources and the two most important raw materials.

Thus. in spite of its present financial position, the Government seems to be prepared to plunge into a programme costing milliards of crowns. The *Neue Freie Presse*, recognising that the scheme is inopportune, declares that it cannot be fully realised for a generation owing to the debts of the State and of local bodies.

Sweden.—The electro-steel industry of Sweden continues to develop rapidly. According to the *Stockholms Dagblad*, one of the largest ironworks companies—the Domnarfvets Järnwerk—has decided to make considerable additions to its plant. Two new blast furnaces are to be erected, and, what is more suggestive of progress, six electric furnaces for Thomas iron, and two 15 to 20-ton electric-steel furnaces, as well as several Martin furnaces, are to be added to the existing plant.

Cranbrook (Kent).—Extension of Supply.—The R.D.C. is in favour of Hastings T.C. extending its area of supply of electricity to the district. The proposal also includes Rye and Tenterden districts.

Darlington.—Year's Working.—The accounts for the year ended March 31st, 1918, shows that the electricity undertaking has a capital of £152,719 and a revenue of £40,806, which yielded a gross profit equal to 11·81 per cent. on the capital employed. One-third of the debt has been paid off, and in addition to the provision for redemption of the debt there are reserves for depreciation, &c., amounting to £20,484. A sum of £7,535 has been expended out of profits on capital works.

Dewsbury.—Price Revision.—From the meter readings in June next the price of energy for power, heating, lighting, and on the rateable-value system, will be increased by another 10 per cent.

Doncaster.—Loan Application.—The T.C. has applied to the L.G.B. for permission to borrow £40,000 for additional plant at the electricity works.

Elland.—Year's Working.—The report on the past year's working of the Council's electricity works shows a loss of £2,600.

Epsom.—The U.D.C. has informed its consulting engineer, Mr. J. H. Rider, that there is no objection to his ascertaining what offer would be made by the South Metropolitan Electric Tramways and Lighting Co., Ltd., for the Council's electricity undertaking.

Falkirk.—E.P.E.A. Award.—The Corporation has been requested by the E.P.E.A. to grant to the electrical engineer the increases given by the terms of the award.

Faversham.—Price Increase.—The T.C. has given notice that as from July 1st next the price of electricity for lighting will be increased to 7d. per unit.

Greenlaw.—Hydro-Electric Scheme.—The Special Lighting District Committee has informed the Berwickshire C.C. that it proposes to utilise the water-power from the River Blackadder for E.L. purposes, and to request that the necessary powers be obtained from the B. of T.

Grimsby.—New Plant.—The Public Lighting Committee recommends the accepting of the tender of the Stirling Boiler Co. for the supply of boiler house plant, for the sum of £18,648, and directing that an offer of £7,500 be made for the "Russian turbine" and alternator, subject to the plant being satisfactory to the Borough electrical engineer; and that, if such offer is accepted, the British Westinghouse Co.'s tender to supply new condensing plant, overhaul and test the turbine and alternator and deliver and erect the whole plant (the Corporation providing rough labour and cartage from the railway to the works) for the sum of £6,125, be accepted.

Hereford.—E.L. Scheme.—At a conference of urban and rural D.C.'s of Herefordshire, held on May 22nd, the Mayor (Councillor E. R. Dymond) explained the Corporation scheme for supplying electricity for power and lighting to areas which might be extended to any distance, but which at present were proposed to be 12 to 20 miles from the city. Already applications had been received from various neighbourhoods within five miles. He explained how the Corporation came to acquire the electric plant, through the Government requiring it for a munition factory. The city, of course, had no power to force the scheme on the District Councils, and before proceeding they wished to learn if those Councils would be prepared to entertain it. Four years would be granted in which to decide, and it rested with them whether the scheme received encouragement or not. There was not a single dissentient to the scheme.

Heston and Isleworth.—Year's Working.—The accounts for the year ending March 31st, shows that the income of the electricity undertaking was £18,647, against £15,434 for the previous year. The sale of energy produced £17,019, and from public lighting £1,368, and from meter rents £255, were received. The expenditure was £18,211, against £14,021 for the previous year. Generation of electricity cost £10,416, and distribution £525. The management expenses were £1,175, the loan charges £4,922, and there was an outlay of £238 on mains and services. The surplus was £436, compared with £7,413 for 1917.

Bulk Supply.—The station engineer reported that it would be necessary to provide for a total prospective demand for 1,421 kw. As the capacity of generators at the station was 1,250 kw., it was necessary to consider what course to adopt. The U.D.C. decided to invite the Twickenham and Teddington Electric Supply Co. to supply in bulk on the basis that the Council would take 400,000 units per annum as a minimum for three years at £4 per kw. of maximum demand, and 0·9d. per unit supplied, plus 10 per cent. per annum on the cost of laying the feeder cable. The price per unit was based on coal at 25s. per ton, and subject to a sliding scale in respect of the cost of coal and labour.

Huddersfield.—Wages.—The unskilled men employed by the electricity undertaking, demanding a 47 hours' week and overtime on all work done in excess of those hours since January 1st, have handed in notice to cease work on May 31st. The skilled men's hours were reduced to 47 on January 1st. The Corporation has replied that it cannot grant the demand. At the time of writing the men are acting without their Federation's sanction.

Hull.—The Electricity and Tramways Committees has held a joint meeting to discuss the amalgamation of the generating stations. It is proposed to close down the tramway power station in Osborne Street, and to depend entirely for lighting and power purposes upon the Sculcoates station. It was agreed that the chairmen and vice-chairmen of each Committee, with the engineers, report upon the question.

Liverpool.—Price Revision.—From June 30th the charges for electricity for lighting, power, and other purposes, are to be increased by a further 25 per cent., a total war increase of 65 per cent. In cases where the rates are subject to adjustment according to the variations in the price of fuel, the post-war advance of 15 per cent. is to be increased by another 10 per cent.

London.—Shoreditch.—The regulation requiring consumers to pay for new services laid has now been withdrawn, and from May 23rd all services which have been approved by the Electricity Committee will be laid free of charge, providing they are within 60 ft. from any of the Council's distributing mains

St. Pancras.—The E.C. recommends that from the June meter readings the present addition of 2½ per cent. be increased to 25 per cent. for energy supplied for power and heating purposes, and to 50 per cent. for energy supplied for all other purposes. The proposed revision will mean that the pre-war rates will be increased by 75 per cent. for power and heating supplies and 50 per cent. for all other purposes.

Bulk Supply.—An agreement has been come to between the County of London Electric Supply Co. and the City of London Electric Lighting Co., under which fresh generating plant is to be installed at the generating station of the City Co., and bulk supply from this plant will be taken by the County of London Co. The agreement has been approved by the Board of Trade, and the work is proceeding.

Newcastle-upon-Tyne.—Electricity Supply Bill.—A conference of representatives of northern municipalities was held in Newcastle-upon-Tyne, on May 23rd, further to consider the Government's Electricity Supply Bill. Objection was taken to the clause which gives power to District Commissioners to lease their powers for the generation of electricity to companies, and the meeting, being of opinion that there is not a sufficient guarantee in the Bill for securing public control, approved of alterations to be submitted to Parliament in favour of absolute public control.

New Zealand.—Water Power.—The Dominion Government proposes starting forthwith the preliminary work at Mangahao in connection with the North Island hydro-electric scheme. There are to be sub-stations at Otaki, Wellington, Featherston, Masterton, Bunnythorpe, Marton, and Dannevirke. Of the 160,000 h.p. required for the North Island, Mangahao will provide 24,000 h.p. The scheme will provide the City of Wellington with power, in addition to the whole of the province.

Christchurch T.C. has decided to raise a loan of £150,000 for the extension of the electric lighting and power scheme and the installation of stand-by plant to obviate the trouble caused last winter when snowstorms brought down the Lake Coleridge transmission lines.

Nigeria.—Tin Mines Electrification.—The Bauchi Tin Mines, Northern Nigeria, are installing hydro-electric power plant to generate 1,500 h.p., to be transmitted 12 miles to the central point of the property. The cost per unit is estimated at 0·6d., against 2·6d. for oil or coal generation; a saving of £40,000 per annum in fuel is estimated. The total cost of the installation is estimated at £85,000.

Oldham.—Proposed New Plant.—A L.G.B. inquiry was held last week into the Corporation's application for permission to borrow £150,000 for the provision of additional plant at the electricity undertaking. The deputy town clerk stated that he wished to have the application increased by £50,000 for mains and transformers, although the additional application had not been sent to the Board, and would not come before the Council until June. The extensions when complete would allow the ordinary day load to be increased to 1,200 kw. with the present amount of standing plant. The proposed new plant would take a nominal day load of 18,000 kw., with the proper amount of stand-by plant. The day load of 18,000 kw. would be taken up by the winter of 1920. The present capacity was 6,000, with a peak load of 12,160 kw. Mr. Blackmore pointed out that machinery had been ready in the cotton mills to be run by electricity: but the cotton trade being controlled it was not allowed to run, and consequently the Corporation took on additional customers. Directly the cotton trade was in a position to do so, additional load from the mills would be demanded of about 3,600 kw. The outstanding loans of the department amounted to £5,790, and during the past four years the Corporation had spent out of revenue to bring the undertaking up to date £36,277. No neighbouring towns could supply Oldham with power. The application was unopposed.

Plymouth.—Year's Working.—There is a deficiency of £2,190 on the past year's working of the Corporation's electricity undertaking. It will be met out of the reserve fund.

Portumna (Galway).—E.L. Scheme.—A company has been formed to start an E.L. scheme with a capital of £4,000 in 4,000 shares of £1 each. A substantial number of shares are already taken up.

Stalybridge.—Electricity Supply Bill.—At a meeting of the Stalybridge, Hyde, Mossley, and Dukinfield Tramways and Electricity Board last week, exception was taken to the Government Bill now before Parliament, and the matter is to be taken up with local members of Parliament.

Taunton.—Proposed Price Increase.—The T.C. has decided to apply to the B. of T. for powers to increase the maximum price of electricity, the limit under the Order having been reached by the recent advance to 75 per cent. over the pre-war rates.

Uruguay.—A company to supply electricity at Azul, Province of Buenos Ayres has been formed at that town. The initial capital will be $100.00 m/n., of which one-fifth has already been subscribed.

United States.—Atlantic Coast Power Supply.—An article in the *Electrical World* gives an account of the views of W. S. Murray at a meeting of the A.I.E.E. on the plan of the Secretary for the Interior for the power supply of the thickly populated industrial district between Washington and Boston. Mr. Murray considers that the annual waste of power in this area through uneconomical production amounts to as much as 50 to 100 million dollars' worth, and in general he is heartily in accord with Secretary Lane's proposals. These include the electrification of all railways in this part of America, the inauguration of the trunk line system of transmission between Boston and Washington, not too near the coast for military reasons, and consisting of steel transmission towers carrying wires bearing three-phase, 25-cycle current at a pressure probably of 150,000 volts, the transmission lines being three or four in number and lying parallel to each other in private ground. There should be large unit tide-water steam-electric stations, hydro-electric stations and steam-electric stations at coal mining centres, the last-mentioned of which should produce a KW.-hour for an expenditure of 10 to 15 lb. of steam. The millions of tons of culm coal now wasting would thus be made available. The fuel consumption ratio between electric locomotives and steam locomotives is 2 to 1 in passenger service, 2½ to 1 in freight haulage service, and 3 to 1 in switching. In industrial factories electric driving will effect a fuel saving in the ratio of 2 to 1. Prof. Breckenridge estimates that coal production has increased by five times in the last few years and that the available supply of anthracite will be exhausted in 75 years. A map which is included in the article shows the chief centres of power concentration in this area, and gives the electrical capacity at present installed in Boston as 450,000 KW.; Worcester, 50,000; Western Massachusetts, 150,000; Providence, 175,000; Albany, 135,000; New Haven, 150,000; New York City, 1,000,000; New Jersey, 250,000; Philadelphia, 400,000; Harrisburg, 125,000; Baltimore, 110,000; and Washington, 100,000 KW.

Walsall.—Hours of Work.—The institution of a 48-hours' week in the case of shift-engineers, and a 47-hours' week in the case of day workers, together with a stoppage of overtime, has necessitated increasing the regular staff by seven men, representing approximately £1,220 per annum.

Windsor.—Mains Extension.—The R.D.C. has given consent to the Windsor Electrical Installation Co., Ltd., laying a main to supply energy to premises at Clewer.

TRAMWAY AND RAILWAY NOTES.

Colne.—Year's Working.—The actual loss on the tramways, last year, was £3,139. At the electrical works there was a loss of £576.

Continental.—Germany.—The Cologne tramway employés struck work on Saturday, leaving the cars standing in the streets. They asked for increased pay of 4s. per day; the employers offered 3s., but the leaders of the agitation were not supported by the bulk of the men. The men then went to work as usual, but resolved to take no money for fares, whereupon the authorities cut off the electricity supply and prevented the cars running. At this stage the British military authorities stepped in, and the trouble was settled by midday.

Belgium.—Antwerp tramway employés were expected to resume work on May 26th. Their dispute with the tramway company is being submitted to arbitration.

Huddersfield.—Year's Working.—For the year ending March 31st last, the capital outlay to date on the Corporation tramways was £477,507. The income was £199,411, the mileage being 2,461,387, compared with £174,292 received in the previous year on 2,784,039 miles run. The working expenses were £140,514, against £117,490 in the previous year. There was a gross surplus of £58,897. The reserve and renewals account was £79,000. The number of passengers carried was 30,946,790, as against 22,616,710 in 1914.

Isle of Man.—Fare Increase.—The Isle of Man Legislature last week authorised the Douglas Corporation to advance the fares on its tramway system by 50 per cent. There has been a loss on the working of the tramways during the war of over £12,000.

Jamaica.—Railway Electrification.—With reference to our note under this heading the week before last, it is said that the local agent of the Westinghouse Co. of New York is collecting data on which the company may tender for laying down the electric railroad.

London.—Traffic receipts of three of the London tramway companies during the last 12 months show the following increases:—South Metropolitan, £14,000; M.E.T., £84,802; L.U.T., £7,954. In most cases the greater portion of the increased revenue has been absorbed in higher working costs. At the meeting of the L.U.T. Co. last week, it was stated that the expenses had gone up £81,970, leaving the company with an adverse balance of £11,040 on the year's working. The company's Act had received the royal assent. Its powers authorise an extension of the company's tenure of the tramways in Middlesex and Surrey until the year 1950; six months after the termination of the war the fares may be increased to a maximum of 1d. per mile for ordinary passengers and three miles for a penny for workmen.

Strike.—The L.U.T. Co. states that a portion of the system was affected on Friday last by a strike at Chiswick and Hounslow depôts, called by certain motor-men refusing to drive with a non-Union conductor. The men were instructed by their Union to return to work.

Clapham and Stockwell underground stations on the City and South London Railway are to have escalators.

Traffic Congestion.—Sir Auckland Geddes, as acting President of the B. of T., received a deputation of London M.P.'s on Friday last, who urged the establishment of a Select Committee to deal with overcrowding and high fares. Sir A. Geddes, in a long reply, said the war had brought about a different distribution of working people during the day, and a consequent disturbance of communications. By moving Government departments from the centre of London to places like Alexandra Park, it was hoped to relieve the congested area considerably. There was no difficulty, he contended, in obtaining import licences for materials and spare parts required for repairs to rolling stock. Traffic concerns and the manufacturers could "get anything they want if they take the trouble to get it." There was a shortage of seasoned timber, but excellent substitutes were available, and he considered that the best policy was to concentrate on repairs at present, rather than build new vehicles. Sir A. Geddes next defended the increased fares. Those within the 12-mile limit were within the statutory maximum charges, and the B. of T. had thus no power to interfere. The London United Tramways Co. had been permitted to increase its fares because its financial position was so bad that it was in the hands of a receiver. Other tramway increases were within the statutory maxima. The tubes were not under the control of the Railway Executive Committee. They had 60 new cars on order before the war, and specifications were being prepared for another 100. Not a single car had been ordered since the armistice. As to the proposed Select Committee, he would do nothing to resist its appointment if it were pressed for, but he did not feel that it was going to help very much. The problem was too big to be tackled by a House of Commons Committee which did not consist of experts, and in any case the whole question of traffic was going to be handled by the Ministry of Ways and Communications. Eventually the deputation agreed to meet Sir Auckland again at a later date.

Manchester.—Traffic Congestion.—Replying to criticisms as to the congested tramway traffic, Councillor Chapman informed the T.C. last week that the Tramways Committee was hoping to provide 100 additional tramcars this year, each of which would cost £2,000, as against £800 before the war.

Mansfield.—Extension.—The Light Railway Commissioners have granted the Mansfield and District Light Railway Co. an Order to extend the system to Rainworth and Clipstone, and to increase fares on an average by 50 per cent.

New Zealand.—Auckland.—The T.C. has accepted a three months' option of the purchase, subject to the confirmation of the ratepayers, of the electric tramways. The price is £1,140,250, with the current year's profits.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Exclusive wireless telegraphy is a Government monopoly in Australia, as a result of the war, and it is unlikely that the Cabinet will revert to pre-war conditions in this regard. There seems little likelihood of the proposal before the Government from a private company, for the erection of a high-power station at Sydney to dispatch and receive messages direct from England, being accepted; it may be taken that wireless will continue a Government monopoly in the same way as the telephone and telegraphs of Australia. It is probable that the scheme to erect a Government station powerful enough to speak direct with England will come up for early Cabinet consideration. It is interesting to learn that the Fremantle and other Australian stations were able, during the war, to intercept messages from Nauen, in Germany, 12,000 miles away. These were the official communications sent out by the German Government.

Another matter to which attention will shortly be given by the Government for the development of the inland portions of Australia is wireless telephony. Successful experiments have been made already by the Royal Australian Radio Service, which demonstrate the commercial value of wireless telephony.

Czecho-Slovakia.—A powerful wireless station has been set up at Belgrade, the ancient capital of Serbia, by the French military authorities. The height of Bianitza, to the east of the city, is the spot chosen for its erection.

Germany.—It is calculated in Germany that an expenditure of over £5,000,000 has been incurred in establishing the German system of submarine cables. The Treaty of Peace stipulates that in the name of her nationals Germany renounces in favour of the Allies certain cables as specified by us last month. It appears that the European terminal sections of both trans-Atlantic cables, of the cable to Vigo, Spain, and the South American cable are left in the hands of Germany. This is also the case with the German Government cable to Norway, and the "various cables in the North Sea and the Baltic." The cables from Shanghai to Yap, and from

Menado to Yap, belong to the German-Netherlands Telegraph Co., which is a purely German private concern, whilst the other cables, with one exception, are the property of private companies. On the other hand, the Shanghai-Tsingtau cable is owned by the German Government, and was worked by State officials. The German cable companies were in receipt of a Government guarantee on their dividends up to a certain percentage, and their cables would have passed into the possession of the Government, free of charge, at the end of 40 years from the date of completion for service. The obligation was placed upon the companies to form a special redemption fund, so that on the expiration of the 40 years the amount available would have been sufficient to pay all debts and redeem the shares at par.

Telegraphic Delays.—According to a *Times* correspondent, messages from Madrid transmitted over Marconi's system were nine and ten days in transit, reaching London several days after letters confirming them.

United States.—The Federal Director of Cables, New York, is issuing daily for the Press a bulletin on the condition of cable service to countries with which Americans principally do business.

President Wilson, in a message to Congress, which met on May 19th, recommends that the control of telegraphs, cables, and telephones be returned to the owners.

A wireless telephone message was received at New Brunswick, N.J., in a closed concrete and steel vault underground. The speech was plainly heard.

Wireless on Ships.—The Bill introduced in the House of Lords recently by Lord Somerleyton to make further provision with respect to wireless telegraphy on ships, provides that every seagoing British ship registered in the United Kingdom, being a passenger steamer or a ship of 1.600 tons gross tonnage or upwards, shall be provided with a wireless telegraph installation, and shall maintain a service at least sufficient to comply with rules which are to be made, and shall be provided with one or more certified operators and watchers. The Board of Trade may exempt any ships, and, in consultation with the Postmaster-General, shall, it is suggested, make rules prescribing the nature of the installation to be provided, of the services to be maintained, and the number of operators and watchers to be carried. Failure to comply with these provisions renders the master or owner of the ship liable to a fine of £500.—*The Times*.

Wireless Telephony.—On Tuesday and Wednesday demonstrations of wireless telephony and direction-finding were given by Marconi's Wireless Telegraph Co. at the works at Chelmsford. Particulars will be given in our next issue.

Wireless Telegraphy.—Speaking on the progress of wireless telegraphy and telephony at the Aldwych Club on Thursday last week, Mr. Godfrey C. Isaacs is reported to have said that there was now a better development than the wireless direction finder. There was a new transmitter which would project a wide divergent beam. The beam would extend over whatever area was required, and, if desired, would indicate some special place. It would have concentrated beams—one, two, or more—which would convey to the man in the skies automatically and intermittently the name of the place he was passing over.

When a number of wireless stations were in close proximity there was considerable interference, which made an efficient service impossible. But that was a thing of the past; in future it would be possible to telephone or telegraph without any possibility of interference. There was now no reason why there should not be wireless telegraph and telephone services between all the principal centres throughout the country. If such services were constructed as auxiliaries to the land-lines, they would render the country a great service and save many millions sterling, particularly in times of storms.

The latest and best station that had been erected was one at Carnarvon, which, although it had been erected to conduct a service with New York, had never yet given that service; it had been engaged for war purposes. He hoped that within a very short time it would be open to commercial service.

There was no doubt that sooner or later they would have an Imperial chain of wireless stations for commercial purposes. The cost of such stations was moderate, cost of maintenance small, and capacity for traffic practically unlimited. Wireless could do 150 words per minute simplex and 300 duplex. It would require but a very simple mechanical improvement to double or quadruple that number of words.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Aberdare.—U.D.C. Supplying and laying of cable. (See this issue.)

Atherton.—June 10th. U.D.C. 2,360 yd. ·1 × ·1 × ·141 in. twin-concentric, paper-insulated and plain lead-sheathed cable. (See this issue.)

Australia.—BRISBANE.—June 18th. Brisbane City Electric Light Co. Supply of rotary converters (specification 10s. 6d.). Offices of the company at Brisbane.—*Tenders.*

SYDNEY.—June 23rd. Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.*

Ballinasloe.—June 7th. Renewal of electric accumulator plant at District Asylum for Joint Committee of Management. Particulars from Resident Medical Superintendent.

Bray.—June 3rd. U.D.C. Electricity Department. One 200-B.H.P. Diesel engine, direct coupled to 135-K.V.A. single-phase alternator and exciter. (May 23rd.)

Bury.—June 6th. Electricity Department. One 6,000-KW. steam turbo-alternator and exciter, with surface condenser and air circulating pumps. (May 16th.)

Dublin.—June 10th. Electric Supply Committee. Transformers and A.C. slot meters for two years. (See this issue.)

Eccles.—June 23rd. Electricity Committee. Supply and laying of three-way underground ducts; supply and drawing-in 2 733 yd. of ·20 sq. in., E.H.T., three-core cable. (See this issue.)

Heywood.—June 11th. Electricity Committee. One 400-KW. rotary converter, transformer, with switchgear and cable work; 1,500 yd. ·15 sq. in. E.H.T. cable; 1,500 yd. ·05 sq. in. E.H.T. cable; 1,000 yd. of ·10 sq. in., ·05 sq. in., and ·10 sq. in. E.H.T. cable. (May 23rd.)

Hull.—Corporation Telephones Committee. Automatic equipment to provide for an increase of 2,000 instruments.

Ilford.—U.D.C. Electricity Department. Supply of 350 yd. L.T. rubber-insulated, and 75 yd. E.H.T., 3-core, paper-insulated, lead-covered cable. (See this issue.)

Loftus.—June 6th. U.D.C. Electric motor, 2, 3 or 4 B.H.P., complete with starter, &c. Mr. B. J. Wormleighton, Surveyor, Town Hall, Loftus.

Manchester.—June 6th. Stores for Electricity Committee for six months. Particulars, obtainable not later than May 30th, from Mr. F. E. Hughes, Secretary, Electricity Department, Town Hall.

June 10th. Tramways Committee. Supply, &c., of (*a*) 2 and 3-ton motor engines and chassis; (*b*) light motor vans suitable for parcels delivery; (*c*) motor car. Mr. J. M. McElroy, General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

Middleton.—June 12th. Electricity Committee. One 1,000-KW. motor converter. (See this issue.)

New Zealand.—June 4th. Public Works Department. 1¼ miles of 11,000-volt cable.*

Rhondda.—June 4th. U.D.C. Four 500-K.V.A. and two 100-K.V.A. three-phase static transformers. Mr. J. M. Bowman, Electrical Engineer, Electricity Works, Porth (Glam.).

Tasmania.—LAUNCESTON.—July 28th. City Council. Sub-station equipment, battery, reversible booster, switchgear, &c. City Electrical Engineer.

Tuam.—June 3rd. Tuam Electric Light & Power Co., Ltd. Gas engine and suction plants, dynamos, storage battery, switchboard. (See this issue.)

Warrington.—June 4th. Electricity Department. H.T. and L.T. lead-covered cable, motors and transformers. (See this issue.)

West Hartlepool.—June 17th. Corporation. H.T. switchgear: two 1,500-KW. transformers; two 500-KW. rotary converters; one cooling tower. (See this issue.)

*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

CLOSED.

Government Contracts.—The undermentioned contracts were placed during April, 1919:—

INDIA OFFICE—STORES DEPARTMENT.

Accumulators.—Edison Accumulators, Ltd.
Dynamos.—J. Stone & Co.
Motor construction.—Bruce Peebles & Co.
Tape.—Johnson & Phillips, Ltd.
Telephones.—Peel-Conner Telephone Works Co., Ltd.
Wheatstone parts.—Elliott Bros., Ltd.
Cells.—Edison Accumulators, Ltd.

CROWN AGENTS FOR THE COLONIES.

Electric light fittings.—General Electric Co., Ltd.
Insulators.—Bullers, Ltd.
Superheater spares.—Superheater Corporation, Ltd.
Train lighting materials.—J. Stone & Co., Ltd.
Wiring materials.—W. T. Henley's Telegraph Works Co., Ltd.

H.M. OFFICE OF WORKS.

Engineering works.—Electric overhead runway, Leslie Flax Mill.—Herbert Morris, Ltd.

Post Office—Stores Department

Telegraph apparatus.—D. Murray.

Telephone ditto.—British Insulated & Helsby Cables, Ltd.; British L. M. Ericsson Manufacturing Co., Ltd.; London Electric Wire Co. and Smiths, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.

Stoneware ducts and bends.—Albion Clay Co., Ltd.; Doulton & Co., Ltd.; H. R. Mansfield; Mountford, Phillips & Co., Ltd.; Oates & Green, Ltd.; Stanley Bros., Ltd.; Sutton & Co.; T. Wragg & Sons, Ltd.

Insulator spindles.—Guest, Keen & Nettlefolds, Ltd.

Flameproof wire.—Macintosh Cable Co., Ltd.

Laying conduits.—Cheltenham, W. Hodge & Co.; Coatbridge-Airdrie, Casey and Darragh; Cricklewood Lane, Doulton & Co., Ltd.; Glasgow-Coatbridge (Sec. II), Casey & Darragh; Glasgow-Dumbarton (Sec. I), Robson, Eckford & Co., Ltd.; Glasgow-Dumbarton (Sec. II), Casey and Darragh, Ltd.; Motherwell-Wishaw, W. Dobson; Ormskirk-Preston (Sec. I), Jewett Bros.; Ormskirk-Preston (Sec. II), W. Dobson; Edinburgh (Sec. III), W. Dobson; Edinburgh (Sec. IV), J. Mowlem & Co., Ltd.; Rawtenstall-Bacup, W. Pollitt & Co., Ltd.; Slough-Windsor, J. Mowlem & Co., Ltd.; Willesden, J. Mowlem & Co., Ltd.

Manufacturing, supplying, and drawing-in and jointing cables.—Liverpool-Chester, Johnson & Phillips, Ltd.; Manchester-Bolton, W. T. Henley's Telegraph Works Co., Ltd.

Laying conduits, and manufacturing, supplying, drawing-in and jointing cables in P.O. engineering districts, as below, for six months from April 1st, 1919.—Scotland, N. & N.E.: Siemens Bros & Co., Ltd. N.W. and S. Lancashire: Callender's Cable & Construction Co., Ltd. N.W.a, S.W.a, and N.M.: Western Electric Co., Ltd. S.W., S.M.E., and S.E., and London (cabling only): Western Electric Co., Ltd.

Melbourne.—City Council. Recommended :—

16 tons bare H.D. copper cables, assorted gauges, £2,273.—B. I. & Helsby Cables, Ltd.

Murrumburrah (N.S.W.).—B.C. Accepted :—

Alternator, transformer, switchboard, meters, lightning arresters, and erection of power-house plant, £1,137.—Australian General Electric Co.

10-KW. transformers, insulators, cables, &c., £435.—W. G. Watson & Co., Ltd. —*Tenders.*

Richmond-on-Thames.—T.C. :—

Electric dust van.—General Vehicle Co., Ltd., £1,295.

FORTHCOMING EVENTS.

Institution of Mechanical Engineers.—Friday, May 30th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Resumed discussion on "The Mechanical Properties of Steel, with some Consideration of the question of Brittleness."

Illuminating Engineering Society.—Friday, May 30th. At 8 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Discussion on "The Gas-filled Lamp and its Effect on Illuminating Engineering," to be opened by Mr. F. W. Willcox.

London County Council.—Friday, May 30th. At 4 p.m. At the County Hall, Spring Gardens, S.W. Conference on "The Report of the Committee Appointed to Inquire into the Position of Natural Science in the Educational System of Great Britain."

Institution of Electrical Engineers.—Monday, June 2nd. At 7.30 p.m. At the Chartered Institute of Patent Agents, Staple Inn Buildings, Holborn, W.C. Informal meeting. Discussion on "The Vicious Circle of Increasing Prices," to be opened by Major K. Edgcumbe, R.E.

Society of Engineers.—Monday, June 2nd. At 5.30 p.m. At Burlington House, W. (Apartments of the Geological Society). Informal meeting. Features include lantern lecture by Mr. A. S. Buckle on "His Visit to France as a Member of the Commission Appointed by the Ministry of Labour for the Resettlement of Officers in Civil Life."

Industrial Reconstruction Council.—Tuesday, June 3rd. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Co-partnership in Industry," to be opened by Mr. E. H. Mundy, Secretary of the Labour Co-partnership Association.

Roentgen Society.—Tuesday, June 3rd. At 8.15 p.m. At the Royal Society of Arts, John Street, Adelphi, W.C. Annual general meeting.

Royal Institution of Great Britain.—Tuesday, June 3rd. At 3 p.m. At Albemarle Street, W. Tyndall lecture on "Listening Under Water," by Prof. W. H. Bragg.

Friday, June 6th. At 5.30 p.m. At Albemarle Street, Piccadilly, W. Lecture on "Atomic Projectiles and their Collisions with Light Atoms," by Sir E. Rutherford, F.R.S.

British Engineers' Association.—Tuesday, June 3rd. At 11.45 a.m. At Connaught Rooms. Annual general meeting, to be followed by a luncheon at 1.15 p.m.

Industrial Administration.—Special series of lectures, by Mr. E. T. Elbourne. At Winchester House, Old Broad Street, E.C.

Wednesday, June 4th. "Factory Organisation." (Lecture I.)
Thursday, June 5th. "Labour Administration." (Lecture I.)
Friday, June 6th. "Factory Costing." (Lecture I.)

NOTES.

Pre-war and Present Prices of Electrical Energy.—Central-station managers who have not yet sent us particulars of their tariffs in 1914 and 1919 are requested to do so as quickly as possible, the matter being now in the press.

The Abortive Strike.—According to the *Daily Dispatch*, the Electrical Trades Union has not yet settled the trouble within its organisation arising from the unofficial strikes at Belfast, the Clyde, and London, for which strike pay was granted. It has been declared by ballot of the rank and file that the executive were wrong in so disbursing the funds, and the question now remains what action the Executive Council will take in view of this decision. One of them, Mr. Stavenhagen, of the London district, has already, it is stated, tendered his resignation.

Electricity at the Royal Agricultural Show, Cardiff.—For patriotic reasons and for propaganda work in the agricultural world, as well as amongst the general public, the Cardiff City Electricity Department and the South Wales Electrical Power Co., in close co-operation, are arranging an exhibit of labour-saving devices at the forthcoming Royal Agricultural Show, to be held in Cardiff from Tuesday, 24th, to Saturday, June 28th next. A Committee, consisting of Messrs. W. A. Chamen (engineer and general manager, South Wales Electrical Power Co.); C. T. Allan (assistant manager, S.W.E.P. Co.); Arthur Ellis (Cardiff City electrical engineer and manager); C. G. Morley New (deputy electrical engineer and manager); and R. Howard Fletcher, B.A. (consulting engineer, Cardiff), has been formed to put the idea in operation, and has taken plot No. 300A in the Show ground, in an excellent position, close to the Main Ring, and near the Royal Pavilion.

Three-phase and single-phase 50-cycle supply will be transformed from 6,600 volts to 400 and 230 volts and transmitted to the exhibit by a low-pressure temporary overhead line about a mile long. This line passes the Moving Machinery Exhibit, where electricity will be on tap for those exhibitors who desire it.

On the plot will be erected a pretty little building as shown below, of which the interior will contain a kitchen, dining room, and showroom, suitably furnished and fitted. As many domestic labour-saving appliances as can be discovered will be shown, to enable the house-wife to see that much of the drudgery and the monotony of domestic work can be eliminated and some of it made pleasurable.

The Americans, for several reasons, appear to be more advanced than we in the use of these small appliances, as one can see by the advertisements in their trade and other papers, also their manufacture does not seem to have been restricted by the war; but, naturally, the Committee desires to have British-made devices. It is, however, experiencing some difficulty in finding the names of the firms who specialise in this work. The main reason for this difficulty is that the British maker during the war ceased the manufacture of home comforts and patriotically turned his whole staff and works on to finishing the war by the making of munitions. Since he has finally "wound up the watch on the Rhine," he has not yet had time to resume his former business.

The Electric Model Home, Cardiff.

In order to help to the best of its ability, the Committee asks the British makers of domestic labour-saving appliances to send their catalogues to Mr. C. T. Allan, Royal Chambers, Queen Street, Cardiff, so that if their machines cannot yet be shown, they can have publicity.

The number of visitors to the Show from all over this country and from abroad is expected to be a record. Lady visitors are urged to come, to see and enjoy Stand No. 300A.

Industrial Essay Competition.—*Unity*, the organ of the National Alliance of Employers and Employed, offers prizes amounting to £200 (presented by Sir Robt. Hadfield, Bart.) for the best essay on either of the following subjects :—A practical scheme for the joint development of industry by Capital and Labour.

The most effective means for the prevention of unemployment.

The most effective means for the prevention of industrial disputes.

Particulars may be had from the Editor, *Unity*, 64, Victoria Street, London, S.W. 1. The competition closes on August 30th, 1919.

Electricity in German Mining Industry.—Numerous new electrical installations for mining purposes have been made during the war. The three-phase double commutator motor has become less favoured for haulage plant. Ilgner haulage motors have shown great advantages for moderate outputs, with provision for cutting the converter (without fly-wheel) out of circuit after each haul, in order to save light-running losses. For outputs of several thousand KW., the induction motor is coming into increasing use. For mine locomotives, the D.C. system has been found to be preferable, both from the point of view of economy and safety of the workers. A considerable number of new electrical installations have been made during the war in the oilfields of Roumania, Galicia, and Germany. Many electrical devices for mining have been developed to meet the needs of the war, such as portable pumps and tunnelling plant. These will probably continue to find use in mining after the war. Electric generating stations have been built in many cases near coal mines for cheap generation and distribution. Notwithstanding the large scale of these stations the cost of generation has not decreased, owing to the increased cost of steam production, which may be taken at present at Mk.4 per ton of steam, or double the cost before the war.—*E.T.Z.*

Electrical Golf.—Representatives of Edinburgh and Glasgow Corporation Electricity Departments' Golf Clubs played the annual golf match (after an interval of four years) over Lothianburn golf course on "Victoria Day," 20th inst.; it resulted as follows :—Edinburgh, 4 . Glasgow, 7

Electric Vehicles.—According to the Electric Vehicle Section of the National Electric Light Association, on January 1st, 1919, approximately 10 per cent. of all automotive street vehicle equipment in New York City was of the electric type. These figures do not include several hundred electric industrial trucks and tractors in use. It will be of interest to note that of the 3,288 electric trucks in use in the metropolitan district, 3,055 are over two years old, 1,492 over six years old, 179 over ten years old, and 23 over 15 years old. It is said that the fact can be established by actual figures that during the first ten years' operation of an electric vehicle it can be kept in service 280 days out of a possible 300 per year, and eliminating painting or serious accidents, 295 days out of a possible 300.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The next informal meeting will be held in the rooms of the Chartered Institute of Patent Agents, Staple Inn Buildings (South Block), close to No. 335, High Holborn, W.C., on Monday, June 2nd, 1919, at 7.30 p.m., when Major Kenelm Edgcumbe, R.E., will open a discussion on "The Vicious Circle of Increasing Prices."

The report of the Committee of the Students' Section for the Session 1918-19 states that during the session there have been eight general meetings and the annual general meeting; the average attendance at these meetings has been 45, the highest recorded being 108. The opening address to the Section was delivered by Prof. Ernest Wilson on November 22nd, 1918, the subject being "The Permeability of Faintly-Magnetic Materials," and at the remaining meetings seven papers and lectures were delivered.

At the meeting of March 18th Mr. Howgrave-Graham showed an interesting exhibition of ancient and modern illuminants, including the first types of incandescent electric lamps.

By the kind consent of the respective authorities, visits have been made during the session to the following works, the average attendance at these being 31 :—Osram-Robertson Lamp Co., Hammersmith; Victoria Telephone Exchange, Westminster; Marconi's Wireless Telegraph Co., Ltd., and Hoffmann Manufacturing Co., Ltd., Chelmsford; Western Electric Co., Ltd., North Woolwich; Siemens Bros. & Co., Ltd., Woolwich; L.B. & S.C. Railway, electrification system.

Further visits have been arranged as follows :—

June 13th, 1919.—Handley-Page, Ltd., Cricklewood.

June 28th, 1919.—National Physical Laboratory, Teddington.

July 8th, 1919.—Anglo-Swedish Electric Welding Co., Ltd., Greenwich; London Electric Supply Corporation, Ltd., Greenwich.

An informal dinner is being arranged for June 6th, 1919.

The Papers Committee of the Council is examining all the Students' papers held over since the award of Students' premiums was suspended, with a view to making awards at an early date.

As a practical means of obtaining a closer link between the Council and the Section, arrangements have been completed during the session, for :—

(*a*) The appointment of a representative of Council as a consultative member of the Students' Committee, and

(*b*) The appointment of a representative of the Students' Committee to be present at those meetings of the Council at which business of special importance to Students is under consideration.

By means of this link, several suggestions for the welfare of the Students' Section have been placed before the Council, some of which have already materialised.

The report shows a considerable improvement in the activities of the Section during the Session 1918-19, and upon the completion of the return of Students to their normal occupations after their duties in connection with the war, and with the aid of the various improvements in the operation of the Students' Section which have been recently introduced, it is hoped that its activities will be still further increased in the near future.

The annual meeting of the Students' Section of the North-Eastern Centre was held in Newcastle-on-Tyne on May 21st, Mr. A. P. Pyne, local president, in the chair. Mr. J. Rosen, the hon. secretary, submitted the annual report, which stated that the membership of the Section totalled 39, as against 30 last session. It was reported that a "live" Committee had been formed, that instructive papers had been prepared for next session, and that visits to the works of prominent firms in the district had been arranged.

Electricity Supply in East Anglia.—A public meeting was held at Beccles on May 14th, to consider the subject of "Electricity: A National Need," having special application to Beccles. The subject was fully explained by Messrs. F. M. Long (Norwich) and Napier Prentice (Stowmarket).

Mr. Napier Prentice referred to the early history of electricity supply in England, and pointed to the progress made in other countries. He referred to Dr. Ferranti's address as president of the I.E.E. in 1907, in which he demonstrated that with proper utilisation of our coal resources, electricity could be developed in large power stations and transmitted throughout the country at one-eighth of a penny per unit, the by-products from the proper utilisation of coal enabling us by intensive cultivation to have our own food supply independent of outside sources and the unnecessary waste by the hauling of large quantities of coal. Mr. Prentice showed what a benefit this would have been to this country during the war if the railways had been free to carry the goods urgently needed by the military authorities, and what assistance such a supply would have been in the manufacture of munitions. He called attention to the Coal Conservation Sub-Committee's report, and touched upon the report of the Board of Trade Committee on "Electrical Power Supply," commenting on the fact that no reference was made to the purchase of gas undertakings in districts in which district electricity boards might operate. His view was that it would be much cheaper for the country to buy out gas interests rather than to have any delay in the prompt carrying out of a national electric supply scheme; and further, it would be unfair that electricity supply, financed nationally, should be in competition with private or municipally-owned gas works. He was glad to say that his directors had adopted that view, and had called the attention of the Board of Trade to the matter. He reminded them that East Anglia was admirably suited for industrial development, given cheap power, and that it was in the national interest so to develop this part of the country. He (Mr. Prentice) had been authorised by his directors to inaugurate a supply in Beccles. It was only part of a much bigger scheme, and he appealed for support in carrying through the work.

Mr. Long explained the object of the national scheme. He strongly advised the people of Beccles to assist the company both by taking a supply of electricity and by giving facilities for the necessary overhead wires.

In the discussion which followed, Mr. A. McQueen (the chairman) said that there was no reason why people who wanted electricity should not have it at once. He hoped it would come to Beccles by next winter.

Provincial Electric Supply Committee.—Mr. H. B. Reuwick, chairman of the Provincial Electric Supply Committee of the United Kingdom, presided on Tuesday at the Holborn Restaurant at the annual meeting of the 120 statutory companies represented in the Association.

Mr. Renwick reported on the vast amount of work done by the Committee in the past year, especially in connection with Parliamentary matters, income-tax allowances, and Labour matters. With regard to the Electricity Supply Bill (which came under special discussion at the meeting), Mr. Renwick said that the year 1919 was likely to become one of the most momentous in the history of the industry. They were on the threshold of far-reaching changes—fraught with good or evil, not only to the industry, but even more, perhaps, to the trade of the country. The industry was now admitted by Parliament to be a key industry, and they were told it was the one industry on which they were to build up the future prosperity of the country, and to rescue the trade of the nation from possible bankruptcy. He dealt with the various points in the Bill where the companies were unfairly treated, and assured the Committee that on all such points amendments would be pressed for. Whatever ground there might be for the nationalisation of the railways, there was no ground whatever for the nationalisation of electric supply. But he raised no objection to official control so long as that control was on proper lines for the purpose of regulating, co-ordinating, and re-organising the industry.

Society of Technical Engineers.—The fifth general meeting of the present session of the Bristol and West of England District Branch was held at the Grand Hotel, Bristol, on the 22nd inst. Mr. H. R. Beasant, vice-chairman (in the unavoidable absence of the chairman, Mr. W. P. Wordsworth), presided over one of the largest attendances since the formation of the Society in the West. After the routine business of the Society had been transacted, a paper, entitled "Aero Engines," was read by Mr. A. H. R. Fedden, technical director to the Cosmos Engineering Co., Ltd.

Appointments Vacant.—Telegraph inspectors (£250 + £120), for the Nigerian Posts and Telegraph Department; assistant electrical engineer (£300 + £120), for the Gold Coast Government Railway Department; chief assistant (£350), for the Kettering U.D.C. Electricity Department; lecturer in the Electrotechnic Department (£240, rising to £400, plus war bonus), for the Borough Polytechnic Institute; meter tester (£252), for the Sunderland Corporation Electricity Department: general manager (£800), for the Hull Corporation Tramways. See our advertisement pages to-day.

Old Students' Dinner.—University College, London.—The annual dinner of the Engineering Society will be held at the Holborn Restaurant on June 20th, 1919. It is hoped to have a large gathering of old students, especially those who have been serving in His Majesty's Forces, to celebrate the Peace.

Old students of the Faculty are asked to communicate with Mr. J. A. Broughall, at Gower Street, if they wish to be present.

American Welding Society.—Welding has attained to such importance in the engineering world that an American society is to be formed to secure its efficiency and promote its extension. The scope of this society will include all branches of the industry, and it will create and assist in maintaining a bureau of welding, which will be a separate organisation designed to derive full advantage from the principle of co-operation in research and standardisation. A temporary organisation, with headquarters at New York, has issued an invitation to all interested in welding to become members of the society, in which will be merged the Welding Committee of the Emergency Fleet Corporation and the National Welding Council.

The Apprenticeship and Skilled Employment Association. The thirteenth annual report of this Association draws attention to the difficulty of inducing lads who have been earning high wages during the war to accept lower wages, while there is a dearth of vacancies under the present unsettled conditions. Interest in apprenticeship schemes has revived, though the war has shown that in many trades skilled craftsmanship is not so necessary as formerly. The report regrets that no definite statement can be obtained as to when the scheme of State assistance for demobilised soldier apprentices will become operative. The finances of the Association are in need of support.

In 1918, 412 boys and 258 girls were placed in situations, and, in all, 1,504 cases were dealt with. Total receipts, including £35 brought forward, were £264.

The Association is doing valuable work, to which our readers can materially contribute both by donations and by applying to it for apprentices when vacancies are available.

Wireless Society for Sheffield.—A wireless society is being formed for Sheffield and the adjoining district. Those desirous of joining are invited to communicate with Mr. L. H. Crowther, 156, Meadow Head, Norton Woodseats, Sheffield.

Inquiries.—Makers of machines for winding small diameter spiral heating resistances are asked for.

The B.A. Meeting at Bournemouth.—The meeting of the British Association for the Advancement of Science opens at Bournemouth on Tuesday, September 9th, with the delivery, in the Winter Gardens, of the address by the president, Sir Charles A. Parsons, K.C.B., who will take as his subject, "Engineering and the War." The proceedings close on Saturday, September 13th. The Reception Room will be at the Municipal College, Lansdowne. The local secretaries' office is Municipal Buildings, Bournemouth. Prof. W. A. Herdman, D.Sc., F.R.S., and Prof. H. H. Turner, D.Sc., F.R.S., are the general secretaries of the Association; and Mr. O. J. R. Howarth is the assistant secretary (Burlington House, London, W.). This will be the first occasion on which the Association has met at Bournemouth, and as it is the first that has been held for several years, owing to war conditions, it is reasonable to anticipate a successful gathering both in point of attendance and in regard to the interest of the subjects for addresses, papers, and discussions. One of the two evening discourses will be delivered in the Winter Gardens on Friday, September 12th, by Mr. Sidney G. Brown, F.R.S., on "The Gyroscopic Compass." Section "A" (Mathematical and Physical Science) will be presided over by Prof. Andrew Gray, F.R.S.; Section "B" (Chemistry), by Prof. P. Phillips Bedson, D.Sc.; Section "F" (Economic Science and Statistics), by Sir Hugh Bell, Bart.; Section "G" (Engineering), by Prof. J. E. Petavel, F.R.S.; Section "L" (Educational Science), by Sir Napier Shaw, F.R.S.; and Section "M" (Agriculture), by Prof. W. Somerville, D.Sc. There are no general excursions to be arranged as part of the Association's programme, but the local executive will furnish information as to places of interest to be visited, and probably some of the Sections will arrange trips on their own.

The Southampton Appointment.—The procedure followed by the Southampton Town Council in appointing a successor to the borough electrical engineer, Mr. H. F. Street, has led to a great deal of discussion in the town and elsewhere. It will be remembered that the post was offered to Mr. H. S. Ellis, of South Shields, without advertising the vacancy. This course immediately aroused fierce opposition, and protests were recorded by the E.T.U. and other Trade Unions in the district, which called for the resignation of the Mayor and other members of the Council. The post was then advertised by the Electricity Committee, after animated discussion in the Council, at a salary of £800 a year, age limit 40 years. Some 42 applications were received, and a short list of three names was selected, comprising Mr. Ellis, Mr. H. P. Stokes (Bexley), and Mr. R. Lomax (Stockport). The Committee interviewed Messrs. Ellis and Stokes; Mr. Lomax had withdrawn his application, and Mr. Stokes, after the interview, wrote saying that, as the decision of the Council was a foregone conclusion, no useful purpose could be served by his presence at an interview with the Council. Protests were lodged by the Trades and Labour Council and the Joint Engineering Societies of Southampton, the latter condemning the methods of the Electricity Department, and the wording of the advertisement, and expressing high appreciation of the valuable services which had been rendered by Mr. Street. The employés of the electricity department also entered a protest, signed by 141 out of 142, against the "irregular and questionable tactics adopted," which had brought the town into disrepute, and had led to the undertaking being "boycotted by all electrical engineers of standing"; the staff held that the age limit was obviously fixed to favour one applicant, and expressed a lack of confidence in the Committee, which was called upon to resign forthwith, the position to be readvertised. The copy of the protest sent to the Council was signed by Mr. A. Glew.

At the Council meeting last week it was stated that the Labour member had withdrawn from the Committee in disgust. The report of the Committee recommended that Mr. Stokes and Mr. Ellis should be invited to attend before the Council, but also recommended that Mr. Ellis be appointed. The Mayor said there was no question of favouritism; Mr. Ellis was chosen on his merits. After a lively discussion Mr. Ellis was appointed by a majority of 29 to 9. In thanking the Council, Mr. Ellis expressed strong resentment at the action of the staff, and stated that he was going to be manager, not they.

We are indebted to the *Southampton Times* for these particulars.

Parliamentary.—Liverpool Corporation is making application to the Light Railway Commissioners for authority to purchase and incorporate in the tramway undertaking the Liverpool and Prescot Light Railway.

Shropshire, Worcestershire, and Staffordshire Electric Power Co. is applying to Parliament for power to raise further capital, &c.

Electricity on the Farm.—Cows are milked by electricity at Hereford. With motive power supplied by an 8·5 H.P. motor about seventy cows are milked twice daily at one dairy, and it is stated that it would take at least five expert milkers to do the work in the same time. A system of light transmission lines has been erected at Hereford, radiating in five directions from the generating station in the centre of the city to a maximum distance at present of 3,400 yards. The poles are erected close into the hedges. In an average case a 10-H.P. motor will meet most of the requirements of a farm, but for such seasonal jobs as thrashing and cider milling motors up to 20 H.P. have been hired out. Root-pulping and chaff-cutting machines are installed, and experience shows that owing to the easy starting of an electric motor the exact quantity of food can be cut and mixed fresh as required, a very important result being a greater yield of cream in the milk. A machine for kibbling corn and rolling oats is also installed, as well as a circular saw. The farm buildings are electrically lighted throughout, and, in addition, some cottages are supplied off the same line through "penny-in-the-slot" meters.

The Westinghouse Mass Meeting.—At the Free Trade Hall, Manchester, on the evening of May 19th, between 3,000 and 4,000 Westinghouse workers of all grades foregathered on common ground with the management and directors, first and foremost to discuss problems of mutual interest and create and absorb a better feeling of confidence, and secondly, to enjoy a musical programme of Westinghouse talent throughout. The meeting was an unqualified success. Capt. H. S. Hilton, managing director of the company, presided, and in his opening remarks pointed out that such a function was the first of its kind in the country. The meeting was an outcome of a suggestion by the Works Committee, and there had been a most gratifying response. It was hoped that it would become an annual function.

Mr. J. Annan Bryce, chairman of the company, spoke of the setting-up of works committees as a sign of the recognition of that human relationship between employers and employed which was going to be the only source of happiness for the country. The experience of the company showed that there was a real desire on the part of the workers to co-operate through the Committee in endeavouring to remove grievances, in assisting in necessary disciplinary measures, in settling holidays and the arrangement of holiday work, and in finding out how men's individual capacities could be best employed. Mr. Bryce put increased production per man as the only means of overcoming the difficulties British industry had now to face—heavy taxation and a handicapped export trade. He described as a fallacy the old idea that there was only a certain amount of work to go round, and that if a man did more he would deprive others of work. The real effect, he said, was that the more a man did the more work there was for other people, the cheaper the article he produced became, and the greater was the demand for it. The argument that because an article was sold cheaper the employer would want to pay less wages was equally wrong, for if the employer could sell more he could afford to pay more. The worker was entitled to higher wages and to shorter hours, and to opportunity for recreation and enjoyment. If he would produce more, and would welcome the adoption of every kind of improved method of machine production, it would be possible not only to pay him more, but to raise his standard of life.

Mr. S. Ratcliffe, chairman of the Works Committee, urged the need for frequent meetings between the workers and the management, where the problems of the industry could be discussed. Those at the head of the Labour movement had considerable difficulty in asking for the loyalty of their members in securing increased production, because that had so often meant just before the war that factories had been choked with goods, and men had been unemployed because they had made too many goods. If that fear could be overcome, and the worker could be sure that his interests were safeguarded, they would get the increased production which was so necessary for the repair of the waste of war.

Mr. W. Rostron, chairman of the Staff Committee, held that in studying the profit and loss account the human element should be taken into consideration as well as the material. Miss Wilson, Women's Welfare Superintendent, voiced the women's point of view. She remarked upon the necessity of every job being "manned" by the proper person: if strength was required, by the man; if it was work which could be done more efficiently by women, then women should do it. Mr. Mensforth, general works manager, remarked that it was an excellent thing to eliminate the differences and get together first the points of agreement.

Capt. Hilton announced that the original allotment of £100,000 worth of shares to be taken up by workers of the company had been over-subscribed. After a musical programme of 10 items had been gone through very satisfactorily, Col. Cradock, director of the company, moved a vote of thanks to the artistes, and the meeting closed.

Industry and Higher Education.—A meeting was held on May 20th between representatives of the Universities and Colleges and representatives of the Federation of British Industries.

Sir Richard Vassar-Smith, Bart., presided over the gathering, and, in his introductory remarks, stated that the meeting had been called to consider the setting up of an organisation which might act as a clearing-house between the universities and the industries of the country. It was desired to make some arrangements by which young men leaving the universities would have the opportunity of passing into productive work, which would give full scope to their abilities and education. Such an organisation should enable the man of real merit to obtain a post which would allow him to use his abilities to the fullest extent.

Mr. H. A. Roberts, of Cambridge University, stated that the suggestion would meet with approval by all interested in national well-being.

Prof. Ferrier, of Bristol University, pointed out that there had been no difficulties in placing the really first-class men, but men of the second class certainly needed assistance. In many cases the second-class men had made good, when they had been able to obtain a position which offered scope; ability was not confined to academic distinction—especially was this the case with regard to work in industry and commerce. There had been a marked tendency for the university-trained men to proceed overseas, and even in the United States the English University man was generally sure of finding employment. It was to be hoped that this exodus of the finer grade of worker would be stopped by the offer of suitable employment in this country.

It was decided that a further meeting should be held to thrash out practical points for the setting-up of the scheme at an early date. The meeting was attended by representatives of the Universities of Birmingham, Bristol, Cambridge, Durham, Glasgow, London, Manchester, Oxford, Sheffield, Wales, and the Imperial College of Technology, and the University College of Nottingham.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The General Purposes Committee of the L.C.C. recommends that for a period of one year, commencing January 1st, 1919, the electrical engineer, and the traffic manager of the Council's tramway department be granted a 10 per cent. addition to their salaries, plus a war bonus of £80 a year, with a maximum increased payment of £300 a year, to be paid in the same manner as in the case of officers in receipt of £800 and over.

Mr. E. L. Pope, distribution engineer, southern section of the L.C.C. tramway department, is retiring from the service owing to ill-health.

Major G. C. Milnes, K.O. Royal Lancaster Regiment, who has been on special service since the Armistice, will be released for his duties as electrical engineer at Lancaster on June 27th, and hopes to return soon after that date.

The Leeds Corporation Tramways Committee has decided to recommend the Council to increase the salary of Mr. J. B. Hamilton, the tramway manager, from £1,000 to £1,500 per year. As Mr. Hamilton has been officiating as the commercial manager to the Corporation at an additional £500 a year, the combined salary, if the recommendation be confirmed, will be £2,000 per year.

Lieut. H. H. Holmes has now been demobilised, and has resigned his position as sales manager of the St. Marylebone electricity department.

On the next degree day, July 5th, 1919, the degree of M.Sc.Tech. (*honoris causa*) is to be conferred by the University of Manchester upon Mr. S. L. Pearce, O.B.E., city electrical engineer; Mr. A. P. M. Fleming, O.B.E., head of research department, British Westinghouse Co., Ltd.; and Mr. H. C. Mensforth, O.B.E., works manager, British Westinghouse Co.

Mr. W. P. Lilwall, assistant engineer, Kettering U.D.C. electricity works, has been appointed electrical engineer and manager of the Fleetwood U.D.C.'s undertaking. There were 147 applicants for the position.

Mr. C. R. Everson, manager of the Plymouth Corporation tramway, is shortly retiring on superannuation. The Tramways Committee has decided to advertise for a successor.

Notwithstanding the controversy with which our readers are familiar, Mr. H. S. Ellis, borough electrical engineer at South Shields, has been appointed to a similar position at Southampton at £800 per annum. Mr. Ellis is the son of the late Sir Joseph Baxter Ellis, first Lord Mayor of Newcastle-upon-Tyne. During the war he acted as technical representative of the Controller of Coal Mines for No. 3 Area.

The Electricity Committee of the Heston and Isleworth U.D.C. recently received a letter from Messrs. Gordon and Marley, solicitors, acknowledging receipt of the notice to terminate his appointment as electrical engineer and manager addressed to Mr. P. E. Rycroft, and stating that the matter had been placed in their hands, and that as soon as they had perused the correspondence they would write further.

Mr. F. W. Purse, city electrical engineer, Carlisle, has been appointed borough electrical engineer to the West Ham Corporation in succession to Mr. J. W. Beauchamp, Director of Electrical Development.

General.—The King has granted permission to the following to wear decorations conferred upon them by the King of the Belgians:—*Officers of the Order of Leopold*: Temp. Maj.-Gen. Sir H. W. Thoruton, K.B.E., general manager of the G.E.Ry.; Sir R. Bruce, C.B., Controller of the London Postal Service. *Chevaliers of the same Order*: G. Morgan, I.S.O., Controller, P.O. Stores Dept.; Sir W. Slingo, Engineer-in-Chief, G.P.O. (now retired); P. Dawson. *Officer of the Order of the Crown*: J. Newlands, C.I.E., C.B.E., Controller of the Central Telegraph Office; W. Noble, Assistant Engineer-in-Chief (now Engineer-in-Chief) of the G.P.O.

Mr. W. N. Y. King, A.C.G.I., A.M.I.E.E., formerly Assistant Inspector of Munitions Areas (Birmingham), is now assistant works engineer to the Austin Motor Co., Ltd., Northfield, Birmingham.

Mr. K. S. Geipel, O.B.E., who has been demobilised from the Royal Engineers after service in France and East Africa, has returned to Messrs. Wm. Geipel & Co.

Mr. E. Laming, shift engineer with the Rochdale Corporation, has been appointed to a similar position with Messrs. John Brown & Co., Ltd., of Sheffield.

Marconi's Wireless Telegraph Co., Ltd., announces that Sir Charles J. Stewart, K.B.E. (the late Public Trustee), has been elected to a seat on the board of the company.

A letter from Sir John Snell was read at a special meeting of the Belfast Corporation last week. Sir John, who has been consultant in connection with the electrical scheme which the Corporation has in hand, intimated that the Government had asked him to accept the position of Chief Electricity Commissioner and Chairman of the Commission under the Electricity (Supply) Bill, and he asked the Corporation if they would release him from his personal contract with them in event of the measure becoming law. A long discussion followed a resolution by Ald. Sir James Johnston to release Sir John, seconded by Ald. Riddell. The Town Solicitor said that beyond doubt the contract was with Sir John Snell, not with his firm, and he had bound himself to carry out all the necessary details, supervise the work, and prepare all plans and specifications that were necessary in connection with the work. However, in his opinion, the Corporation was competent to release Sir John on proper terms. It was decided to release Sir John from his contract and any liability to the Corporation.

Sir Albert Stanley, M.P., has now resigned the presidency of the Board of Trade, owing to the necessity of his taking a complete rest at once. Sir Auckland Geddes, K.C.B., M.P., has been appointed to the office that Sir Albert, who has been seriously ill of late, has felt compelled to relinquish.

Mr. Phillip Vassar Hunter, for many years chief electrical engineer to Messrs. Merz & McLellan, of Newcastle-on-Tyne and London, is leaving that firm to join the management staff of Messrs. Callender's Cable & Construction Co., Ltd. Mr. Hunter has been connected with the development of electrical power on the North-East Coast since its very beginning, and has had wide experience of high-tension generation and transmission there and elsewhere. During the later stages of the war Mr. Hunter was, by arrangement with Messrs. Merz and McLellan, attached to the Naval Staff of the Admiralty as Engineering Adviser to the Director of the Anti-Submarine Division in connection with the development of anti-submarine devices and apparatus. He has been recently released from Admiralty service, and becomes a member of Callender's as from June 1st specially for the development of super-tension mains and accessories.

The Industrial Reconstruction Council is arranging a complimentary dinner to be given to the Rt. Hon. J. H. Whitley, M.P., by members of the Joint Standing Industrial Councils and the Interim Industrial Reconstruction Committees. It will be held at the Connaught Rooms at 7.15 p.m. on Wednesday, July 9th.

Roll of Honour.—Sapper A. W. Wells, R.E., who was on the staff at the Windsor electric light works, is reported dead, after being missing since August 21st last.

Obituary.—Prof. Fedoroff Mirovitch.—According to the *Times*, a wireless message from Moscow reports the death of the mining engineer Prof. Fedoroff Mirovitch, renowned for his scientific work in crystallography.

NEW COMPANIES REGISTERED.

Norfolk Engineering Co., Ltd. (155,326).—Private company. Registered May 20th. Capital, £500 in £1 shares. Electrical and mechanical engineers, and manufacturers of kinematograph projectors. The subscribers (each with one share) are:—R. W. Hickmao, 67, City Road, Sheffield, electrician; P. A. J. Norton, 390, Cricket Inn Road, Sheffield, engineer. The first directors are: R. W. Hickman and P. A. J. Norton. Registered office: 223, Bernard Street, Sheffield.

Turbines, Ltd. (155,393).—Registered May 22nd. Capital, £20,000 in 10,000 shares of £1 each and 100,000 shares of 2s. each. Engineers, &c. First directors:—F. B. Woodruff, 223, Kew Road, S.W., shipbroker; D. Brown, 5, Talbot Road, South Tottenham, shipbroker; H. Vale, Park Place, S.W., gentleman; W. Boorman, 5, Masons Avenue, E.C. 2, gentleman; B. K. Parkin, 137a, Finchley Road, N.W.5, consulting engineer; A. P. Whitehead, 190, Haworth Road, Hounslow, director, Middlesex Engineering Co.; D. Scarf, 8, Spencer Gardens, East Sheen, S.W. 14, bank clerk. Registered office: 59, St. Mary Axe, E.C.

Vickers-Petters, Ltd. (155,436)—This company has been registered as a private company, with a nominal capital of £500,000 in £1 shares (180,000 6 per cent. cum. pref. and 320,000 ord.). The objects are: To take over certain property and rights on the terms of two draft agreements (1) with Vickers, Ltd., and (2) with Petters, Ltd., and to carry on the business of engineers, contractors, iron and metal founders, launch and shipbuilders, metal workers, smiths, iron and steel converters, shipowners, wharfingers, &c. The subscribers (each with one share) are:—E. W. Petters, Ltd., 73, Queen Victoria Street, E.C., engineer, E. J. Alldis, 18, Macdonald Road, Forest Gate, E. 7, clerk. There are to be not less than five nor more than seven directors. When there are five directors, three are to be nominated by Vickers, Ltd., and two by Petters, Ltd., and when there are seven four are to be nominated by Vickers, Ltd., and three by Petters, Ltd. No qualification is required. Remuneration as fixed by the company. Solicitors: Linklater & Co., 2, Bond Court, Walbrook, E.C.

Cannon Motor & Electric Works, Ltd. (155,293).—Private company. Registered May 20th. Capital, £1,000 in £1 shares. To acquire the business of motor car or electrical repairers, dealers in motor vehicles, &c., recently carried on by A. Jay and M. J. Wallage, and now solely by M. J. Wallage, at 10-12, Cannon Lane, Brighton, as the Cannon Motor Works. First directors.—A. W. Turner, 50, Preston Street, Brighton; and M. J. Wallage, 1, Devonshire Terrace, Brighton. Registered office: 46, Old Steine, Brighton.

Thurlow Wholesale Electric Supplies, Ltd. (155,317).—Private company. Registered May 20th. Capital, £5,000 in £1 shares. Objects as indicated by the title. The subscribers (each with one share) are:—R. N. Herbert, 337a, Norwood Road, S.E. 27, electrical engineer; Miss M. F. Aylward, 37, Hamilton Road, West Norwood, clerk; W. Osborne, 16, Maley Avenue, West Norwood, S.E. 27, electrician; L. A. Fenner, 13, Heyford Avenue, South Lambeth Road, S.W. 8, scientific instrument maker. The first directors are: Miss M. F. Aylward and W. Osborne. Registered office: 337, Norwood Road, S.E. 27.

Oxley, Lawrence & Co., Ltd. (155,270).—Private company. Registered May 19th. Capital, £10,000 in £1 shares. Mechanical and electrical engineers, &c. The subscribers (each with one share) are:—H. H. Oxley, 13, King Edward Avenue, Dartford, electrical engineer; G. C. Lawrence, 11, Brentgood Street, Bury St. Edmunds, marine engineer. Directors: H. H. Oxley and G. C. Lawrence. Registered office: 60-61, Blackfriars Road, S.E. 1.

Wm. J. Ferguson (Redditch), Ltd. (155,252).—Private company. Registered May 17th. Capital, £1,000 in £1 shares (500 pref.). Electrical and mechanical engineers, &c. Agreement with W. J. Ferguson. The subscribers are:—W. J. Ferguson, 144, Mount Pleasant, Redditch, electrical engineer, 150 shares; J. A. Mills, Crown Hotel, Redditch, licensed victualler, 100 shares; M. Hardman, Ewart Cottage, Millsboro' Road, Redditch, captain, 200 shares. Directors: W. F. Ferguson, J. A. Mills, M. Hardman. Registered office: 15, Market Place, Redditch, Worcester.

C.L.I. Manufacturing Co., Ltd. (155,159).—Private company. Registered May 15th. Capital, £10,000 in £1 shares. Manufacturers of and dealers in electrical apparatus and machinery. The subscribers (each with one share) are:—G. A. Lister, 82, Styvechale Avenue, Coventry, engineer; W. S. Tunbridge, 116 Colmore Row, Birmingham, solicitor. Directors: G. A. Lister and C. A. Lister, Sneyd Park, Bristol, manufacturers; D. K. Morris, 14, Waverley Road, Kenilworth, electrical engineer; E. A. Watson, 14, Bottecille Road, Acocks Green, electrical engineer; E. W. Richmond, The Firs, Dursley, Glos., engineer. Registered office: 116, Colmore Row, Birmingham.

Saunders Electrical Co., Ltd. (155,209).—Private company. Registered May 16th. Capital, £2,900 in £1 shares. Manufacturers and repairers of and dealers in electrical appliances and apparatus, &c. The subscribers (each with one share) are:—W. M. Lindley, Vilette, Binley, Coventry; H. L. Wilson, The Furlongs, Ryton-on-Dunsmore, both law clerks. The directors are to be appointed by the subscribers. Solicitors: R. A. Rotherham & Co., Coventry.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

James Keith & Blackman Co., Ltd.—£250 debs. registered May 7th, 1919, part of series of £10,000, charged on general assets.

Frank Wigglesworth & Co., Ltd.—£5,000 debs. registered May 2nd, 1919, charged on the company's undertaking and property, present and future, including uncalled capital.

Bankfoot Power Co., Ltd.—Satisfaction to the extent of £5,000 of charge for £10,000, registered August, 1911.

Renew Electric Lamp Co., Ltd.—Debs. registered May 12th, 1919, for £500, £250, and £1,000, part of a series of £4,000.

City of Buenos Aires Tramways Co., Ltd. (82,214).—Capital, £1,240,000 in 248,000 shares of £5 each. Return dated March 3rd, 1919. All shares issued; £1,240,000 paid. Mortgages and charges: £170,000.

Waste Heat & Gas Electrical Generating Stations, Ltd. (91,738).—Capital, £350,000 in £1 shares. Return dated April 14th, 1919. 320,000 shares taken up; £320,000 paid. Mortgages and charges: Nil.

CITY NOTES.

Oriental Telephone and Electric Co., Ltd.

For the year ended December 31st last the gross earnings, including dividends and interest from subsidiary companies, &c., were £100,320; with excess profits duty refunded and amount brought forward the total amount was £119,133. The working expenses, maintenance, &c., were £55,720, and after paying interest expenses incurred in connection with increase of capital issue and bonus shares, and redemption charges, paying the preference dividend also, a total dividend of 10 per cent., free of tax, on the ordinary shares, £7,587 is placed to reserve, £2,000 to staff pensions fund, and £11,052 carried forward.

The business of the company continues to extend, notwithstanding the continuance of the adverse circumstances created by the war. The Government embargo on the supply of telephone material, both here and in India, and the difficulties of shipment have in particular proved a serious obstacle to the expansion of the service during the year. In consequence of these restrictions there is a considerable waiting list of new subscribers at each of the branches of the company and its subsidiaries; and expenditure in connection with new stations and other deferred work is likely to be heavy for some time to come. The rates of subscriptions at Madras, Rangoon, and Moulmein have been slightly raised in order to counter-balance to some extent the abnormal cost of maintenance and working.

In accordance with the special resolutions confirmed at an extraordinary general meeting held on July 15th, 1918, the authorised capital of the company was increased to £400,000 by the creation of a further 100,000 new ordinary shares of £1 each, and a clause (84a) was added to the Articles of Association under the heading "Capitalisation of Profits and Distribution of Surplus Capital Assets." By a resolution passed the same day, a sum of £107,587, forming part of the company's reserve fund, was capitalised and applied to paying in full for 107,587 ordinary shares which were allotted to the shareholders in proportion to their holdings.

As notified in last year's report, the Government of Egypt purchased the undertaking of the Telephone Co. of Egypt, Ltd., as from January 1st, 1918. The liquidation of that company is now proceeding, and, it is hoped, will be finally completed at an early date. In accordance with Clause 84a of the Articles of Association, the company in general meeting on November 20th, 1918, resolved that the sum of £1 6s. per ordinary share (being part of the surplus capital assets of the company, consequent upon the sale of the Egyptian undertaking) be distributed as capital amongst the ordinary shareholders, and the distribution was accordingly made.

The Indian local companies continue to show increased revenues for the past year, and dividends have been declared by both of them at the same rates as for 1917, viz., 16 per cent. by the Bombay Telephone Co., Ltd., and 7 per cent. by the Bengal Telephone Co., Ltd.

The net revenue of the China and Japan Telephone & Electric Co., Ltd., is somewhat less than that of the previous year, in consequence of heavier charges for maintenance, &c., the high rate of exchange ruling, and additional taxation in the United Kingdom. The usual rate of dividend, viz., 10 per cent., free of income-tax, has, however, been maintained.

British Electric Transformer Co., Ltd.

Mr. Berry, presiding at the annual meeting, on May 22nd, said that during the year they had issued the balance of their ordinary and preference shares to the full authorised amount of £200,000. The reserve account stood at £45,729, and it was proposed to increase it by £7,500. The item of sundry creditors was about £10,000 more than last year, the amount naturally increasing with the larger volume of work in hand. They had expended £6,104 during the year on the purchase of freehold land, plant, and machinery. The stock was about £33,500 more. That was naturally a fluctuating item and varied from year to year with the amount of work in hand. Sundry debtors were about £13,000 more, but they were all considered good. Turning to the profit and loss account, the gross profit showed an increase of about £6,000 over last year, and the net profit was over £5,000 more, which was a satisfactory increase. The directors recommended the payment of the usual 6 per cent. on the preference shares. For three years during the war period the dividend on the ordinary shares was reduced to 7½ per cent, and as much cash as possible was put back into the business in order to help them carry on. Last year they were able to revert to their pre-war rate of 10 per cent., which he thought might now be considered a full and sufficient dividend. It was pleasant, by payment of a bonus of 2½ per cent., to afford some special recognition of the rights of the ordinary shareholders, and it was an indication as to what should be hoped for in the way of an ordinary dividend. Owing to the necessary heavy taxation, the community, through the Government, divided dividends with shareholders so that 15 per cent. to-day was scarcely equivalent to 10 per cent. in the past. In view of the extent of the work in hand the directors had obtained the sanction of the Treasury for the issue of 125,000 shares, half ordinary and half preference, bringing up the issued and authorised capital to £325,000. That was by no means all the additional working capital they required. It was so largely over-applied for that they were unable to give larger applicants anything like what they asked for. The small shareholders, however, including the employés, got practically all they applied for. Their greatest difficulty, which was also the case with other specialist firms, was to produce and constantly improve inventions which possessed such outstanding merits that this and other countries could be made to feel the need of them. The shareholders should realise that the strength and capacity for development of such a business as they possessed was greatly enhanced by the extraordinary complexity of their products. There could be no two opinions as to the future demand for their products, and the board would take every opportunity to keep the company so placed as to be of the maximum value to the shareholders, the workers, and the industry. In conclusion, he reminded the shareholders that they could be of great use to the company and themselves by using "Tricity" methods in the home, and he referred to the fact that the directors were having a number of rooms fitted up at "Tricity House," 48-50, Oxford Street, showing applications of electricity in the home, which he said he hoped would be visited by shareholders later on to see for themselves what great domestic help they could reasonably expect from electricity.

Fellows Magneto Co., Ltd.

At the annual meeting, held on 21st inst., Mr. V. L. Fellows, who presided, said that the meeting was being held at the works at Willesden in order to afford shareholders the opportunity of viewing the works, which evidenced the very important and extensive business that had been built up during the war on an original capital of only £66,000. During the year the capital was increased to £114,696. The directors now recommended the payment of a final 5¼ per cent., making 9½ per cent. for the year, on double the original preferred capital, and a dividend of 24 per cent. on the ordinary shares, as compared with 15 per cent. for the 18 months to the end of 1917. Moreover, they had set aside £4,496 for depreciation, &c., and retained a surplus in hand of £3,130. Judging from contracts already in hand, and from business done since December 31st, they were earning considerable profits, sufficient to cover the expenses due to the change over to peace production, and also to maintain the present dividends, not only on the issued capital, but also on the new capital for the issue of which they would ask approval, in order to provide for the extension of the factory, and for general purposes. In view, however, of the profitable prices ruling for other motor electrical accessories, their manufacture had been undertaken by the company, and in one case a very large contract sufficient to absorb their entire surplus output had already been accepted. The company was therefore no longer dependent solely on one product. Prospects were most encouraging. The demand for their magnetos both in the home, foreign, and Colonial markets was greater than they could at present supply. They had the advantage, moreover, of being safeguarded against undue competition by the Government protection which the magneto industry must continue to receive as a "key industry" of national importance. They had also concluded arrangements of a highly satisfactory nature for the handling of their export trade for the whole world. The directors had decided to recommend the doubling of the present authorised capital by the creation of 50,000 ordinary shares of 10s. each, and 100,000 8 per cent. cumulative participating preferred shares of £1 each. The shareholders would have the prior right of subscribing for the new issue, on favourable terms.

The directors' report states that for the year ended December 31st last, after allowing £4,638 for depreciation and writing down preliminary expenses the available profit is £14,128, as against £8,514 for the previous 18 months, plus £1,182 brought forward, making £15,311. The directors recommend payment of final cumulative dividend of 4 per cent., less tax, together with a participating dividend of 1½ per cent., less tax, on the preference shares, making 9½ per cent. for the year, and a dividend of 24 per cent., less tax, on the ordinary shares, leaving £3,130, which after deducting excess profits tax (if any) it is proposed to place to reserve, less £1,000 to be carried forward. The report states since the armistice large contracts for the supply of magnetos for export and for the home markets have been accepted, and deliveries already made.

French Companies.

The receipts of *The Chemin de Fer Nord-Sud* in 1918 amounted to £621,000, as compared with £601,000 in the previous year. As, however, the working expenses and financial charges increased in a greater proportion the year has closed with a loss of £24,000, as against profits of £22,000 in 1917.

The Compagnie Continentale Edison reports gross profits of £44,000 in 1918, as contrasted with £10,000 in the preceding twelve months, and the net profits were £16,000 and £22,000 in the two years respectively. Including the balance brought forward the amount available for disposal is £27,000, and the directors recommend a dividend of 6 per cent., as against 4 per cent. in 1917.

The report of *The Compagnie Generale de la Telegraphie sans Fil*, presented at the recent meeting held in Paris, states that the gross profits in 1918 amounted to £51,000, and the net profits to £36,000. It was decided to pay a dividend of £1 1s. 6d. per share. The shareholders also sanctioned a proposal to increase the share capital from £500,000 to £1,000,000 so as to provide funds for the development of the company's own business and assist the associated companies.

The receipts of *The Compagnie de Chemin de [illegible] Metropolitain of Paris* in 1918 amounted to £2,990,000, as compared with £2,855,000 in the preceding year. On the other hand, the working expenses increased from £1,454,000 in 1917 to £1,823,000 last year, whilst the financial charges raise the total charges to £3,122,000. The result is a deficit of £132,000, which, however, is reduced to £82,000 by the appropriation of the balance brought forward from 1917. This unfavourable situation renders it impossible to pay any dividend for 1918, whereas a rate of 5.6 per cent. was distributed in 1917. Negotiations are proceeding, however, between the company and the Paris City Council, and if these are successful they will guarantee the payment of 1 per cent. on the shares for last year.

Shanghai Electric Construction Co., Ltd.—The profit, £71,537, for 1918 compares with £67,504 for 1917. Including £14,264 brought forward the amount is £85,801, out of which £10,000 has been put to reserve for renewals, and £8,000 to extinguish preliminary expenses account. The dividend for the year is 10 per cent. and a bonus of 5 per cent., less income tax, and £19,801 is to be carried forward, subject to excess profits duty. The loss by exchange on subsidiary coinage in 1918 was £39,038, equal to 12.20 per cent. on the capital. The ratio of depreciation to gross takings was somewhat increased during the year, and still shows an unfavourable tendency. The traffic and net receipts for the current year continue to be satisfactory; 15 trailers and 7 railless electric cars will be brought into service as soon as practicable to meet the increasing traffic. There will then be 90 motors, 85 trailers, and 14 railless cars (total 189). Operating expenses show an increase, due to the greater cost of power resulting from the high price of coal, which is likely to continue for the present.

Aster Engineering Co. (1913), Ltd.—Dividend for 1918 10 per cent., free of income-tax, leaving £33,282 (subject to excess profits duty for 1918) to carry forward. At the annual meeting, held in London on May 14th, Mr. R. H. Wheeler, who presided, said that during the war they had manufactured their engines for electric generating sets, searchlights, electric welding, wireless telegraphy, the lighting of aerodromes and camps, &c. They had also produced a number of "Green" engines up to 500 H.P. for coastal motor-boats. Their pioneer work in the development of internal-combustion engines had enabled them to make a substantial contribution toward the national requirements at a critical period. They were in an excellent position for carrying out their post-war programme, and could confidently look forward to a long period of increasing prosperity if the workmen did their part in enabling the firm to compete in the world's markets.

Electric Construction Co., Ltd.—The net profit for the year ended March 31st, 1919, after providing £6,481 for debenture interest and £10,000 for depreciation is £68,680, plus £31,886 brought forward, less excess profits duty paid for year ended March 31st last £28,219. After paying 7 per cent. on the preference shares and a final dividend at the rate of 9 per cent. per annum on the ordinary shares, making 7½ per cent. for the year and a bonus of 2½ per cent. on the ordinary, all under deduction of income tax, £12,263 is transferred to general reserve, leaving £38,669 to be carried forward, subject to liability for excess profits duty. The report states the company having been engaged in electrical work only during the war, no serious dislocation arose after the armistice was signed, but the turnover was affected by the cancellation or postponement of war orders. The volume of business obtained since has been considerably in excess of the capacity of the works at Wolverhampton, and it was accordingly decided to make an important extension which it is hoped will be completed by the autumn. The issue in March last of £75,000 ordinary shares to provide the necessary funds was fully subscribed.

West London & Provincial Electric Supply Co., Ltd.—The annual meeting was held on May 21st. The chairman (Mr. H. Kahn) said the profit and loss account of the West London undertaking showed little change, as the amount received from the Chiswick E.S. Corporation was the same as last year, transfer fees had been slightly less, and sundry expenses £15 more, making the balance profit £3,477, as against £3,494. The total amount with the balance brought forward was £3,539, out of which it was proposed to pay a dividend on the cumulative shares of 6 per cent., less tax, and the interest on arrears for the year 1913 of 4½ per cent. on the funding certificates carrying forward £87. The Chiswick Co. (which also supplied Aberystwyth) showed an increase on the sale of current of £1,010. The total gross revenue was £839 higher than last year, due to higher prices charged, which were not sufficient to offset the higher price of fuel and labour. Cost of generation was £1,117. Purchases of current in bulk had increased by £627, the total expenditure showing an increase of £1,164. As regards 1919, he hoped that they had reached the highest point as regards price of fuel and rates of wages, and believed the coming year would show an improvement, which had already been borne out by the results of the first quarter.

Calcutta Electric Supply Corporation, Ltd.—The report for 1918 shows as follows: Units sold 30,431,132, as against 26,596,827 in 1917. Houses connected 9,897, an increase of 156. Gross revenue £304,955, against £259,397. Net revenue £214,095, against £173,949. The net profit for 1918, plus balance brought forward and interest received, £261,960. £54,279 has been placed to the credit of the depreciation and renewals account. Excess profits duty estimated at £32,000 for 1917-18 is provided for in addition to £15,000 reserved in last year's accounts. £4,000 is put to reserve, £5,000 to the insurance fund, £12,500 to the pension fund, and a final dividend is recommended on the ordinary shares for the second half-year of 6½ per cent., plus bonus of 1 per cent., leaving £56,324 to be carried forward after providing for the directors' additional remuneration of £3,000. Expenditure on capital account last year £30,855. Total outlay to December 31st last £1,398,675. The demand for electrical energy still continues to increase. Units sold to consumers:—

	1919.	1918
Five weeks ended January 31st ...	2,555,453	2,456,464
Four weeks ended February 28th ...	2,009,647	2,080,083
Four weeks ended March 28th ...	2,379,613	2,440,756

Potteries Electric Traction Co., Ltd.—During 1918 the revenue was £224,139. Traffic and parcels receipts amounted to £206,135, an increase of £46,074. Expenses increased by £28,277. After deducting all expenses chargeable to revenue including £11,025 for debenture interest and a provision of £10,000 for renewals, there remains £53,561 (plus £8,380 brought forward), as compared with £34,444 for 1917. There is put to reserve account £25,000. A dividend of 5 per cent. per annum on both the preference and ordinary shares is paid, leaving to carry forward £12,441. The gross receipts show considerable expansion as a result of the alterations made in the fares in May last. The company has been approached by the Stoke-on-Trent Corporation for the purchase of the company's undertaking

Richardsons, Westgarth & Co., Ltd.—The profit for 1918, after providing for estimated liabilities to Government, was £133,275. Two years' preference dividend arrears have been paid, and out of the available balance of £23,817 a further year's dividend is proposed. The directors also propose another year's preference dividend out of current year's profits, thus bringing payments to end of April, 1912.

Babcock & Wilcox, Ltd.—Net profit for 1918, £438,986, plus £77,055 brought forward. After paying the preference dividends and 9 per cent. on the ordinary shares, free of income tax; £150,000 has been placed to reserve fund, £10,000 to the staff pensions fund, and £92,088 remains to be carried forward. The change over from war work to ordinary is proceeding as rapidly as possible. The construction of the works of the Spanish company is proceeding as rapidly as possible. The company has recently acquired from the Government the buildings and some of the plant of the two national projectile factories at Renfrew: these will form part of the increases in buildings and plant necessitated by the reduction of the ordinary working hours from 57 to 47.

Vickers-Metropolitan.—Allotment letters of the new issue created for the purpose of acquiring the shares of the Metropolitan Carriage, Wagon & Finance Co. were posted on Monday. In accordance with the agreement entered into between Vickers and the Metropolitan Co. for the purchase of the shares of the latter, the following directors of the Metropolitan Co. have been appointed directors of Vickers: Mr. S. Dudley Docker, C.B.; Sir E. V. Hiley, K.B.E., Mr. H. Walker, and Mr. E. Hickman. Sir George T. Buckham and Mr. H. J. Morriss have also been appointed directors of Vickers.

Chloride Electrical Storage Co., Ltd.—Final dividend of 5 per cent., tax free, on the ordinary shares, making 10 per cent. for the year.

Western Telegraph Co., Ltd.—Third quarterly interim dividend of 3s. per share, free of income tax, for the year ending June 30th, 1919, being at the rate of 6 per cent. per annum.

Chesham Electric Light & Power Co., Ltd.—Dividend 5 per cent.; to depreciation £800; carrying forward £3,139.

La Plata Electric Tramways, Ltd.—After paying debenture and other interest there is a loss for 1918 of £2,731.

STOCKS AND SHARES.

Tuesday Evening.

Noticeable contraction in Stock Exchange market activity is one of the features since last we wrote. In House colloquialism, markets have rather boiled over. Big rises had occurred, and a few operators started to take profits in such shares as Marconis and others which had enjoyed dramatic advances. One seller makes many, and, as markets turned from a condition of buoyancy to one of greater caution, a steady stream of sellers appeared. Fresh hints of a Government Consolidation 4 per cent. Loan at 80, with earlier commencement of annual drawings at 100, tended to weaken prices of gilt-edged stocks offering lesser attraction. Investment and speculation have both shrunk considerably in volume.

Exceptional strength is that shown by the Undergrounds. A general tip to buy the £10 shares of the Underground Electric Railways led to the price being hoisted to 4, from which they went back to 3⅞. The shilling shares rose to 11s. 3d. before a slight reaction set in, and the income bonds hardened to 95½. In sympathy with this movement, Districts recovered ½. Meanwhile the steam stocks dwindle in price day by day.

The decline in home electricity shares, started by the Second Reading of the Government Bill, has been arrested, but business is very quiet, and there is little doing in any of the leading shares. Manufacturing shares are steady. The Electric Construction report shows that the profits for the year just ended were £68,700, some £1,900 better than the previous year's figures. As already noticed here, the dividend and bonus, making 10 per cent., are repeated, and the reserve fund is raised to £85,000, with nearly £39,000 carried forward. English Electrics keep firm at 28s. 6d. Edison Swans eased off a shade. A new introduction to the market is C. A. Vandervell shares, the company which specialises in motor-car lighting, and dealings began in the £1 ordinary at 33s. 9d., in the shilling deferred at 6s. 6d. The former have reacted to 32s. 6d. Johnson & Phillips new ordinary shares were largely over-subscribed. There is no check at present upon the eagerness which the public display in taking up any new issue that offers reasonable security and prospects. Rumours continue to sport with the probability of forthcoming amalgamations in the electrical world.

British Electric Tractions drooped to 47½. Brazilian Tractions shed 2 points of their good rise. British Columbia Electric Railway issues have jumped up in consequence of the 2½ per cent. dividend declared on the preferred ordinary stock. This issue has risen 2 points to 46, and the deferred, which was down to 32 early in the present month, is now 43½. To the investor, the 5 per cent. preference stock standing at 62½, and paying 8 per cent. on the money, may be commended as useful to mix with others that yield less, for it deserves a capital appreciation of several points. Montreal Electric at 230 is 5 points higher. Gains of 1 are shown by Canadian General Electric at 125, and Consolidated Gas & Electric of Baltimore at 111, while Electric Light of Cochabamba bonds are 2 higher at 85½. On the other hand, Electrical Development of Ontario fives have weakened to 97½. The Mexican group has made further substantial recovery. Argentine Trams are rather harder.

Marconis, as already observed, proved somewhat reactionary. The price rose breathlessly to 6 9/16 on the hopes of what compensation from the Government next week may bring forth, but at this point the sellers came along in force, and the price subsided to 6⅛, which still leaves, of course, a material improvement on the month. Marconi Marines touched 3 9/16 before easing off to 3 7/16, while American and Canadian Marconi reacted to 30s. 6d. and 16s. 9d. respectively. Direct United States Cable shares have made a good move towards recovering their recent heavy drop, and at 4¾ are 15s. higher. The s.s. *Faraday* was repairing the company's cable when it picked up Mr. Hawker's signal. The Eastern group is quiet. Holders are well satisfied to wait for what some of them regard as a certain increase in dividends, following upon that lately declared by the Globe Telegraph & Trust Co. Chile Telephones have fallen 7s. 6d.

Babcock & Wilcox had been dull, but rallied to 3⅞ on the issue of the report. India-Rubber shares are over 5s. higher. Rubber shares as a whole are heavy, with a few bright exceptions. The new Vickers 5 per cent. tax-free preference are being dealt in about 20s. 6d. Copper shares show a disposition to improve.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies

	Dividend 1917.	Dividend 1918.	Price May 27, 1919.	Rise or fall.	Yield p.c.
Brompton Ordinary	10	8	6¾	—	£5 8 10
Charing Cross Ordinary	4	4	8¼	—	6 8 1
do. do. do. 4½ Pref...	4½	4½	6¼	—	6 18 4
Chelsea	6	8	8⅝	—1/16	4 2 9
City of London	8	8	11⅛	+⅛	6 14 6
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 8
do. do. 6 per cent. Pref.	6	6	10	+⅛	6 0 0
Kensington Ordinary	7	8	6¾	—	5 4 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref...	6	6	3⅞	—	7 14 10
Metropolitan	4	6	8⅛	—	8 0 0
do. 4½ per cent. Pref. ..	4½	4½	6¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	6	5	2¾	—	7 5 6
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6⅛	—	6 10 8

Telegraphs and Telephones.

	Dividend 1917.	Dividend 1918.	Price May 27, 1919.	Rise or fall.	Yield p.c.
Anglo-Am. Tel. Pref.	6	6	89	—	6 1 0
do. Def.	1½	33/6	22½	—	7 8 0
Chile Telephone	8	8	7	−⅜	5 14 4
Cuba Sub. Ord.	7	7	11	−⅛	*6 4 5
Eastern Extension	8	8	16⅜	—	*4 17 9
Eastern Tel. Ord.	8	8	166½xd	+2	*4 16 1
Globe Tel. and T. Ord.	7	8	16¼	—	*4 19 3
do. do. Pref.	6	6	10½	—	5 14 6
Great Northern Tel.	22	22	82	—	6 17 6
Indo-European	13	13	65	—	5 18 2
Marconi	20	20	6⅛	−5/16	3 6 0
Oriental Telephone Ord.	10	15	2⅜	−1/16	6 6 4
United R. Plate Tel.	8	8	7 15/16	+1/16	*5 1 0
West India and Panama	1/3	1/3	1 13/32	—	*4 8 4
Western Telegraph	8	8	17¼	+⅛	*4 12 9

Home Rails.

	Dividend 1917.	Dividend 1918.	Price May 27, 1919.	Rise or fall.	Yield p.c.
Central London Ord. Assented ..	4	4	63½	—	6 6 0
Metropolitan	1	1¼	26½	−½	4 14 4
do. District	Nil	Nil	25	+½	Nil
Underground Electric Ordinary..	Nil	Nil	3⅞	+¾	Nil
do. do. "A" ..	Nil	Nil	10/6	+1/3	Nil
do. do. Income ..	4	5	95½	+½	*5 3 8

Foreign Trams, &c.

	Dividend 1917.	Dividend 1918.	Price May 27, 1919.	Rise or fall.	Yield p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	3¾	+⅛	—
do. do. 2nd Pref. ..	—	—	8¼	+¼	—
do. do. 5 Deb... ..	5	5	68½	—	7 8 5
Brazil Tractions	—	—	62	−2	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62½	+2	8 1 4
do. do. Preferred	Nil	2½	46½	+2	5 7 6
do. do. Deferred	Nil	Nil	43½	+2	Nil
do. do. Deb. ..	4½	4½	62	—	6 17 4
Mexico Trams 5 per cent. Bonds..	Nil	Nil	62½	+2	Nil
do. 6 per cent. Bonds..	Nil	Nil	53½	+5	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	70	+8	—

Manufacturing Companies.

	Dividend 1917.	Dividend 1918.	Price May 27, 1919.	Rise or fall.	Yield p.c.
Babcock & Wilcox	15	15	3⅞	—	3 17 6
British Aluminium Ord.	10	10	1 11/16	—	5 18 6
British Insulated Ord.	25	12½	2¼	—	5 11 1
British Westinghouse Pref. ..	7½	8	2 11/16	—	5 19 6
Callenders	25	25	10¼	—	6 8 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	3 7/32	−1/16	6 5 0
Edison-Swan, "A"	—	—	1 3/32	—	5 17 0
do. do. 5 per cent. Deb. ..	4	5	75½	—	6 12 8
Electric Construction	10	10	1 9/32	—	7 16 0
Gen. Elec. Pref.	6	6½	10⅛	—	6 8 10
do. Ord.	10	10	21½	−½	*4 13 0
Henley	25	25	2⅜	—	5 5 3
do. 4½ Pref..	4½	4½	3⅞	—	5 16 9
India-Rubber	10	10	17½	+¼	*5 14 3
Siemens Ord...	—	10	6 15/16	—	*7 4 0
Telegraph Con	20	20	25½	—	4 13 6

*Dividends paid free of Income Tax.

THE TELEPHONE SERVICE OF LARGE CITIES, WITH SPECIAL REFERENCE TO LONDON.

By E. A. LAIDLAW, M.I.E.E., and W. H. GRINSTEAD, A.M.I.E.E.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The subscriber's estimate of the telephone service is the only real criterion of a satisfactory service. The subscriber, too, in including each factor in his estimate, unconsciously weights it according to the way it affects him. The authors do not wish to suggest that service observation is of little value, but it cannot do more than measure certain factors which are by no means all that the subscribers understand by "service."

Errors affect, even on the best operated equipments, 2 to 5 per cent. of the local calls, and up to 9 per cent. of the junction calls (Am). In addition, operating irregularities affect some 7 to 10 per cent. of the calls. Without changes in the type of equipment, an improvement in these figures might be obtained by lowering the operator's load. Possible modifications in equipment having for their object the assistance of the operator may effect some slight improvement, but their effect on the accuracy of the service must be slight.

Each of these errors and irregularities arises from an operator doing something which she ought not to have done. Modifications in equipment will not remove this human tendency to err; they can only lessen it. "Automatic" systems are not subject to errors of this nature. No considerable improvement in the accuracy of the service, therefore, can be expected from equipments of the manual type. For improvement we must look to the introduction of mechanical operation.

Concerning speed, the subscriber is influenced far more by extremes than by average figures. The extreme delays are in many cases due to operating errors. It is the period taken to receive a reply which is important from the subscriber's point of view, and is directly under control of the administration. An improvement is to be looked for in two respects, first a shortening of the average time taken to ring the wanted subscriber, and second, a greater uniformity in this time.

Improvement can only be obtained at considerable expense and by the sacrifice of the advantage of the increased load which alone would justify modifications to aid the operator. The introduction of mechanical apparatus for completing junction calls would bring the service on all calls up to the level of that shown for local calls. A further improvement would result from the extension of mechanical operation to the completion of both local and junction calls, *i.e.*, "full automatic" working.

The speed of disconnection is of particular interest to the busy subscribers. On about 10 per cent. of the calls, it is necessary for the subscriber to call in the operator by flashing the supervisory signal to make a further call. Although 5 seconds may appear to be a reasonably short time for the disconnection, it does not represent accurately the state of affairs as viewed by the subscriber. For instance, if the call has been one incoming from another exchange, the average time taken to disconnect and free the line becomes 10 seconds.

Extensive modifications of manual central battery equipments have been proposed to provide instantaneous disconnection. But it is doubtful whether it would be justifiable to incur the additional cost which would improve the service in this one particular only.

The elimination of delays in disconnection and in the establishment of further connections is an improvement which is afforded in a high degree by mechanical operation. The full benefit of this feature is not, however, obtained at present on some public automatic systems which are so arranged that the release of both lines is controlled by the calling subscriber. The extent to which this arrangement detracts from the full advantage of instantaneous disconnection is, however, quite small.

The standards of construction to which modern administrations are working are such that no striking improvements in transmission are likely to be made. Future development is more likely to have its effect upon the methods of attaining these standards than in raising their level.

Two means are available of compensating for the transmission difficulties due to the use of small conductors and the length of the junctions. The application of loading in large cities is not easy. The increase of voltage, however, seems to present advantages in every way. In addition to improvements in transmission, the higher voltage affords larger margins on the operating requirements of the relays, and so reduces maintenance expense.

The cost of the increased amount of energy per call taken from the central battery, as well as any slight increase in the capital costs which can be ascribed solely to the increase in voltage, should be more than compensated for by the transmission and maintenance advantages.

It is possible that one voltage could be standardised for both manual and automatic equipments. The benefits would be considerable both to the administration and to the suppliers of exchange plant.

Operators' irregularities included all those which make a service unsatisfactory from the subscriber's point of view. One of the chief of these is the "number engaged" trouble. The percentage of calls on which the subscriber receives this report varies from 10 per cent. over the whole day on moderately busy exchanges up to nearly 20 per cent. during the busy hour on the busiest exchanges. Another item is the "no reply" report, which is given on about 2 per cent. of the calls. Some 2 per cent. of the incoming calls to a subscriber are cases in which he is called in error, and bad operating at private branch exchanges affect another 2 per cent. of the calls.

A reduction in the number of these irregularities is not altogether in the hands of the administration. An improvement is only to be sought in reducing the length of time each line is engaged, particularly during the busy periods. The holding time may be reduced by reducing the time taken to set up the connection, by improving the quickness of answer on the part of the called subscriber, and by reducing the time of disconnection. There is little hope of improvement in these items, without a change in the type of equipment. Automatic equipment promises a considerable reduction in the time of engagement. No difference is made in respect of the decrease in the duration of the conversation, amounting in some cases to as much as 40 per cent., which has been observed when an exchange is converted from manual to automatic working.

The irregularities due to subscribers and private-branch-exchange operators form a class for which, it may be claimed, the administration is not responsible. But this view cannot be entertained. It is the duty of the administration to modify its methods and equipment to reduce all sources of dissatisfaction to a minimum as far as this can be done economically.

No greater number of subscribers' irregularities is to be expected with the full automatic system than with the manual system, and the total amount of wrong number trouble, when that due to the operators is included, is likely to be considerably less. The increase of wrong number trouble with the amount of junction working is noticeable in the case of the manual exchanges. There will be no such increase with automatic systems in which the operation is precisely similar for both junction and local calls.

The authors have in the foregoing section tried to consider the matter from the point of view of the telephone-using public. Telephone service is a service rendered to and paid for by the public, and it is not those who render a service, but those who are served, whose opinion of the quality of the service must ultimately be accepted.

Without a departure from the types of equipment at present standard, there are two possibilities, namely, to improve the operators and to improve the equipments; neither alternative presents a hopeful prospect of effecting improvements in the service, especially when the large increase to be expected in the complexity and size of the telephone system is considered.

Turning to the possibilities afforded by newer methods of operation, experience shows that mechanical operation will afford a service of improved accuracy and speed, particularly in those items which appeal to the public. Assuming 80 per cent. junction working, the called subscribers' bell is rung in an average time of 10 sec., as against 26.2 sec. on a call with manual service. 98 per cent. of his connections are completed to this stage in 30 sec., against 68 sec., and he can free himself and establish a second connection with no delay whatever. The use of mechanical operation has also a favourable effect on the number of irregularities, particularly upon the "number engaged" trouble. Experience shows that the wrong numbers called by subscribers with the dial are 1.4 per cent., against 1.9 per cent. On systems in large cities the difference would be even more marked. Cut-offs and double connections occur less frequently, and the fear that the subscriber would prove incapable of handling the dial correctly has proved groundless.

There appears to be therefore little hope of effecting improvements in the quality of the service with the existing manual types of switching equipment. Mechanical operation, however, offers improvements in almost every item.

An ideal tariff, from the commercial standpoint, should be proportioned to the expenses in every respect. This cost is made up of (i) costs individual to the subscriber; (ii) costs of setting up the connection; and (iii) charges on the common connecting plant.

The old "flat" rate tariff ignored the fact that the service given to different subscribers might vary considerably in the cost of setting up and in the use made of the common connecting plant. The "message" and "measured rates" take account of this, and the third item is covered roughly by charging "junction fees."

The only equitable way of allocating the expenses of the common plant is in relation to the amount of it brought into use and the time of its use for each connection.

The problem is much simplified by the acceptance of the principle of a "unit of telephone service" as a basis for the variable part of the charge made to the subscriber. The meter which records the units consumed is assumed to be in operation continuously during the conversation, and the rate at which the units are consumed on any given connection can be varied according to the amount of plant involved. A subscriber would be charged for his telephone service almost in the same way as for his electric light, varying according to the apparatus he brings into use.

This method of charging is scientific and fair, simpler than the message or measured rate, and will be readily understood by the public. It very considerably simplifies the problem of automatically registering special-fee calls on mechanically operated systems.

By making arrangements such that the rate of recording on all meters can easily be altered, differential rates for different times of the day can easily be arranged. This permits attention to be given to the telephone load factor. Any improvement in the load factor would have a considerable effect on the cost of providing exchange and junction equipment for large cities. Further, the reduced rates for the greater part of the day would lead to a much increased use of telephone communication and would undoubtedly appeal strongly to the small user. The subscriber might be afforded the protection of a certification of the correctness of his meter and metering circuit by an independent authority. Its practical application of the principle of the "telephone unit" is not without its difficulties, but the investigations already made, although retarded by the war, have advanced sufficiently to demonstrate its practicability.

Under the present conditions any exact analysis of expenses is of little value. What can be examined with advantage, however, is the general direction in which each quantity concerned is varying, and the probable effect of this variation.

The authors have tried to consider what alterations in the methods and plant of the telephone service of large cities might be made to enable the changed conditions to be faced. They find that nearly every indication is in favour of the extensive application of mechanical operation. Although the prices of automatic equipment have been subject to the same rise as all other manufactured products, there are possibilities of considerable reductions, due to improved design and manufacturing methods, when the quantities to be handled become more reasonable from the manufacturer's point of view than they have been in the past.

The introduction of a full automatic system would very considerably reduce the administrative and operating charges which form about 23 per cent. of the expenses per station and show tendencies to increase out of all bounds in the future. Experience shows that it would effect very little, if any, increase in the maintenance costs, which form another 23 per cent. A reduction of rents and other building charges would result. The item "interest," amounting to 11 per cent., would show a slight increase, but it must be remembered that a large proportion of the interest refers to the line plant. Depreciation (24 per cent.) would tend to be increased, assuming the same life for automatic equipments as for manual.

To proceed in the future with automatic equipment will result in expenses lower than with manual equipment, and will afford relief from the upward tendencies of the several important items of expense. Certainly, if the change is to be made, there is likely to be no more favourable opportunity than the present.

The question arises: to what extent shall mechanical operation be applied, is the "semi-automatic" or the "full automatic" system to be preferred for telephone service in large cities?

The experience and records of the performance of the full automatic systems which have now been working in this country for some years, show that control by the operator is unnecessary, except in such special classes as trunk connections and those from coin boxes. Even the latter could be handled automatically if suitable methods of charging for the calls were adopted. The work of the operator is very considerably facilitated by the semi-automatic apparatus, but its monotony is even greater than with the manual system.

The additional capital cost of the subscribers' dials with the automatic system is almost balanced by that of the operators' equipment and impulse-sending devices with the semi-automatic system, while the latter must be debited with the greater floor space and greater administrative and operating charges. The speed of the service afforded by the full automatic system is undoubtedly greater than that on the semi-automatic. In cases where a direct comparison has been made to ascertain the subscriber's attitude to the question, the result has shown a decided preference for the "full automatic." The subscriber is evidently quite willing to undertake the dialling rather than await the attention of an operator, even with the speed with which the semi-automatic apparatus endows her.

There is in the semi-automatic system a feature which appears attractive for the transition period, namely, that the existing exchange names and numbers may be retained. Special keys are provided, one for each exchange, the depression of which causes the impulses directing the connection to that exchange to be sent. With an extensive area, the number of these keys becomes excessive. The present difficulties in accommodating and operating order-wire keys are sufficient to condemn any proposal of this nature. This difficulty could be avoided by adopting the automatic numbering scheme for the semi-automatic system, but this eliminates the very feature the attractiveness of which led to discussion of the question. Even if adopted for the early stages of the conversion with a view to avoiding number changes, the changes would have to be faced on the later conversion to full automatic, and they would then be a much more serious matter on account of the largely increased number of subscribers.

The case of London always springs to mind as the one in which the difficulties of conversion are more serious than in any other city in the world. The London telephone area extends over 640 square miles, and in spite of its extent it is one organic whole. The intercourse between each part of it and the remainder is such that any attempt to divide it into two or more distinct areas fails on account of the impossibility of choosing a boundary across which the amount of intercommunication could be satisfactorily handled by the methods usually employed between separate areas.

Allowing for increase in the population within the area, and assuming a development up to a figure of 10 for the inhabitants per telephone, the number of stations will ultimately not be far short of one million, with a corresponding number of direct lines of 700,000. The average number of lines per exchange at present is roughly 2,000. The size of a manual exchange is limited by the length of the operator's arm and minimum diameter practicable for the connecting plugs to about 10,000 working lines. On the manual system, therefore, some 150 to 200 exchanges would be ultimately necessary. Even with the number of exchanges existing, over 70, the difficulties of junction working are severely felt in their effect both on the service and on the expenses. It becomes, indeed, questionable whether a purely manual system would be capable of dealing satisfactorily with the ultimate conditions.

In densely developed areas it will be desirable to provide direct junctions between each automatic exchange and every other in order to secure the shortest routes for the large numbers of junctions. The junction arrangements are therefore the same as with the manual system, although operating costs are absent in the automatic system. Insurance against interruptions in service and convenience in the organisation for the maintenance of junction circuits would also tell in favour of direct junctions.

The position of an automatic exchange is determined by very much the same factors as those operating with the manual system, chiefly subscriber's line mileage, and land and building costs. In the suburbs, where the telephones are distributed in groups separated by comparatively open districts, the facilities afforded by the automatic system for opening sub-exchanges, without incurring additional costs for "B" operating, would lead to the provision of more exchanges and so would have an influence on their position. Where the denser parts form an area of elongated shape an exchange towards each end might take the place of a single exchange in the centre.

In densely developed Central London the size of the exchange, no longer limited by the length of the operator's arm, would tend to increase in order to secure the advantages of the reduced cost per line of large buildings. It would, under the ultimate conditions, be limited possibly only by the physical difficulties of providing duct space in the approaches to the exchange building. The exchanges in the suburban districts would therefore tend to be more numerous, and those in the central districts less numerous, than with a corresponding manual system.

The selection of the method and time for the change of the subscribers' numbers is one of the serious problems to be faced in the introduction of the full automatic system. Seeing how intimately it affects the subscribers, it calls for ample consideration and boldness and firmness in applying the solution decided upon. As a manual system develops the need for number changes is always present. With the full automatic system, however, if a well-designed numbering scheme based on careful development studies is applied at the outset, the numbers then allotted need suffer little change thereafter.

The authors' proposal would be to change at one time the numbers of all the subscribers connected to exchanges in the "Inner London" area, *i.e.*, within the boundaries of the present County of London. Each "Outer London" exchange would retain its present name and numbering until it became incorporated in the full automatic exchange system. This distinction between "Inner" and "Outer London" would not appear unreasonable to the subscribers, for the dividing line is already marked.

The proposal to change all "Inner London" exchange names and numbers to the new automatic region names and numbers at one time prior to the commencement of the work of converting the plant, has numerous advantages. The change could be made shortly after the public announcement of the decision to install the automatic system, at a time when the subscribers would be in a mood to accept it willingly. It could be made at a date which might be definitely fixed a considerable time in advance, so that the subscribers have plenty of notice. Further, there is the very considerable advantage in changing all the numbers at the same time that each user knows his correspondents' numbers are being changed. This should assist considerably in the reduction of inquiry traffic after the change. The earlier the change is made the less the inconvenience both to the subscribers and the administration. A wholesale change not only tends to reduce the actual trouble always attendant on number changes, but is likely to give rise to less irritation and imaginary trouble than a succession of piecemeal changes extending over eight to ten years. By making a universal change before commencing the conversion, time is given for subscribers to become accustomed to the new numbers and one of the difficulties attending exchange transfers is eliminated.

Only the "Inner" (County of London) area would at first form a united automatic exchange system. Any outlying exchanges converted would remain individual centres, retaining their old name and, perhaps even to a large extent, their old numbering, just as Epsom, which has already been converted, does at present. As the network is built outwards to them, they could assume the new numbering and be embodied in the main system.

The authors think that the changes that have already taken place and are now in progress among the telephone-using public and in the labour and manufacturing worlds, are such as to demand considerable advances in types of plant and methods, if improvements in the service and provision against increased expenses are to be made in the future. Little more than the present standard of service is to be expected from manual switchboards, and mechanical operation offers striking improvements in service and a means of reducing those items of expense which show the strongest tendencies to increase.

As to the time of the introduction of the automatic system, the immediate future is undoubtedly the most favourable, offering an opportunity which will not occur again. On account of the war, not only are the amount of plant and the number of subscribers affected less than they will ever be in the future, but the depreciation account is in a better position to stand the heavy replacement charges than it would be in normal times.

An attempt has been made to show by a study of the London area that there are no fundamental difficulties to be expected in the application of automatic systems to large cities, either in the ultimate arrangements or during the transition period.

The authors do not wish it to be thought that they have attempted to say in any way how the case of London ought to be treated They have merely used it as an example to draw attention to, and stimulate discussion of, the effects on the provision of telephone service of the recent serious changes in many factors.

Discussion.

Sir W. Slingo opened the discussion by congratulating the authors on the valuable addition they had made to the literature on this subject. The present paper was the second important one that had been read before the Institution on this subject. It was only as recently as 1912 that the first experiments with automatic exchanges were made in this country, and they already had something like 14 such exchanges at work. He had always anticipated that automatic exchanges would come during his lifetime, but he had certainly never expected to see them adopted during his working career. In his opinion, if the automatic system was to be introduced in any area, the whole of that area should be converted at once, and not one part at a time. If he remembered rightly, they had in the London telephone area something like 74 exchanges; the difficulty of converting such a number of exchanges would therefore be appreciated, and should not be minimised. Another difficulty he foresaw was that of manufacturing the necessary apparatus that would be required. In this country there were only three firms that could manufacture the requisite equipment on a sufficiently large scale, and if one out of the three firms secured the contract he did not see how it would be able to deliver in a reasonable space of time. On the other hand, he did not quite see how they would be able to surmount the difficulties that would arise if they had several contractors working on different parts of the equipment at the same time, as uniformity of equipment throughout London was essential. Referring to the Leeds automatic exchange, which had now been in service for 12 months, Sir William admitted that he had had grave misgivings about it at first, but it had, much to everyone's relief, given complete satisfaction. It was a question of tackling the thing in the right manner, and not commencing with too large a figure. Now that the Leeds five-figure exchange had proved itself satisfactory, he did not see any reason why a six-figure exchange should not work, nor even why the system should not be applied to London with equally good results. With regard to costs, the capital cost of automatic exchanges was about 60 per cent. greater than for manual exchanges, but the annual costs were less for the former type, and it became a question of satisfying the purse-holder. Another problem was that of the shortened life of the manual exchange when displaced in favour of the automatic, and in his opinion this cost should be debited to the automatic exchange. In conclusion, he congratulated the authors on having drawn such a large gathering to hear their paper read.

Col. C. B. Clay took exception to certain remarks made by the previous speaker; he (Col. Clay) had some 3,000 men at work that day, and he was prepared to double that number at any time. The statement that there were only three firms in this country that could manufacture the requisite equipment on a sufficiently large scale was, he thought, quite unfair. Turning to the paper itself, he had not had time to go into it, and was not, therefore, prepared to discuss the subject. He suggested that the Institution should allow more time for members to digest the papers before they came up for discussion.

Col. Sir A. M. Ogilvie, C.B., congratulated the authors on the field covered by the paper; he well knew the amount of work that must have been involved. With regard to costs, he thought the automatic exchange had made good, and similar remarks would apply to the question of increased efficiency. Experience had shown that the difficulties of the five-figure exchange were not so great as had commonly been thought. Concerning conversion from manual to the automatic system, he thought that gradual conversion would be found to be extremely difficult, and it would take something like 12 years to complete in an area like London, not forgetting the increased difficulty and cost of working the system during the period of transition. Nevertheless, in about 12 years' time he thought the existing system would have become quite incapable of dealing with the traffic, and the problems of conversion would, therefore, sooner or later have to be faced.

Mr. C. A. Baker's remarks were chiefly confined to tariffs. He would like to know whether the tendency was to increase rather than decrease tariffs. Of course, owing to the war, it was very difficult to say what the costs should be to-day, but in his opinion the £5 10s. or £6 10s. charged for the installation of a telephone in the London area was much too high. The Post Office argued that in the London area each subscriber had a much larger number than usual of people with whom he could talk, but it could also be argued that the Post Office had a much larger number of subscribers in that particular area than was usually the case. Another point that he had noticed was that the efficiency of services was much higher in small towns than in large ones. Concerning the checking of accounts, the Post Office kept its accounts hidden away, and no subscriber ever had a chance of checking same. Perhaps some form of meter system, where the meter was on the subscriber's premises, might reduce the amount of friction that occurred on this point at the present time. Another point of importance was that of security against breakdown. The Press had stated that during the recent snowstorms something like 11,000 lines were brought down. This was really a very bad state of affairs, and he (Mr. Baker) thought the Post Office might with advantage use a higher factor of safety.

Mr. J. E. Kingsbury said that the Post Office and the manufacturers had always succeeded in treating each other fairly in the past, and in his opinion the difficulty suggested by Sir W. Slingo would be found capable of satisfactory solution.

The rest of the speakers dealt mainly with questions of detail. The importance of the transition arrangements were emphasised, and it appeared that the present cost of automatic equipment was much higher than that of the manual type. This, it was considered, should be reduced, and the conversion of the London system would justify manufacturing methods having this object in view. The question of renumbering subscribers was discussed as one of the greatest importance to the public Suggestions for avoiding or reducing it were made, but it appeared that code numbers or letters indicating the exchanges would have to be prefixed to subscribers' individual numbers. The average official "life" of a telephone operator was stated to be only four years, so that there would be no great displacement of operators by the change.

The authors reserved their reply for insertion in the *Journal* of the Institution.

THE STILL ENGINE: A NEW PRIME MOVER OF HIGH EFFICIENCY AND BRITISH ORIGIN.

By FRANK E. D. ACLAND, M.Inst.C.E.

(*Abstract of paper read before the* Royal Society of Arts, *May 26th,* 1919.)

The conversion of heat into useful work, with the minimum of waste, depends on the efficiency of the means employed; that is to say, it depends on the losses in the heat cycle, and on the losses in the mechanism employed for producing the heat and converting it into power.

"The efficiency of a heat engine is the ratio of the heat converted into mechanical work to the total amount of heat which enters the engine." It by no means follows that an engine, which thermodynamically attains the highest indicated efficiency in relation to the ideal, is in practice the most efficient for its purpose, or the most economical in fuel.

Efficiency from the user's point of view is the ratio of the useful work to the total heat in the fuel used.

Comparing the cycle of steam with that of combustion engines, the latter has two great advantages over the former. The fuel which imparts the heat to the working fluid is introduced directly into its working cylinder, and the temperatures and pressures are far above the limits of those possible in the steam engine and boiler.

The steam engine suffers from heavy heat losses in the creation of its heat; it is forced to work at comparatively low temperatures and pressures, and with superheating, compounding, and condensing added to it, has arrived at a point where further efficiency is well-nigh impossible. The further recovery of thermal loss in the steam engine, or in the mechanism, is a difficult, if not an almost impossible, task. In the internal-combustion engine all the losses at present existing are capable of some recovery, and certainly of considerable reduction.

The maximum ideal efficiency of a heat engine is obtained where the difference existing between the highest and lowest temperatures of the working fluid is greatest in proportion to the maximum temperature, and here the internal-combustion engine, with an initial temperature higher than the furnace temperature of the boiler, and even higher than the melting-point of cast iron, is capable of realising better thermal conditions than any other form of heat engine; but in its turn it suffers from two disadvantages—it ejects its working fluid at a temperature too high for ideal conditions, and it loses heat energy to a regrettable extent in the cooling of its cylinder.

The result obtained in practice from the two cycles separately, based on their best performances after half a century of intensive development, is that in the steam engine there is a loss of over 80 per cent. of the heat contained in the fuel, and in the combustion engine of 60 per cent.

The recovery and efficient use of the waste has been the work of many years of patient research by William Joseph Still and others associated with him, and has resulted in the design and construction of a variety of engines which bear out the correctness of his principles, and point to a vast field of further practical application.

employed; it makes use of the recoverable heat which passes through the surfaces of the combustion cylinder, as well as into the exhaust gases, for the evaporation of steam, which steam is expanded in the combustion cylinder itself on one side of the main piston, the combustion stroke acting on the other side. It increases the power of the engine, and reduces the consumption of the fuel per H.P. developed.

Its primary object is not to use the waste heat for raising steam, but first to use it in improving the thermal conditions of the working cylinder, and so ensure the maximum efficiency from the fuel burnt within it, diminishing, as a consequence, the heat lost in that operation. Since the maximum efficiency is obtained by combustion of the fuel in the cylinder, and the minimum by the evaporation of the water in the steam generator, it is evident that the larger the quantity of steam which can be generated per H.P. developed by the combustion cycle, the lower must be the heat efficiency of the whole machine.

In the Still engine (fig. 1) the jacket and cooling water form part of the circulating system of a steam generator, which may be an integral part of the engine, or external to it. The cooling water therefore enters and leaves the jacket at a constant temperature, regulated by the pressure of the steam; the cooling being effected by converting the water into steam without raising its temperature. Excluding the radiation losses, which are kept low by lagging, all the heat which passes through the walls is thus usefully recovered in the water as steam. The temperature of the cylinder wall is uniform over the whole of its exterior surface, and the heat lost to the cooling water at each stage of the cycle—compression, combustion, and expansion—is diminished.

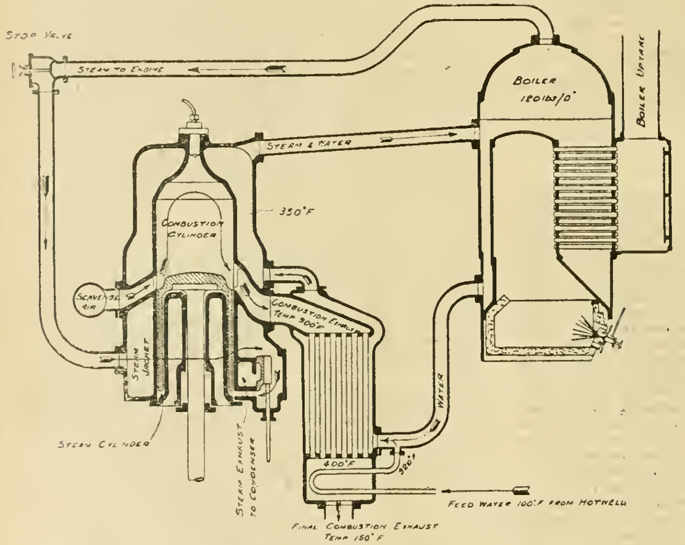

Fig. 1.—The Still Engine; Sectional Diagram.

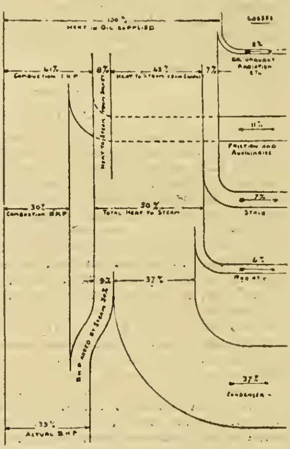

Fig. 2.—Heat Balance Diagram.

The possibility of combining in one engine the superior thermal cycle at the high temperatures and pressures of the combustion engine with the low thermal cycle of steam to deal with its rejected heat, and, in the same engine, add the superior working advantages of the steam engine, was the basis of his work.

The development of the internal-combustion engine has included many proposals and attempts to utilise the heat going to waste in the exhaust and cooling water; but while in existing engines some proportion of the heat can be usefully recovered as steam from the exhaust gases, the cooling water from the jacket is of little value, owing to its low temperature, and the efficiency of the engine itself is not augmented. If, however, the temperature of the cooling water could be maintained at that of steam at useful pressure, the efficiency of the engine would be improved and the weight of steam be usefully increased.

It has been inadvisable during the past four and a-half years to allow publication, but the time has arrived when the principles of this new development should be available for examination and discussion, and an account be given of some of the results achieved. The results already obtained from engines which are admittedly experimental types, constructed under disadvantageous conditions, are sufficiently remarkable to substantiate their claim to be of real importance, while they give promise of far wider application and further improvement.

The Still engine is an engine capable of using in its main working cylinder any form of liquid or gaseous fuel hitherto

During compression, owing to the walls being at steam temperature, the incoming charge picks up heat, instead of losing it, during the greater part of the stroke, an advantage of the greatest value to the heavy oil types of Still engines, where an air charge is taken in at the full outstroke, and is compressed to a pressure where its increased temperature ensures the certain ignition and combustion of the fuel which is injected into it.

During combustion and expansion, the uniform and higher mean temperature of the walls reduces the heat lost to the jacket water. Some of the heat thus economised adds to the useful work on the piston, the balance passing out in the exhaust gases for recovery.

To ensure the maintenance, in a practical and reliable manner, of the temperature conditions which produce this efficiency during the combustion cycle, a departure from the design and construction of the cylinders of normal internal-combustion engines is imperative; they have hitherto been made of cast iron, of a thickness sufficient to resist the working and thermal stresses thrown upon them, including occasional heavy loads caused by pre-ignition of the explosive charge. With these thick walls or liners, the temperature difference between their inner and outer surfaces, which is essential if the surplus heat is to be carried off, can only be obtained safely by the circulation of water at low temperature through the jacket; this is especially the case in cylinders of considerable diameter, or capable of high power per swept volume.

The cylinder of a Still engine consists of an inner liner, which is approximately one-third to one-fourth of the usual thickness; it is ribbed externally so as to add to its conducting surface and provide suitable passage for the cooling water, and it is reinforced by an outer hoop capable of withstanding the highest pressures to be met with in working. The stresses due, in ordinary practice, to the cold water at the inlet, and the hotter water at the outlet, are suppressed in the Still cylinder, the cooling water being at a controlled and uniform temperature throughout (fig. 3).

No failure of a cylinder of any kind has occurred, even under most severe, even abnormal, test conditions, *e.g.*, with mean combustion pressures of 180 lb. per square inch in a two-stroke engine, to which was added overload steam mean pressures of 70 lb., *i.e.*, a total M.E.P. per revolution of 250 lb. per sq. in.

Steam from Waste Heat.

In gas and oil engines of constant-volume and constant-pressure types, the combined losses in radiation, cooling water, and exhaust gases, range between 75 per cent. and 65 per cent. The highest indicated thermal efficiency claimed under test conditions with a Diesel engine (Mathot) 300 B.H.P., four-stroke, at three-quarter load, is 47 per cent. (36 per cent. brake efficiency). If 4 per cent. is allowed for radiation, 49 per cent. of the total heat is available for recovery, and if 10 per cent. efficiency is assumed for the steam cycle, the brake thermal efficiency of an engine giving this high result would be raised by 10 per cent. of 49 = 4.9, *i.e.*, 36 + 4.9 = 41 per cent.; but there is no reason why the steam generated and used under the conditions of the Still system should be limited to so low a figure. Fifteen per cent. seems a more reasonable assumption, and even a higher figure may be anticipated, in which case a brake thermal efficiency of 44 per cent. should be possible in a complete installation.

The Still engine may be of the constant-volume or constant-pressure type, or a combination of both; its losses to the cooling water are not the same as in a normal engine of either type, except in so far that they vary with the type, with the cycle, with the efficiency of the combustion stroke, and with the load. At normal and full loads, such heat units, in a Still engine, as pass into the jacket water, which is at steam temperature and pressure, are lessened and are wholly recovered without loss—radiation excluded—in overcoming the latent heat of the water and give off their steam in the steam space in proportion to the heat flow at those loads. At lower loads less steam is produced, until at still lower loads no steam at all is measurable. In other words, the jacket losses are practically eliminated.

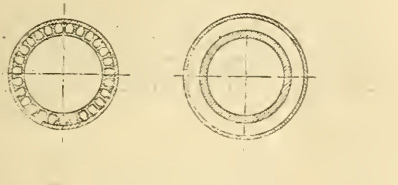

Fig. 3.—Sections of Cylinders of the Still Engine and Ordinary Gas Engine.

The exhaust gases take a subsidiary, but important part in the cycle; their usefulness in ordinary combustion engines, in raising steam, is limited to the amount of heat recoverable between the initial temperature of the exhaust and that of, say, 50 deg. F. above the steam temperature, after which the whole volume passes away to atmosphere at a still useful temperature, less a small percentage available for feed-water heating. But in the Still engine, the exhaust gases, after raising their quantum of steam, are employed in preheating all the water required for the steam generated in the jacket water and in the generator. Trials at full efficiency over long periods and steady loads, show terminal stack temperatures as low as 150 deg. F. The heat efficiency of the combined cycles is therefore exceedingly good, with an initial temperature of over 2,000 deg. F., and a final exhaust to atmosphere at 150 deg. F.

The weight of steam recovered may vary from a maximum of about 7 lb. per B.H.P.-hour, developed by the combustion cycle of a four-stroke constant-volume engine, at full load, to a minimum at light loads which is hardly measurable.

The steam thus recovered is a by-product, is limited in amount, and its value depends upon the efficiency of its employment. This is carried out in a logical manner. In place of being expanded in external auxiliary engines, with their thermal and mechanical losses, it is returned to the combustion cylinders of the Still engine, and is expanded on the opposite side of its main piston, one stroke being performed by steam and the other by combustion.

The piston and cylinder walls, pre-heated by the combustion stroke, are at a higher temperature than the steam when it is admitted and while it is being expanded; there is, therefore, no loss from condensation, and the steam exhausts at a slight superheat above the normal expansion temperature, a condition which is unattainable in any form of steam engine without direct loss of energy (fig. 4). With an early cut-off, it can be expanded economically right out to atmospheric pressure, or below it, and be either re-compressed (Stumpf cycle) or exhausted to condenser. The steam, during expansion, forms an efficient means of cooling the piston.

The effect of the steam in its co-operation with and reaction on the combustion cycle has been the subject of many series of exhaustive tests. The engine used for this research was of constant-volume type, four-stroke. It first underwent a series of tests, so as to arrive at its "initial H.P." as an explosion engine. The quantity of steam generated per "initial B.H.P." from the jacket alone averaged 3.28 lb. per B.H.P.-hour, and from the jacket and exhaust together 6 lb. per B.H.P.-hour. A whole series of these early trials was carried out under the supervision of Mr. C. Vernon Boys, F.R.S.

The *mean* temperature of the cylinder walls is higher than in ordinary engines; the piston is cooler, owing to the expansion of the steam behind it; the heat efficiency of the combustion cycle is augmented, owing to the walls being at a higher and constant temperature; frictional losses are reduced by the higher temperature, and by the steam overcoming the inertia of the reciprocating masses at the lower dead centre;[*] the mechanical efficiency of the whole engine is higher than that obtainable in a normal engine of similar type; the steam, expanding as it does in a cylinder hotter than itself, gives an indicator diagram larger than that theoretically obtainable under ideal conditions in an ordinary steam engine; 29 per cent. of additional B.H.P. is added to the shaft of the engine, without increase in the fuel consumption (steam not condensed); 40 per cent. is added with condenser used (air pump separately driven); the I.H.P. due to steam appears as B.H.P. added to the shaft, all the mechanical losses having already been accounted for in measuring the combustion B.H.P. The average M.E.P. from the combustion stroke was 90 lb. per sq. in. The steam evaporated by the "waste heat" gave 14 lb. per sq. in. M.E.P. on every return stroke. This is equivalent to 90+28=118 lb. per sq. in. M.E.P. in a normal four-stroke engine.

By admitting additional steam generated by fuel under the boiler, the steam M.E.P. was raised to 72 lb. per sq. in.; the total M.E.P. was, therefore, equal to 90 + 144 = 234 lb. per sq. in. M.E.P. in a normal four-stroke engine.

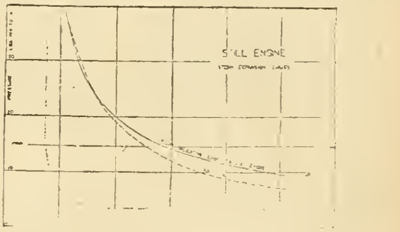

Fig. 4.—Steam Indicator Diagram.

The first experimental gas engine constructed was a two-stroke engine capable of developing 590 B.H.P. from three cylinders at 400 R.P.M., bore 8 in. It was a high-speed engine, designed with special regard to obtaining data about the recovery of steam from waste heat (jacket and exhaust). It was first operated on town gas—540 B.TH.U., and subsequently converted for oil fuel. Its efficiency was not high, owing to its being a two-stroke engine with a short stroke, but its consumption per B.H.P. was 15 cu. ft. per hour (31.3 per cent. efficiency), a very promising result.

With a combustion indicated efficiency of 36 per cent., radiation 4 per cent., boiler loss 10 per cent., there remains 50 per cent. for recovery; allowing 10 per cent. efficiency for the steam cycle, a gain of 5 per cent. is assured, and the total indicated efficiency of the engine will not be less than 41 per cent. If 20 per cent. efficiency is obtained from the steam cycle, as appears possible, the total indicated efficiency will be 46 per cent.

A gas engine which can give a brake thermal efficiency 30 per cent. better than its predecessors, and which, by governor control alone, can meet any demand up to and over 100 per cent. overload, while maintaining a good efficiency at that increased output, cannot be neglected.

Great improvements have lately been made in gas producers, some of light weight, which answer automatically to all variations of load. The addition of a steam cycle to gas engines operating with these producers, will give a means of manœuvring and starting, which will fit them for service as marine engines and locomotives for road or rail.

The Still heavy oil engine starts with the cylinders and pistons pre-heated. The air charge, from the moment of its entry into the cylinder, picks up heat from the containing walls and continues to do so during at least 70 per cent. of the compression stroke, with the result that the temperature necessary for firing with certainty the first injected charge of fuel is reached with a compression pressure 50 per cent. less than that required in a Diesel engine.

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[*] In Prof. Hopkinson's trials the frictional loss at 65 deg. F. was nearly double that when the jacket water was at the maximum obtainable, 212 deg. F. In Still's trials, the jacket water was at a constant temperature of 320 deg. F.

A Still heavy-oil engine can be designed for constant pressure or constant volume, or both can be employed in the same engine by correct timing of the fuel injection. It claims for its combustion cycle an efficiency higher than that of the Diesel, less weight and space per H.P., and for its combined cycle an efficiency not less than 20 per cent. higher than any prime mover which uses fuel as its source of heat.

The first engine designed for the use of heavy oil was of the opposed-piston type, 16 in. diameter, 32 in. total stroke, 150 R.P.M., the combustion taking place between the pistons with the steam generated by the jacket water and exhaust gases expanded at the back of both pistons (the steam passed from the auxiliary boiler through H.P. and I.P. cylinders and finally to the Still engine as an L.P. cylinder, and thence to the condenser).

The steam H.P. and I.P. cylinder was connected to a prolongation of the main shaft at 90 deg. to the main crank; all auxiliaries were separately driven, thermo-couples were connected to all important points in the plant between the combustion space and base of stack. The oil was injected by blast air, scavenge by a fan, pressures from .5 to 1 lb. per sq. in. It was fitted with a brake and fly-yheel of 4¼ tons weight; from full power (300 B.H.P. at 160 revolutions) it will reverse by a single lever from ahead to astern in ten to twelve seconds.

The fact that these engines are capable of running under steam alone, and under constant temperature conditions, gives a facility and security in carrying out preliminary tests and subsequent accurate research which is not possessed by any other combustion engine. All mechanical adjustments, valve setting, degree of compression, temperatures, and so on, can be established at all speeds before any fuel is injected into the main cylinder.

The dimensions of the cylinder were: Bore, 13½ in.; stroke, 22 in.; two-stroke cycle, opposed pistons; steam side as for L.P. cylinder. It forms the basis of a six-cylinder set, two of them using H.P. steam, which is compounded into the other four as L.P.

The combustion takes place between the pistons, the steam acting on the return stroke at the back of both pistons. After a series of preliminary tests under steam alone, in which data were obtained for the various mechanical adjustments, the scavenge, compression pressures, and temperatures, at various speeds, oil was injected for the first time. The engine fired its first charge without hesitation, and completed a series of tests of over two hours' continuous running, without adjustment, giving an output by gradually increasing the weight of oil admitted of 100, 150, 200, &c., up to 400 I.H.P., at a maximum speed of 380 R.P.M., for which she was designed.

This unit has been subjected to many long and varied tests by representatives of various Governments, as well as to constant research work under severe conditions. Its best consumption of fuel (Admiralty shale oil) has been as low as 0.302 lb. per B.H.P. (scavenge pump not included), over a test of one hour's duration under normal waste-heat conditions. It developed 330 B.H.P. for six hours at 360 R.P.M. (a single cylinder) under waste-heat conditions. It will develop 400 B.H.P. continuously with added steam, and has developed 540 B.H.P. at 380 revolutions over short periods. (Combustion M.E.P. 128.2 lb., steam M.E.P. 57.9 lb., total M.E.P. 186.6 lb.) The thermal brake efficiency from below quarter-load to full power is maintained at approximately 40 per cent. over the whole range.

With added steam from the boiler, 5,000 B.H.P. would be obtained from two six-cylinder sets, with a weight of about 70 tons, including all auxiliaries and water, and extreme overloads up to 6,000 B.H.P. could be obtained.

The application of the Still system to commercial marine work is being developed in this country and abroad; the two-stroke single-piston type, in powers of 100 H.P. per cylinder and 400 H.P. per cylinder, having been adopted.

Engines of this type at 120 R.P.M., with a cylinder 22 in. diameter by 36 in. stroke, giving 4,200 S.H.P. on two shafts, with all auxiliaries and water, would weigh about 600 tons. A geared-turbine plant in a similar ship would weigh 20 per cent. more, and would consume approximately 2,000 tons more fuel for a double journey lasting 1,000 hours.

The success already achieved has led to a careful study into the application of this system to locomotive work.

A Still engine designed for locomotive work would be capable of giving an efficiency at the rails of 30 per cent. over 90 per cent. of its running time—six times as good as the present locomotive; while during the accelerating period its efficiency would be at least 15 per cent., or three times as good. In surmounting long inclines with heavy loads, the engine would be capable of developing about four times the power which it develops at its most efficient or normal running load.

That a two-stroke, high-speed engine of an early type, not designed specially for efficiency, should already have reached an actual indicated efficiency of 47 per cent., that is to say, an efficiency ratio of 70 per cent., warrants the assurance that still higher efficiencies will be obtained in later designs, where full advantage is taken of lessons already learned with regard to clearances, compounding, and so on, which are being embodied in designs now under construction.

Exports and Imports of Electrical Goods during January, February, March, and April, 1919.

The official returns of electrical imports and exports for the months of January. February, March, and April, 1919, which we publish below, show as regards exports, an increase of £535,734 over the four preceding months, and an increase of £705,172 over the first four months of 1918. The figures are as follows :—

1918.		1918.		1919.	
Jan. ...	£225,585	Sept. ...	£280,438	Jan. ...	£390,210
Feb. ...	255,064	Oct. ...	263,501	Feb. ...	326,658
Mar. ...	174,482	Nov. ...	229,031	Mar. ...	420,452
April ...	255,771	Dec. ...	307,370	April ...	478,754
	£910,902		£1,080,340		£1,616,074

All the items, except carbons, show increases in values as compared with the last four months, the principal improvements occurring in electrical goods amounting to £189 000; insulated wire, £144,000; batteries, £124,000; and electrical machinery, £48,000.

The electrical imports for the first four months of the year were:—January. £97,292; February, £178,384; March, £163.269; April, £196,631; as compared with September, £124,233; October, £143,902; November, £124,077; December, £85,416; an increase of £157,000 for the four months, and an increase of £37,000 over the first four months of 1918. The figures for telegraphic and telephonic imports for the four months of 1919 under review, show an increase of £72,000, while considerable increases appear in the items for electrical goods and machinery. The re-exports of foreign and overseas electrical material show a slight increase, the totals being—January, £5,115; February, £11,255; March, £8,108; April, £6,095; as compared with September, £6,330; October, £6,196; November, £10,092; December, £1,332.

Total number of electric glow lamps exported, imported and re-exported, for the past four months :—

	Exports. No.		Imports. No.		Re-exports. No.
Jan.	114,375	Jan. ...	524,130	Jan. ...	1,700
Feb.	113.063	Feb. ...	419 685	Feb. ...	48
March	125,307	March	277,814	March...	3,209
April	99,432	April ...	589,254	April ...	2,800
Total for four months, 1919 ...	452,177		1,810,913		7,757

as compared with the totals for the first four months of 1918—exports, 600,159; imports, 421,668; re-exports, 213,266.

	January.			February.			March.			April.		
	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exports.	Exports.	Imports.	Re-exp'ts.
Electrical goods ...	87.440	16,106	2,856	69,950	79.755	2,722	85,295	36,162	2,916	80,037	33,033	2,889
Insulated wire ...	38.750	626	280	48.225	3.580	5,174	68,416	2.850	656	83,988	3.796	1,413
Glow lamps ...	9,146	22.367	52	7,997	20,766	19	8.965	35,421	338	7.937	56,004	150
Arc do. & parts ...	5 355	10,914	—	2,109	6,939	—	1.707	3,901	—	3,930	3,927	12
Batteries	53 067	6,689	99	31,330	2,479	—	53.165	3,876	50	29,343	1.195	16
Meters	17.618	2.611	297	10,498	3,363	—	6.949	4,438	60	25,193	2,497	50
Machinery ...	106,646	21.277	1,456	90,642	41,525	2,265	97,317	43,476	3,028	115,958	64,312	1.437
Carbons	189	2,946	—	487	1,649	452	—	2,474	—	1,784	1,205	8
Teleg. & telep. mat'l	71,999	13,756	75	65.240	18,328	623	98,638	30.671	1,060	130,584	30,665	120
Totals ...	£390,210	£97,292	£5,115	£326,658	£178,384	£11,255	£420,452	£163,269	£8,108	£478,754	£196,634	£6,095

DEVELOPMENT OF THE RIVER DEE.

A report by Mr. S. E. Britton, city electrical engineer, Chester, upon the practicability of developing the water power of the river Dee (North Wales) for the generation of electricity for agricultural purposes and rural industries was submitted to the Board of Agriculture and Fisheries last month, and is now under consideration.

Investigations of the river Dee for the utilisation of water power at the Chester weir commenced in 1911, and for the purpose of this report in August, 1917. The report is dated April, 1919. The Dee from Bala lake to Chester weir has a total length of 76 miles, and there are five principal named tributaries. The area of the catchment draining at Chester weir is 675 sq. miles, and the upper hilly parts of the basin consist generally of non-permeable strata; the rain water runs quickly off the sloping ground into the water courses feeding the main river. The rainfall in the basin varies considerably in different localities; the average yearly rainfall being 44 in. A rough estimate of the population of the area within the influence of the scheme would be rather less than 60,000 inhabitants.

The gradient of the river falls between Bala lake and Chester weir 524 feet. On the portion of the river under consideration, namely, Llangollen to Chester, the fall is 220 feet. Of this, 178 ft. is on 15 miles of river between Llangollen and Erbistock, and from Erbistock to Chester 42 ft. on 32 miles. Records indicate that the gradient and cross section of the river from Llangollen to Erbistock are such as will accommodate the maximum flow after heavy rainfall, and with the exception of a few small areas inundation does not occur to an important extent above Erbistock. From Erbistock to Chester the conditions are less favourable, and inundation is liable to occur for short periods over comparatively large areas.

There is abundant evidence that the neglected state of the river causes it in times of flood to rise to a higher level. The discharge of the Dee would be substantially improved by the removal of obstacles. The succession of bends between Bangor and Farndon have great influence on the discharge and inundation. From an engineering point of view it does not appear difficult to devise works to increase the discharge in this particular locality. A model representing 19 miles of river was experimented with and indicated that straightening would cut off ten miles of river, and shorten it 7½ miles through the district liable to flood. The effect of straightening would increase the gradient from 0.8 to 1.6 ft. per mile, the discharge capacity approximately 85 per cent., and reduce the period of flooding by about 50 per cent. over approximately 3,000 acres of agricultural land. The cost of straightening, including controlling works at Chester, is estimated at £250,000. Whether the river is or is not straightened, a considerable benefit would be gained by providing additional means to let out flood water at the Chester weir. The Chester Corporation has under consideration a further development of the water power of the Chester weir, and this would be a favourable opportunity of carrying out a scheme for the twofold purpose.

As soon as the demand during periods of low river flow exceeds the water power available, then impounding should be taken in hand. It appears probable that the level of lake Bala could be raised 4 or 5 ft. without material detriment to the surroundings. The area of lake Bala is 1.9 sq. miles. Every foot which the present level can be raised would provide storage for 53 million cu. ft. of water. The Birkenhead Corporation water supply reservoirs will have an area of 1.22 sq. miles, and each foot that the level can be raised would give 34 million cu. ft. additional storage. The fall between Llangollen and Erbistock does not offer natural facilities for the development of both navigation and power. The fall between Erbistock, or Bangor-on-Dee and Chester, however, offers a more favourable proposition for navigation

The strata and natural formation of the bed and banks of the Dee, and the contour of adjacent lands, offer suitable sites, free from engineering difficulties, upon which to construct weirs and power houses, with every prospect of carrying out the work at moderate cost and in a reasonable time.

From Llangollen to Erbistock the stations could economically utilise the run-off water for 275 days per annum; and from Erbistock to Chester 235 days per annum; in the former case there would be 90 days and in the latter 130 days per annum when the run-off water would exceed that which could be used. It appears that the water power of the Dee between Chester and Llangollen can be most economically harnessed by the erection of 16 weirs and hydroelectric installations. The heights of the weirs would vary from 7.5 to 37 ft., with an average height of 12 ft. The approximate power available per year at each station would vary from 1,808,750 to 11,823,660 units, an average of 3,737,356, or a total of 59,797,810 units, based on a continuous use of the power for 24 hours each day, the utilisation of the flow of the river for eight months per annum and a portion of the flow for the remaining four months. The average aggregate monthly demand which the scheme would meet would vary from 1,937 to 10,625 kw.-hours, or an average of 6,805 kw.-hours based on the use of turbines of the same size at all stations except one, that being where the highest fall of 37 ft. is suggested. It is proposed that 15 of the stations be equipped with turbines capable of passing 30,000 cu. ft. of water per minute when operating at ¾ gate opening on a fall of 7 ft. This would make it possible for the whole of the apparatus to be made in this country, reduce spare parts to a minimum, and result in placing on the market a British-made turbine of type and size suitable for the development of low-fall water power on other suitable rivers.

For agricultural purposes 50 million units per annum would serve the requirements of about 800 sq. miles, equivalent to a belt of land 15 miles wide on each side of the river from Llangollen to Chester. Other interests near the river deserving of a supply would probably render the scheme of greatest national service by restricting it to a strip of land on each side of the river 3 to 5 miles in width, representing about 200 sq. miles. The smaller area would avoid the use of lengthy transmission lines and step-up transformers.

There is little doubt that the method of development under consideration could be extended up to Bala, and to a lesser extent along the principal tributaries of the Dee. Every source of water power in country districts capable of developing 10 h.p. and upwards, should have its commercial value carefully investigated The financial success would depend on procuring a ready market for the disposal of the energy available, and its ultimate full use and maximum success upon the rapidity with which new industries are inaugurated. In promoting an undertaking of this character it is essential to organise an energetic business-getting campaign. Agriculturists and country folk shy at modern innovations and lack initiative. To break down this want of confidence the undertaking should be prepared to electrically equip several good examples of each of the different industries in the area of supply, on the principle of "no economy no pay." Such inducements would undoubtedly be of substantial benefit to all concerned.

The main transmission line, capable of transmitting 1,000 kw., would cost £800 per mile, that is £48,800, and transmission lines from the power stations to the main arteries, 27 miles, at £600 per mile, would cost £16,200, or a total of £65,000. The average cost of the installations would be £29,700. The cost of cutting a tunnel or tunnels capable of conveying 50,000 cu. ft. of water per min. to installation No. 12 is estimated at £60,000, making a total cost of the 16 installations and main transmission lines £600,200.

It is doubtful whether the whole of the scheme could be carried out at once. To start the scheme, stations at Bangor-on-Dee, Newbridge, and Llangollen appear to be the most suitable. These stations and 24 miles of transmission lines would serve an area of 96 miles. The three stations would generate 10,796,000 B.O.T. units per annum. The capital cost of three stations would be £106,920; and 24 miles of transmission line, £23,040, or a total of £129,960. The total annual expenditure would be £21,223, or 0.47d. per unit. After reducing the units generated by 20 per cent., there would be available for consumers 8,636,800 units, which, at an average income of 1.5d. per unit, would bring in £53,980, and leave a credit balance of £32,757 per annum.

The powers required to enable the scheme to be carried out and observations by Mr. A. C. Williams, engineer to the Dee Conservancy, are dealt with in appendices.

ELECTRICAL POWER ENGINEERS' ASSOCIATION.

We have received the following communications from Mr. W. Arthur Jones, general secretary of the Association:—

Electricity (Supply) Bill.

The proposals of the Government in respect of the Electricity (Supply) Industry as laid down in the Bill recently introduced are of vital importance to the technical engineers engaged in that industry.

As the protective association of staff engineers engaged in the electricity (power and supply) industry, the Electrical Power Engineers' Association, in conjunction with other associations, has taken an active interest in matters pertaining to this Bill, and the National Executive Council of the E.P.E.A. appreciates that its proposals on this matter have received the sympathetic consideration of the promoters of the Bill. The suggestions of the E.P.E.A. were of necessity put forward without complete knowledge of the main proposals of the Bill, and now that these are available, some amendments are desirable to meet the case of the technical engineers.

Clause 5.—In clause 5, provision is made for representation on the District Electricity Boards. It is desirable that a definition of "labour" should be laid down, and attention is drawn to the Trades Disputes Act, 1906 (Sec. 5), and the Munitions of War Act, 1906 (Sec. 12), wherein "workmen" are defined on the widest basis of employés including staff. In the Electricity (Supply) Bill a similar definition should be added to clause 41, or clause 5 should be amended on these lines.

Clause 17.—In clause 17 provision is made for "compensation for deprivation of employment" *after* District Electricity Boards have taken over undertakings, but no provision is made for the compensation of any officer or servant who suffers deprivation of employment before the District Electricity Board has taken over undertakings, although under clause 20 two or more of the authorised undertakers may combine their management, with probable reduction of staffs.

The following letter has already been received by a member of the E.P.E.A., dated May 13th, 1919:—

The situation created by the Government proposals for electricity supply has led to a reconsideration of the Power Company's plans, and a decision to do away with the construction department. In the circumstances your engagement with the company will be terminated at the end of June.

Further, the expression, "any generating station or main transmission line . . . any officer or servant who has been regularly employed in or about such station or line" does not cover all officers or servants of the distribution department of an undertaking, unless the expression "in or about" such station covers the whole undertaking to be taken over.

Clause 36.—In this clause, sec. 4, of the Conspiracy and Protection of Property Act, 1875, has been incorporated. If the right to strike is to be taken away from one section of the community, it is imperative that satisfactory means of adjusting differences and disputes should be provided for.

Attention is also drawn to the fact that staff officials do not come within the scope of the Wages (Temporary Regulation) Act, as such officials are not "workmen of a class to which a prescribed rate of wages is applicable," so that decisions of an agreed arbitrator are not legally binding, and can be, and have been, ignored by employers.

It is strongly urged that while it is necessary in the public interest to retain the clause in question, adequate arrangements should be made for the prompt discussions of any disputes or differences that may occur, and for the decisions arrived at to be made binding upon all parties.

Superannuation.—Clause 17 has a reference to the question of superannuation, but it is to be regretted that the opportunity to deal with this question on a national basis has not been utilised. Many staff officials, technical and otherwise, in the electricity (supply) industry are already participants in superannuation schemes, either national or local.

The E.P.E.A. is of opinion that this matter, and also the suggestions relating to compensation, could be met with the adoption in the Electricity (Supply) Bill of such clauses of sec. 60 of the Port of London Act, 1908, as are germane to the subjects.

Yorkshire Dispute Settled.

At a meeting held at Dewsbury on the 17th inst., the engineering staff of the Yorkshire Electric Power Co. resolved to hand in their notices as a protest against the curt dismissal of one of their number, a prominent official of the E.P.E.A., and on account of other grievances, including the unsatisfactory payments made under the E.P.E.A. Award 9,281, and called upon the National Executive Council of the E.P.E.A. to take immediate action.

A satisfactory reply not having been received from the company in the stipulated time, 74 members thereupon handed in their notices to terminate their engagements.

As a result of negotiations, a meeting was held on the 25th inst. between representatives of the board of directors of the Yorkshire Electric Power Co., together with the engineer and manager, when the matters in dispute were discussed. The principal point at issue was settled, and satisfactory assurances were given that the other grievances would be attended to without delay. Consequent upon the agreement, all notices terminating engagements are to be withdrawn and cancelled by both sides.

The head office of this Association has now been transferred to 65-66, Chancery Lane, London, W.C. 2. (Telephone Holborn 4806.)

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

11,873. "Thermionic detectors of electric oscillations." J. A. Fleming. May 12th.

11,888. "Electric battery cells." A. Spencer. May 12th.

11,909. "Electric switches." A. H. F. Perl. May 12th.

11,912. "Alternating-current motors, &c." F. S. Carey & Carey-Gavey Syndicate. May 12th.

11,916. "Means for controlling series of electric motors." F. G. Warburton. May 12th.

11,919. "Electromagnetic relays for control of electrical installations, &c." Soc. Anon. des Etablissements L. Bleriot. May 12th. (France, August 26th, 1918.)

11,920. "Electric contact devices." Soc. Anon. des Etablissements L. Bleriot. May 12th. (France, August 27th, 1918.)

11,921. "Electromagnetic controlling devices." Soc. Anon. des Etablissements L. Bleriot. May 12th. (France, August 28th, 1918.)

11,935. "Manufacture of incandescence electric lamps." F. Harrison. May 13th.

11,940. "Double combination magneto earthing switch." R. G. Metcalfe. May 13th.

11,953. "Assembling electric switches and accessories." J. B. Tucker and J. H. Tucker & Co. May 13th.

11,960. "Double combination magneto earthing switch." J. Britton. May 13th.

11,967. "Dynamo-electric machines." H. Knowles. May 13th.

11,979. "Electric liquid heaters." J. K. Greenhill, H. B. C. Pollard and G. F. Watson. May 13th.

12,003. "Sparking plugs." Soc. Generale des Huiles et Fournitures Industrielles L'Oleo. May 13th. (France, February 3rd.)

12,004. "Receiving systems for wireless telegraphy and telephony." H. J. Round. May 13th.

12,005. "Thermionic receiving devices for wireless telegraphy and telephony." H. J. Round. May 13th.

12,006. "Apparatus for wireless telegraphy and telephony." H. J. Round. May 13th.

12,007. "Telephone receivers." H. J. Round. May 13th.

12,008. "Receiving aerials for wireless telegraphy and telephony." H. J. Round. May 13th.

12,009. "Electric storage batteries." G. Marconi. May 13th.

12,015. "Method of fixing terminal screws or studs in carbon rods, bars, &c." L. Cornelis. May 13th.

12,033. "Cutting and shaping vulcanite, &c." C. Harrison & Sterling Telephone & Electric Co. May 13th.

12,042. "Obtaining single-phase alternating current from existing three-phase systems." A. M. Taylor. May 14th.

12,045. "Sparking plugs." J. H. Banks & V. Crabb. May 14th.

12,080. "Electric horns." C. H. Offord & W. E. Parker. May 14th.

12,081. "Battery system for sparking plugs and electrical advertisement signs." E. L. Terrey. May 14th.

12,095. "Electric heater." J. Nolan. May 14th.

12,153. "Means for coating electric conductors, wires, springs, &c., with liquids." F. C. Cook. May 14th.

12,157. "Dynamo-electric machines." British Westinghouse Electric and Manufacturing Co. May 14th. (U.S.A., June 17th, 1918.)

12,158. "Protective apparatus for dynamo-electric machines." British Westinghouse Electric & Manufacturing Co. May 14th. (U.S.A., June 29th, 1918.)

12,165. "Electric switches." G. W. Bilks & C. Sharp. May 14th.

12,166. "Ignition systems used with internal-combustion engines." E. Harrison. May 14th.

12,172. "Electrical receiving apparatus." F. G. Creed, Creed & Co., and D. McLennan. May 14th.

12,173. "Electrical receiving apparatus." Creed & Co. & D. McLennan. May 14th.

12,189. "Electric generators." C. H. Offord & W. E. Parker. May 15th.

12,192. "Sparking plugs for internal-combustion engines." F. A. L. Johnson. May 15th.

12,195. "Ceiling roses, &c., of electric lamps, and means for controlling the latter." H. E. Hadwen & H. Willis. May 15th.

12,229. "Contractor devices for electric circuits." G. B. Mann. May 15th.

12,233. "Tool for electric cable." E. A. Claremont & G. H. Scholes. May 15th.

12,254. "Electrical precipitation of particles from gas." F. H. Haviland and D. K. Morris. May 15th.

12,269. "Negative elements for electric batteries." A. Pouchain. May 15th.

12,286. "Petrol-electric rail coach or truck for use as fire engines." H. H. Carter & Tilling-Stevens, Ltd. May 15th.

12,319. "Electrical measuring instruments." A. W. Lishman. May 16th.

12,325. "Protective covering of electric wires and cables." E. S. Seymour. May 16th.

12,337. "Electric switches." J. R. Craig. May 16th.

12,361. "Electric cookers." G. Wilkinson. May 16th.

12,373. "System of wireless direction finding." N. P. Hinton. May 16th.

12,412. "Ignition appliances for internal-combustion engines." T. H. Martyn. May 16th.

12,429. "Electric heating apparatus." M. Samanon. May 17th.

12,430. "Sponge appliances for administration of electricity." E. Peckham. May 17th.

12,436. "Method of securing sparking plug binding screws, &c." H. F. Smith. May 17th.

12,447. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. P. Lundberg & G. Pegg. May 17th.

12,466. "Electric hoisting motors, &c." W. E. M. Ayres & British Westinghouse Electric & Manufacturing Co. May 17th.

12,481. "Electric controllers." R. Amberton. May 17th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

12,566. Electrolytic oxidation process, and apparatus therefor. C. I. Syndicate, H. C. Jenkins, W. Blackmore & A. Howard. September 5th, 1916. (125,608.)

14,005. Means for detecting sounds. D. McLennan. October 3rd, 1916. (125,644.)

14,006. Diaphragms for use in or with sound-transmitting and sound-receiving instruments or apparatus. D. McLennan. October 3rd, 1916. (125,645.)

14,163. Means for interrupting electric circuits containing vapour converters. British Westinghouse Electric & Manufacturing Co. October 7th, 1915. (125,646.)

1917.

10,583. Dynamo-electric machines. Vickers, Ltd., & S. F. Barclay. July 23rd, 1917. (125,673.)

1918.

4,795. Electric motor generators. T. Preece. March 19th, 1918. (125,692.)

5,245. Electrical heating devices, especially adapted for use with hatching, bacteriological, and the like apparatus. Sir C. S. Forbes. March 25th, 1918. (125,703.)

6,453. Electrically-heating machine for stamping metal articles. J. Bill. April 16th, 1918. (125,719.)

6,659. Electromagnetic switches. British Thomson-Houston Co. & H. C. Hastings. April 19th, 1918. (125,732.)

6,682. Electrically-operated drilling apparatus. H. Scholey & F. K. Woodroffe. April 19th, 1918. (125,733.)

6,706. Protective devices for alternating current electric systems. A. E. McColl. April 20th, 1918. (Addition to 16,708/17. Cognate application 16,203/18.) (125,736.)

6,762. Electromagnetic switches. British Thomson-Houston Co. & H. C. Hastings. April 22nd, 1918. (125,740.)

6,781. Electrical switchgear. A. Reyrolle & Co. & H. W. Clothier. April 22nd, 1918. (125,741.)

6,932. Terminals for magneto-electric machines and other electrical apparatus. R. B. North & A. M. Allen. April 24th, 1918. (125,752.)

6,988. Electric lamp fixtures. S. W. Farber. April 25th, 1918. (125,760.)

7,008. Electric ignition devices for internal-combustion engines. W. O. Kennington. April 25th, 1918. (125,762.)

7,022. Apparatus for the electromagnetic treatment of the human body. J. Krauer. April 26th, 1918. (125,763.)

7,046. Electrical timing devices. J. Gray (Warren Clock Co., U.S.A.). April 26th, 1918. (125,766.)

7,969. Stabilised magnetic compass. G. B. Harrison & G. R. C. Campbell. May 13th, 1918. (125,791.)

7,978. Trolleys or collectors for electric tramways and the like. E. R. Thomas. May 13th, 1918. (125,792.)

8,220. Electro-therapeutic apparatus. H. Notter. May 16th, 1917. (116,281.)

THE

ELECTRICAL REVIEW.

Vol. LXXXIV. JUNE 6, 1919. No. 2,167.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "Ageekay, Cent., London." Code, A B C,
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

FOREIGN AGENTS:

Adelaide: Messrs. Atkinson & Co., Gresham Street.
Auckland N.Z.: Gordon & Gotch, Albert Street; Peter G. Tait, P.O. Box 392.
Brisbane: Gordon & Gotch, Queen St.
Christchurch, N.Z.: Gordon and Gotch, Manchester Street.
Dunedin, N.Z.: Gordon & Gotch, Princes Street.
Johannesburg, Capetown, Bloemfontein, Durban, Port Elizabeth, &c.: Central News Agency, Ltd.
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Wellington, N.Z.: Gordon & Gotch, Cuba Street.

Cheques and Postal Orders (on Chief Office, London) to be made payable to The Electrical Review, Limited, and crossed "London City and Midland Bank, Newgate Street Branch."

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MISTRUST AND TRUST.

The Report of the Committee appointed by the Ministry of Reconstruction in February, 1918, to consider the probable extension of trade organisations and combinations and methods of safeguarding the public interest, states that throughout the whole of industry there exists an increasing tendency towards combination. In some sections of the Press this is ascribed to the war. We remember that a Government investigation was required before it was realised that beer was usually consumed by the half pint; but we do not think there was any generally-held idea that this was a result of the war, though this view would be just as reasonable as the other.

The fact is that rings, trusts, combines, cartels, and other means of regulating the market have been on the increase for many years. There was a time, not so very long ago, when it was held up as strong evidence of German far-sightedness and business acumen that there should be trade combinations in Germany. It is true that the existence of trusts in America was proclaimed as an indication of a serious overdose of original sin; but consistency is the bugbear of small minds.

There can be no doubt that cut-throat competition never did anybody any good. Manufacturers lost money, quality had to deteriorate, the consumer suffered. A vicious circle was set up, and the only way of keeping things going was to restrict competition. This has been the line of reasoning followed in numberless instances, and up to a point there is nothing wrong with it. It has been pointed out over and over again that it is a bad thing for manufacturers to fail to make profits. The manufacturer whose finances are in a satisfactory condition has more money to devote to experimental research, and the development of new apparatus. Syndicated action which has for its object the advancement of industry is entirely praiseworthy. Similar action which has for its object the exploitation of the consumer is entirely damnable, in the true sense of the word. The Committee recommends that means shall be established for preventing the abuse of joint action.

To some extent the remedy against exploitation is automatic; for if prices are increased to an unreasonably profitable level by the group controlling any product, other manufacturers will arise and flourish, mushroom-like, under the protection thus afforded.

The loose-jointed co-operation of separate firms interested in some particular product is, however, a somewhat different proposition from the huge consolidations of firms under directorates which, if not identical, have many common features, with millions of capital behind them. These great amalgamations have more opportunity for, as well as more interest in, squeezing the last shilling out of the market. They present also a far more formidable antagonism to competition. They can so reduce prices as to make it impossible for competitors to remain in the business, and having cleared the ground, they can raise them as high as they like. This kind of thing has taken place in the past, and

American exploits in this direction have been made the subject of sensational novels. All the profits remain in the hands of the one great organisation. In the looser bonds of the trading association it is unlikely that the members will unanimously wish to make prices unreasonably high, for it is almost invariably the case that the smaller firms work at less expense than the larger; that is to say, they make more profit out of a given contract at the same price. The larger firms, therefore, will not wish to make prices such that in the event of one of the smaller firms securing a large contract, that smaller firm will be enabled to make considerably more profit than it would normally be satisfied with, and so strengthen its financial position. The smaller firms, conscious of the superiority of their larger competitors in reputation and in selling organisation, will desire that prices shall remain at a level which, while giving them a good profit, shall still be a little tight for the firm operating at big expense. The spirit of competition is still alive, and tends to protect the interests of the buyer.

It is quite clear that a selling organisation, however small, costs money to run, and this money must be found out of the profits on the orders taken. If a firm is particularly unfortunate. there may be a considerable time in which tenders are unsuccessful, and the object of most trading associations seems to be to provide a fund out of which tendering expenses may be met. It may be safely assumed that in all combinations now operating successfully, the cement which holds them together is the financial, or pooling, arrangement underlying them. The money may be found by fixing prices at a flat level, and paying into a pool a certain fixed sum per unit of production sold; by the addition of a percentage to the selling price, which addition is paid into a pool; by the addition of a certain definite lump sum, which is paid into the pool by the successful tenderer, or by other similar means, or a combination of more than one of these methods. The pool so provided will probably be shared out among all the parties interested, each combination having its own particular method of accomplishing this result. This much is pretty generally known among buyers, and, as a rule, it is not resented. If the money were not raised in this way, it would have to be obtained by a general rise in prices, for there is no source, except the customer, from which the money for paying these necessary expenses can be drawn.

From such combinations as exist in the engineering world, the customer has little to apprehend. A matter which ought to come within the scope of the Committee's terms of reference is the effect of these associations and amalgamations on the staffs of the concerns composing them. Free intercourse between a group of men on one subject leads inevitably to discussion of other interests which they have in common, and we do not think it can be truthfully denied that questions concerning employment have been talked over, and certain lines of action from time to time agreed upon.

It has recently been stated by a writer in a contemporary that there is considerable difficulty, amounting almost to impossibility, in the way of the engineer who wishes to transfer his energies from one firm to another engaged in a similar line of manufacture. This state of things extends beyond the industry in which we are immediately interested, and is entirely independent of such restrictions as leaving certificates and the like temporary measures introduced during the war. We have not the slightest hesitation in giving it the strongest possible condemnation.

Radius agreements have been proved to be illegal. The restrictions now under consideration are on all fours with them, but it is infinitely more difficult, if not impossible, to drag them into the daylight. The only way of exterminating them is by the assiduous cultivation of such a code of honour among the present generation of engineers and administrative staffs as will assure that when they reach the positions of high command, they will not continue the obnoxious practices to which so many of them now very rightly object.

This, then, is the chief public danger we apprehend from the combination of trading undertakings. We do not believe that in this country the public will tamely submit for ever to profiteering or exploitation. The public is very well able to take care of itself, and combined action on the part of buyers would soon be brought in to combat anything iniquitous emanating from the other side of the counter.

The Royal Institute of Electrical Engineers.

Recently, commenting on the doings of the I.E.E., we referred to the scheme for obtaining a Royal Charter for the Institution, which the President, Mr. C. H. Wordingham, had foreshadowed in his inaugural address, and expressed a hope that he would succeed in crowning his period of office by its accomplishment. The outlines of the scheme are now before us, and will be found elsewhere in this issue, forming part of the President's address to the Territorial Centres; it is stated in the *Journal* of the I.E.E. that an opportunity will be afforded of discussing the proposals at headquarters, as well as at all the Centres.

As reported in our last issue, the President himself stated that the Committee appointed by the Institution last session to consider the subject was "taken aback" when he disclosed to it his views, and appealed to the Council for further instructions; after studying the scheme we cannot profess to be surprised at the Committee's action, for the difference between what the Committee expected to hear and what it presumably did hear was comparable to that between shrapnel and high-explosive shell. But what was the reply of the Council?

The President said, in his address, that some of the elder members of the Institution thought that the members wished it to be "merely a scientific and technical body for the discussion of papers on engineering subjects"; the President's impression, on the other hand, was that the majority of the members wanted something very different—not only that it should be a scientific body, but also that it should develop the commercial side of the industry.

The latter view is the one which we have consistently supported ever since Dr. Ferranti strove to wake up the Institution; and while Mr. Wordingham, on occasion, has expressed a personal preference for the former policy, he has manifested a determination to do, so far as possible, what the majority of members wish to have done, and, in view of their being the majority, are entitled to have done. We congratulate him on the genuinely democratic spirit with which he is inspired, and his readiness to examine all sides of a subject in search of the truth—not that he may conceal it, after the fashion of Herod and other politicians, but that he may cling to it and translate it into action.

His policy, in brief, is to carry out the principle which he has enunciated—that no matter affecting the electrical industry is outside the scope of the Institution's interests. How he proposes to attain that object is so ably and clearly demonstrated in that part of his address which relates to the Royal Charter (which we reproduce almost *in extenso*), that we cannot do better than recommend our readers to study it there. It will be seen that co-operation, or collaboration, is the keynote of the scheme. As a preliminary necessary step, the President defines the parties that are able to collaborate, most of which already exist in essence; it will be noted that the "Professional Council" is the only one of these which is not explicitly based upon a nuclear organisation, but as the functions assigned to it—with one exception—are at present discharged by the Council of the Institution, we may take it that that body would be the nucleus of the Professional Council.

As we have said, the details of the proposed scheme are given elsewhere in our pages. It will be seen that it is an exceedingly ambitious proposal, on the broadest lines. We have nothing but praise for it, and we trust that the President will have the happiness of seeing it carried into effect, though, of course, that consummation cannot be attained during his brief remaining period of office.

Transition Problems.

In pre-war days the causes of unemployment were the subject of interminable discussion. There is little in the diagnosis of those days to help us in our consideration of the problem that confronts us now. The Hun brought about the temporary disorganisation of most of our industries, and although it is seven months since the Armistice was signed, there has not yet been time or opportunity for those industries to be completely rearranged or re-established on a Peace basis. We are in the midst of the transition period —a period which was expected to be, and unquestionably is, one of extreme difficulty. Peace is not yet signed, the cost of living and prices of material remain high, labour continues to threaten and to make ever-increasing demands as to wages and hours—these and other similar factors combine to cause feelings of uncertainty and a measure of fear. Industry cannot show enterprise under such conditions, and in consequence demobilised men cannot be absorbed. Already the higher cost of production of many lines of manufacture, due to the heavy wages bill and other causes, is driving work out of the country. Foreign competitors are proceeding energetically with their schemes for supplying the British market, and our own heavier burdens, in the absence of increased efficiency in production, are assisting them to gain their end before, with hands free from Peace-making, the nation is able to adopt a definite Peace-time trade policy. Considering all that is happening, especially the reports that reach us from different directions respecting the trade promotion efforts of Allies and enemies alike, it is not surprising that the manufacturers are appealing urgently to the Government to show their hand in regard to economic policy. They are not satisfied with the Government temporary import restriction measures, and they call for definite guidance as to what is to be the national trade policy, especially for safeguarding key industries. A statement is promised soon after Peace is signed. In the interests of the men who have returned from the fighting forces it is profoundly to be hoped that signature will not long be deferred. Meanwhile, we may direct readers' attention to the statement by Sir Auckland Geddes, reported in our "Business Notes" to-day, regarding the value of the work of the Consultative Council on Imports in promoting employment during the transitional period, and respecting the attention which "other minds" had been giving to the working out of a "permanent" policy.

There is plenty of evidence accumulating which proves the following facts beyond dispute :—

Increased cost, due to higher wages and shorter hours, has, in the absence of increased output, driven orders abroad which should have been executed by British labour. Meanwhile, British workmen are unemployed. Some men receive high wages involving others in unemployment so that they earn no wages at all.

Due to the same cause, British manufacturers are disinclined to launch out upon new enterprises either at home or abroad.

Such disinclination is encouraged by uncertainty whether the nation means to do anything to assist the British manufacturer to give employment to British workpeople, by preventing the British market from being flooded with American and Japanese manufactures—especially the latter made by very low-priced labour.

Subject to reasonable consideration being given to special cases, women should not be allowed to remain in places formerly occupied by men if men who have fought for their country cannot be absorbed.

There is abundance of work in prospect, and in due course the trades we represent should give occupation to far larger numbers of employés, both men and women, than ever in the past, but until the transition period is over, better an unemployed woman than an unemployed man who "did his bit" over there. Women can fill a place in the engineering trades with marked adaptability and skill ; that is proved beyond dispute, but hundreds of thousands who did unskilled work during the war would be doing the best thing for themselves and for the homes of England if they returned to the duties for which they are by nature—and may we add by grace?—so admirably fitted. As their husbands, brothers, and sons had to submit to compulsory service in order to defeat the enemy, so now it may be necessary for compulsory idleness in respect of industry to be imposed upon some women if they will not give way voluntarily.

The Future of the German Wireless System.

According to a German report from Berlin, one of the indispensable conditions for the resumption of international relations, particularly in an economic respect, relates to the removal of the restrictions imposed by Great Britain and her Allies on German wireless telegraphy, together with the release of the German submarine cables. This question will probably be definitely settled in connection with the negotiations at Versailles. But in view of the urgency of the matter, the Germans have already entered upon negotiations for the resumption of the international wireless service. The following information on the position of affairs was recently supplied to a German correspondent from competent quarters at the Post Office in Berlin.

The negotiations met with no success at first. The Germans addressed a request to America asking for wireless traffic with the United States to be allowed, and for the guiding lines for this purpose to be stated, but America did not reply. Then the representatives of the American newspapers, assisted by the Trade Commission at present in Germany, applied to the American Government, in order on their part to support the German application, but in this case also no reply was received. "On the other hand, Germany has been approached by private interests offering to receive German radiograms regularly at American private stations. Negotiations as to the possibility of such traffic are proceeding at present, and every prospect exists that an agreement will be brought about."

The wireless service between Germany and neutral countries was recently released by England. Thereupon the German Government replied that it could only accept this concession if the traffic could take place without limitation, as previously to the war. As, however, England continued to insist on the control of the wireless traffic, the release which was offered was declined by Germany.

The Dutch Electrical Industry.

The third Trade Fair, which was held recently at Utrecht, has afforded a German correspondent an occasion for expressing an opinion on the situation of the electrical industry in Holland, as seen from the Teutonic point of view. Although the fairs are scarcely intended to enable the Dutch to get a footing in the export trade, they represent, at all events, an attempt to show that they hope to be able to meet the requirements of the inland market as far as possible. The largest group on exhibition, the correspondent states, comprised the electrical industry, iron and other metals, and machinery. A very active participation of makers took place, and the exhibits showed that the works concerned had made considerable progress during the years of war. Many manufactures which formerly were obtained from Germany are now produced in Holland tolerably well both in the matter of price and quality. The products in question chiefly concern generators and motors, electrical apparatus and measuring instruments for the most varied purposes, marine turbines, and machinery for sugar mills, and installations of machinery up to 65,000 H.P. can also be carried out. Whilst admitting the progress made by the Dutch engineering industry, the correspondent raises the question whether the Dutch firms have proceeded so far that their manufactures can be compared with the corresponding German industry. The developments in Germany have certainly been very disadvantageous for German industry and export trade, the wages movement in particular having contributed greatly towards reducing efficiency. But, in his opinion, it is not appropriate to represent German industry as a negligible quantity, owing to "the enormous technical progress" which has taken place in the electrical and machinery industry also during the war. If the Germans are not at present what they were prior to the war, he concludes that they are justified in assuming that as soon as normal conditions arrive they will be able to regain their productive capacity, and, consequently, the possibility of participating actively in export business.

THE ELECTRICAL EQUIPMENT OF H.M. FACTORY, GRETNA.

By A. S. CROSS, M.I.E.E.

(Concluded from page 622.)

Lighting.—The station lighting is obtained from two small 440/220-volt Westinghouse transformers. The lamps are connected from phase to neutral, and are therefore designed for 125 volts. The installation was carried out by Messrs. Tyler & Freeman.

Performance.—Indicating steam pressure and temperature gauges are installed, while a Lea recorder permanently charts the turbine steam consumptions, and CO_2 recorders, &c., keep a continuous check on the boiler performances. These, in addition to the electricity meters, allow of a constant watch being kept on the station efficiency.

At the average week-day load of 5,000 KW. the coal consumption per KW.-hour, including a very light week-end output, works out at 2·3 lb. The fuel used tested out at 11,200 B.TH.U., 10 per cent. ash, and 8·4 per cent. moisture contents. Fuel tests were taken three times weekly.

As will be seen from fig. 2, p. 619, the load was of a very satisfactory nature. Two 3,000-KW. sets were normally kept in operation, their weekly average steam consumption, as measured by the Lea recorder, being 15·8 lb. per KW.-hour. The power consumed by the turbine and boiler auxiliaries and lighting works out at 7½ per cent. of the total generated.

The average CO_2 recorded was 11 per cent. at the normal 5,000-KW. load, when four boilers were in service.

The average combustible matter in the ash was 9·0 per cent., due to the presence of riddlings.

The power-factor was 0·72. The factory load consisted of some 700 motors ranging from 250 to 0·5 H.P., the majority being below 30 H.P.

Distribution.—The H.T. supply is fed to eight sub-stations, lying roughly in a line extending 4½ miles east and west of the power house, over two overhead systems situated 150 ft. apart. Each line is composed of six conductors, or two per phase, upon pin insulators carried on lattice masts, embedded in concrete. The copper section of the main lines is 6 × 0·125 sq. in., the span 420 ft., and the clearance 20 ft. Special masts are placed at angles and at the terminals, where shackle, instead of pin, insulators are used. The H.T. overhead mains were supplied and fixed by Messrs. Siemens Bros., of Woolwich.

The lines are led out of the power house, and into and out of the sub-stations, through a 50-yard length of cable, which affords a measure of protection against lightning troubles. An earth wire is run above the conductors and bonded to the masts, which are earthed by special plates at every fifth mast. The masts are illustrated on the opposite page, together with a guard span.

The H.T. lines exceed 20 miles in length, of which about 15 miles is protected on the Merz-Hunter split-conductor principle, with overload adjustment at the power house end. The rest is protected on the core-balance system, giving quick trip on an earth fault, and against overload.

The main line Merz-Hunter protection has proved much the more satisfactory, for it isolates a passing trouble on one line without interrupting the supply over the other.

The line and transformation losses averaged 10 per cent.

Sub-Station Plant.—A typical sub-station is one in which four 500-KW., oil-cooled, Ferranti, core-type, 6,600/440-volt, mesh-star transformers, &c., are erected. Tappings are arranged for 6,300 and 6,000 volts, and the star point of the secondary winding is brought out to a fourth terminal for earthing purposes.

The transformers are mounted on rails placed upon concrete foundations, from which they can be run on to a trolley for overhaul or repair.

All lifting is done outside the buildings; in fact, the design is such as to get reasonable safety in working, at the lowest possible cost. Except in the case of the largest sub-station, natural draught through roof louvres and grids at floor level gives all the ventilation needed.

The sub-station switchgear is all of Messrs. Reyrolle's standard ironclad draw-out pattern. The H.T. bars are run in solid, while the L.T. are air-insulated. The transformer units have Merz-Price balance protection and overload time trips, and the L.T. feeders have overload trips with time adjustment.

The H.T. feeders and transformer secondaries have an ammeter in circuit, while the L.T. feeders are arranged with ammeter and watt-hour meters, so that each factory sub-section can be charged for the energy it consumes. The H.T. and L.T. current is led in and out of the sub-stations through three-core, paper-insulated, lead-covered, tape-armoured cable, of Messrs. Siemens Bros.' manufacture, the trifurcating boxes forming a part of the Reyrolle units.

Distribution and Wiring.—The L.T. distribution was all at 440 volts for power, but for lighting 125 volts had to be chosen, to conform to the Home Office Rules governing installations in danger areas. Three-phase 2·5 to 25-K.V.A. Westinghouse mesh-star transformers, having a 440/220 voltage ratio, were installed at suitable points; four wires were led from the transformer secondaries, the lamps being connected from phase wire to neutral.

The main 440-volt power and lighting feeders were run partly underground and partly overhead to suit the varying circumstances in the different portions of the factory. At the Dornock end the whole area is covered with a mass of overhead and underground pipes connecting up the various buildings. Pipe-lines are run to carry water, compressed air, steam, acids and brine (for cooling) from one part to another, and these run in all directions and at all sorts of levels; there are also roads and pathways that require lighting, and main-line and light-gauge railways, and numerous runways to be considered. There was a further complication in that some sections were required to be run in conjunction with one another, and must therefore be on one supply, whilst others must be kept separate, so that the consumption could be metered for costing purposes, &c. As these sections were not always conveniently situated to suit this, it will be obvious that the L.T. distribution was not a simple matter.

On account of the acid fumes it was decided to use solid, and not stranded, copper for the overhead lines, and 0·15 sq. in. was adopted as the largest that could be conveniently handled, two, three, or four such conductors being run in parallel for the heavier feeders.

For the overhead lines, the pole work, &c., was based on Post Office standards. Although weather conditions were particularly severe along the Solway, it was felt that it was not necessary to adopt the much heavier and more expensive construction involved by adherence to Board of Trade Regulations. In the end the decision was fully justified, for there has not been a single case of failure of these lines since they were erected. As well over 100 tons of copper were erected, corresponding to some 500 miles of conductor, carried on over 3,000 poles, this record would seem to indicate that the Board of Trade Regulations are unnecessarily severe, particularly as a large proportion of the lines were erected and in use during the very severe winter and spring of 1915—16, which did so much damage, and which were as stormy at Gretna as in any part of the country.

The conductors on the cross-arms were spaced 12 in. apart, and the cross-arms were 15 in. apart. Up to six conductors were run on one cross arm. All 440-volt lines were fitted with earthed guard wires below the lines on the system recommended by Mr. A. P. Trotter, late of the Board of Trade, and every sixth pole was fitted with an earth plate to which the guard wires and L.T. transformer neutrals were connected, the middle wire of the lighting system being earthed at all points.

Each lighting transformer was controlled by a T.P. switch-fuse on the primary side, and by three S.P. fuses and a link on the secondary. In the townships, and in sections of the factory where buildings were not available, the transformers were housed in small wood cabins, the upper parts of which contained the switches, &c., and were lined with uralite.

The lighting and power wiring in the buildings was carried out in accordance with standard practice, various

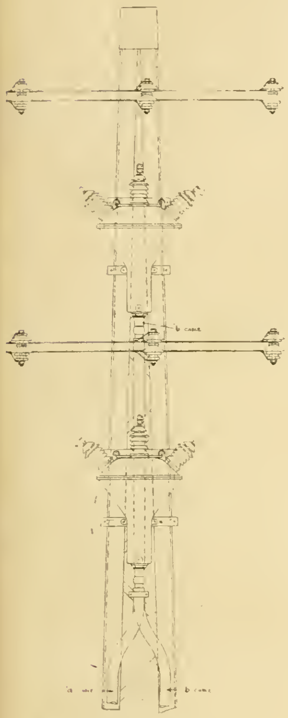


Fig. 7.
Detail of Terminal Mast.

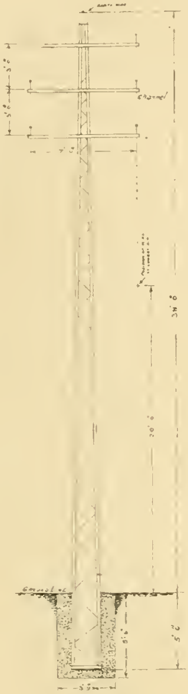


Fig. 8.
Intermediate Mast.

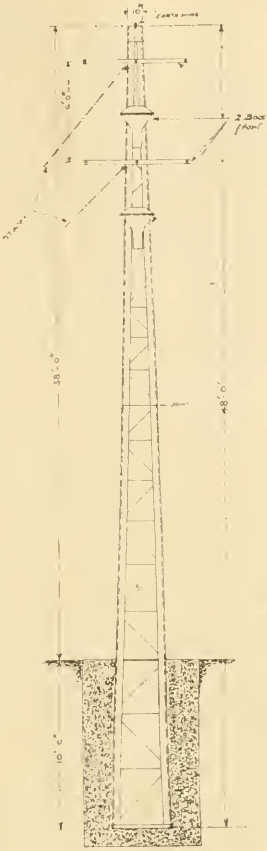


Fig. 9.
Terminal Mast.

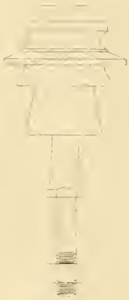


Fig. 10.
Insulator.

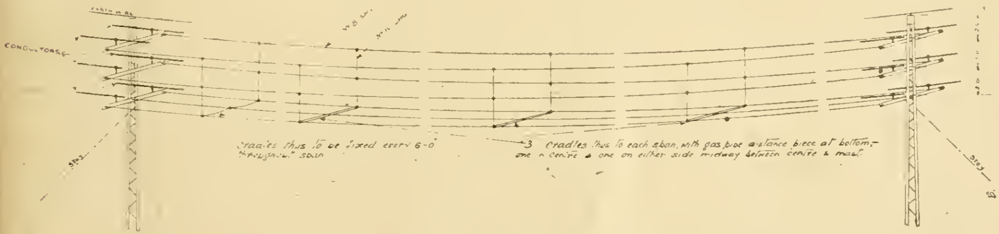

Earth wire
Conductors
Stay
Cradles thus to be fixed every 6-0" throughout span
3 Cradles thus to each span, with gas pipe distance piece at bottom; one in centre & one on either side midway between centre & mast.
Stay

Fig. 11.—Guard Span.

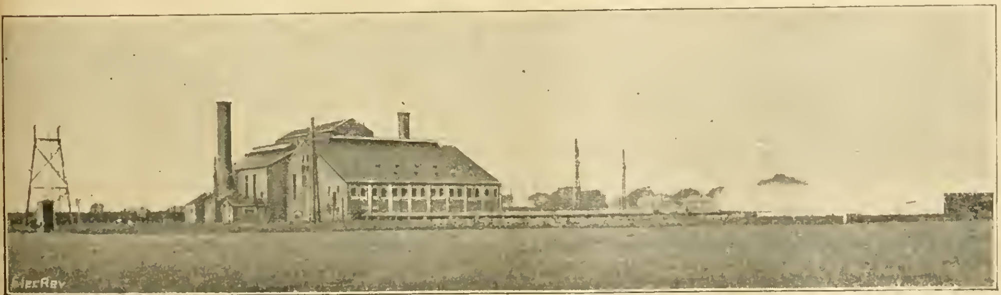


Fig. 12.—Exterior of Gretna Power Station; Cooling-Pond on Right.

systems of wiring being used to suit the varying conditions. Many of the buildings in the danger area had to be lit from outside, and those inside mounds, such as the magazines, were provided with special swinging fittings so that these could be swung away clear of the buildings during thunderstorms. External lighting had also to be provided for the ether plant on account of the explosion and fire risk, and as these buildings were 50 or 60 ft. square with three or four storeys all fairly full of machinery, and other apparatus, the problem was not an easy one to solve. The suggestion of one Government official (not in the Explosives Department), that each fitting should be connected to a special ventilation system, was not adopted.

Most of the buildings in the explosives area also were controlled from points 60 ft. to 100 ft. away, and connected up by underground cables, no switch or overhead line being allowed nearer than this. All such buildings were wired throughout in galvanised tubing with watertight fittings.

The acid buildings were wired with C.T.S. cable, which proved very satisfactory. It stood the severe conditions in the sulphuric acid buildings without giving any trouble at all, and in the nitric acid buildings trouble only occurred in the retort houses at places where the rubber sheathing was in tension or compression—at bends or where pinched in the insulators; the results, however, were much more satisfactory than those obtained in similar buildings elsewhere wired in galvanised tubing painted with acid-resisting paint. The fittings in the acid buildings were all provided with the St. Helens Co.'s acid-proof ceiling roses and holders.

Practically all other parts of the factory were wired in tubing, each building or group of buildings being balanced on the three phases; the lighting loads varied from 20 kw. for the Mannheim sulphuric acid plant down to buildings requiring only one or two lights. Some 50,000 lamps in all were installed.

The power wiring was carried out wherever practical with three-core, rubber-insulated, wire-armoured cable; this was much cheaper to install than tubing, and proved entirely satisfactory in all sizes from 3/22 up to 37/14 s.w.g. The motors ranged from 250 h.p. for the refrigerating plant down to a tiny machine for the photo printing apparatus, &c. In the aggregate some 18,000 h.p. was installed.

The wiring in the townships varied rather more than in the factory buildings. The early wooden huts were all wired with open wiring on cleats, whilst for larger brick buildings—such as the kinemas, clubs, churches, &c., and the bigger houses—tubing was used to a considerable extent. For smaller brick houses—cottages, hostels, and small villas—Henley's wiring system was first adopted, but had to be abandoned, as the use of lead was prohibited, and C.T.S. wiring was then adopted. Both systems proved entirely satisfactory. They were only adopted after specimen cottages had been wired and carefully examined and tested by the engineers in charge of the work and by Mr. Raymond Unwin, the architect for the township, and Mr. C. M. Crickmer, the resident architect.

A few figures to indicate the magnitude of the installation may be of interest. One or two have already been given relating to the overhead line work, &c. For the internal wiring of the buildings over 600,000 ft. of tube were used, and over 750 miles of rubber-insulated conductor, with over 30 miles of paper-insulated cable in addition, of two, three, and four cores, the last item being exclusive of a quantity of heavy distributors laid by Messrs. Siemens Bros., and of the h.t. cable. Over 200 miles of soft-drawn bare copper was used for binding wires on the overhead lines and for earthing purposes, the total length of bare copper conductor of all kinds used being nearly a million yards.

The whole of the installation (apart from the power-house equipment, the h.t. lines and the sub-stations, and a part of the power wiring, which was carried out by Messrs. W. C. Martin & Co.) was entrusted to Messrs. Tyler and Freeman, of London. They were also responsible for designing the general layout of the lighting distribution system from the sub-stations, and for the design of the lighting installations in all the buildings in the factory and the two townships. The whole of the work was subject to the general supervision of the writer, the Ministry Electrical Engineer for the factory, who, ably assisted by Mr. H. J. London, the late Mr. F. A. Bird, and others, was responsible for the design of the whole electrical equipment, and with Messrs. S. Pearson and Son, the Construction Managers, for the general execution of the whole of the work.

A regrettable error crept into the first half of this article last week. On page 621, at the bottom of the second column, it was stated that "the 3,000-kw. units have a steam consumption, excluding auxiliaries, of 14·2 lb. per kw.-hour at full load." . . . . The correct figures should have read 13·50 lb. steam consumption, excluding auxiliaries, and 13·9 lb. including auxiliaries.

RESEARCH PUBLICITY.

By D. Ross Kennedy.

In any scheme for organising and co-ordinating research, the collection and dissemination of data applicable to, and emanating from, research work, must be given a prominent position.

Organisation is the systematic sequence of sustained effort, guided and adjusted by the accurate record and analysis of the effect. Whilst the recognition of *practical* research will complete the sequence of effort, an efficient record and publicity department is necessary for the registration of the effect.

One of the inducements to subscribe to Research Associations under the Government scheme, is the privilege of receiving "a regular service of summarised technical information which will keep the subscriber abreast of the technical development in the industry at home and abroad." Again, in the Draft of Memorandum of Association, one of the objects (3*d*) for which the Association is established is "to establish, form and maintain museums, collections, libraries and collections of literature, statistics and information relating to the said trade or industry, or to matters of interest to the members thereof, and to translate, compile, collect, publish, lend and sell, and endeavour to secure or contribute to the translation, compilation, collection and publication, by Parliament, Government Departments, and other bodies or persons, of any such literature, statistics and information." The foregoing indicates, to some extent, the work of the research record department, and it might be inferred that it is intended to include the publication of the results of research and the data in connection therewith. But such an inference is apparently incorrect. The avoidance of a specific reference to the results of research is evidently intentional, because under "Notes on Articles of Association" (5), it is stated that "Provision should be made for the results of any researches, as obtained from time to time, being communicated in the first instance to the Committee of Council, in order that, after consultation with the Board of Association and any other co-operating bodies and persons, the Committee may determine in the national interest whether, and if so, to what extent and under what conditions, the results shall be made available." Under these conditions, it is not impossible for the position to arise in which some firms would be in possession of the results and others not, a state of affairs detrimental to the efficient working of the Association. But when research is organised to discriminate between *scientific* and *practical* research, it will be unnecessary, and a hindrance to the industry's progress, to restrict the publication of the results of scientific research. Scientific investigation cannot be circumscribed by any national interest; the scientific laboratory is world-wide. On the other hand, if technical co-operation in practical research is effected, as it should be, through the Trade Associations, the results of practical research will be restricted in publicity to the industry supporting the researches and the national interests will be the industry's interests. Under the co-operative conditions, the home industry will be strong enough to protect its interests from the malpractices of manufacturers abroad.

Any successful scheme for organising and co-ordinating research must be built up on the solid foundation formed by an efficient record and publicity department, just as successful selling organisations of the engineering industry must be strongly supported by the efficient collection, compilation and distribution of data relating to the development of design and improvements in methods of manufacture of the establishment's productions. This is true whether the information is confined to a confidential circulation or given unlimited publicity. The publicity measures indicated in the Government Research Department Reports require to be developed to a much greater degree, especially in the direction of recording, analysing, and compiling the data relating to the results of research. When the Government department desires to be accepted as "a clearing house for information," it does not realise the magnitude of the task of collecting, analysing, compiling, and distributing the technical and scientific data even in connection with but one specialised branch of one industry, to say nothing of several industries and their sub-divisions. Experience will prove the advisability of decentralisation to permit of the documentation of research in its more intimate details at the source of origination and site of application. When the course is finally set, and the indicator left at full speed ahead, the huge stream of records and data which must follow the organisation of research, if it is to fufil expectations, will tax the resources of any one record and publicity department. There is, therefore, a further inducement to separately organise practical research in its relation to the engineering industry, so that the work of the accompanying record and publicity department will be confined to limits which will be a pre-assurance of satisfactory service.

The initial work of a record and publicity department consists of collecting, filing, and indexing all the information and data of any interest to the research workers in the branch of engineering concerned, including the results of researches. In this section, photographic records should be obtained of apparatus and appliances used in the research laboratory at the various stages of the work in progress.

Photographic records are of material importance in practical research work, for although drawings be issued for the construction of the apparatus, the adaptation of existing material to the necessity of the moment may give a different impression of the actual appliance when completed. Prints of these photographs, together with reports from the laboratories, abstracts from scientific and technical journals, and all other information and data available, should be segregated, indexed, and filed in a condition easily accessible when required for compiling and editorial purposes.

The material thus collected should be analysed and compiled for publication in a form convenient for reference. As literary productions, scientific publications, originating chiefly in educational institutions, differ essentially from technical publications, and scientists on the whole do not consider the literature of the technical Press as scientific. Consequently the scientist is often deprived of valuable scientific information contained in technical publications, and the scientific records being, therefore, incomplete, the progress of scientific research is retarded. When compiling scientific publications, abstracts from the technical Press are almost totally prohibited, and the acceptance of a contribution denotes its scientific virtue before it is published. On the other hand, technical journals publish contributions on all subjects relating to the industry, and it is left to the reader to discriminate between the scientific and technical value of the matter published. Through the medium of the record and publicity department of the research organisation, all matter published of any interest to research, whether appearing in scientific transactions or technical journals, should be abstracted and made easily accessible for the ultimate use of the research workers, and in this respect prevent the progress of research from being retarded.

When the data have been analysed and concisely arranged, they should be finally edited. Industrial technical literature frequently shows the lack of responsible editorial supervision. The alteration of the construction of a sentence by introducing a particular term may often remove an unwieldy circumlocution, and incidentally arouse a flagging interest. Through the judicious exercise of the editorial functions it is possible to present to the reader a clear and pregnant description conducive to a correct and appreciative understanding of an otherwise obscure subject. In the publication of practical research literature this procedure is essential to the efficient utilisation of the records.

In addition to the publication of original information obtained within, and issued to, its own organisation, the editorial selection of abstracts from all available outside sources of scientific and technical information is of great importance, as the more complete the issue of records and data is maintained, the more efficient will be the work of the laboratories. Practical research must be based as much as possible on known facts and very little on guesswork; and although the temptation for guesswork is always present, it is only by ferreting out information and making the collection of data as complete as possible, that the work of the laboratories will be continued with a vigorous persistence. A problem, intimating a serviceable solution, may arise on which very few obvious data are available; but by the assiduous collection of small details a sufficient number of conditions ultimately present themselves to indicate, with some prospects of success, the direction in which the practical research should proceed. In its pursuance of this branch of the work of research, the record and publicity department will be in a position to co-ordinate the work of its attendant laboratories and also prevent the work of these laboratories from overlapping those of other laboratories with which exchanges of data have been arranged.

Of the publications issued from the record and publicity department, the more important will be confidential, with a limited circulation. In the first place, data and information should be issued for the sole use of the research workers. In the second place, the results of researches conducted within the organisation, together with contemporary scientific and technical data and information from other sources, must be issued to the firms supporting the research organisation. In addition to these publications, there should be a publicity bulletin, for which every endeavour should be made to secure an extended circulation. This form of publication should contain the results and particulars of research work of interest to selling engineers and also to the public who form the market for the products of the industry. The success of this publication depends upon the interesting and pleasantly-instructive manner in which the information should be presented to the reader, whose patience must not be taxed with trite technical expressions. When furnishing particulars for publicity purposes, the designing engineer, as a rule, records actual facts, apparently with the assumption that the reader will come to the same conclusions on a subject in which the designing engineer is specially versed. If published as received, the important commercial attributes of the record are not properly appreciated, because the record enjoins too severe an exertion on the part of the reader who becomes burdened with a mass of undigested facts. This unjustly handicaps, especially, the commercial or selling engineer who must be conversant with a number of different productions. Hence it is necessary that research records be re-written and compiled by the publicity engineer in such a form that the selling engineer and the buyer will be supplied with easily digested information. Thus the technical data contained in the records of research will be turned to advantage for commercial purposes. This type of publication should demonstrate the commercial value of research work, and by indicating the industrial progress obtained through research, attract the interest and secure the support of the commercial side of the engineering industry.

Victory March of London Troops.—Officers and other ranks of the London Electrical Engineers R.E. (T.F.) who have served overseas, and who wish to take part in the Review by the King, and Victory March of London Territorials on Saturday, July 5th, are requested to send their names to the Organising Officer, 46, Regency Street, London, S.W. Applications should be made at once.

SOME CONSIDERATIONS REGARDING THE MATHEMATICAL TRAINING OF ENGINEERING STUDENTS.

By G. W. STUBBINGS.

The various reforms that have from time to time taken place in the normal schemes for the education of engineers have brought about the desirable result that the average young engineer of to-day has a fairly good working knowledge of mathematics. The teaching of mathematics with special reference to engineering problems, and the discarding of the practice of regarding the calculus as somewhat of a sacred study, to be approached with superstitious reverence, have tended to give the engineer such a knowledge of mathematics as will serve him as an invaluable tool, to be used in connection with the various problems that confront him in the practice of his profession.

It has been remarked by a celebrated writer that, although a more or less complicated mathematical expression is developed by a series of strictly logical steps from comparatively simple propositions, yet the ability to follow such an investigation with ease comes only with considerable training. This fact, which cannot be disputed, is not a little strange, and the ability to follow mathematical reasoning, as far as can be ascertained, bears no sort of relation to the quantity of what is usually called intelligence. In other words, a man who finds the utmost difficulty in following such an investigation is not necessarily stupid, but is deficient in some mental power distinct from those ordinarily required. This particular power seems to be that of concentration; and the power of concentration, while being inborn in some persons, is only attained by others as the result of more or less prolonged training.

The ability to follow mathematical investigations—however important and desirable it may be to the mere dilatory student of, or dabbler in physical science, is certainly only part of what is necessary for an engineer. Notwithstanding this, it is essentially necessary in acquiring a knowledge of the groundwork of the subject. In such acquisition of foundational principles, natural ability will be of first importance, for the mental training that can practically compensate for lack of this ability has not yet been received. This fact will account for the marked differences that all teachers find in the rates at which various students progress with the knowledge of foundational principles. This knowledge is, however, absolutely essential, as without a sound foundation no reliable or trustworthy structure can be raised. It is, nevertheless, a fact that many students, through sheer inability to follow what to other students seems so very obvious, fail to keep a grip of the development of the subject that to the bright student proceeds in so orderly and so logical a way. Once this grip is lost, future work is almost useless, as the confusion and perplexity of the student will rapidly increase.

For the purpose of the ordinary engineer it is fortunate that the amount of what may be called theoretical work that need be undertaken is relatively small. Prof. Perry, in his celebrated book on the Calculus, has amply demonstrated in Chapters 1 and 2 of this work what can be done with quite a meagre knowledge of the theoretical side of mathematics. In view of this fact, it is certainly a mistake, and unfair to the student deficient in the ability, to proceed rapidly with this work, or to attempt more than is absolutely necessary. It is to be remembered that mathematics should be to the engineer a servant, and not a master, and no good purpose is served in attempting to acquire more knowledge of the subject than can be held in a thoroughly firm intellectual grip.

It has been previously remarked that the mere ability to follow and grasp the logical development of mathematical science is only a part of what is required of an engineer. He should, within the limits of his knowledge, be capable of originating as well as following investigations, and he must, moreover, not only be able to express everyday problems in mathematical language, that he may apply to them the knowledge he has attained, but he must be capable of the reverse process, and be able to interpret the results he arrives at, and give them an actual numerical significance. This consideration seems to point to their being at least three other directions in which the engineer must possess some degree of skill. These may be enumerated as (*a*) the ability to translate any problem involving magnitude into mathematical language; (*b*) the ability so to transform the various mathematical expressions met with, as to render the several theoretical principles capable of immediate application; and (*c*) the more or less mechanical ability to apply these rules, and by correct working to obtain trustworthy numerical results. These various points are of equal importance with the ability to follow and grasp theoretical principles, and they constitute the practical side of mathematical science in a very real sense. Ability in these three directions does not by any means follow from a natural aptitude for the theoretical side of the subject. A student who will easily and enthusiastically follow a lecturer into the most abstruse branches of mathematics, may yet be quite incapable of developing a simple investigation a little out of the beaten track. The ability of such a student will obviously be of far less practical value, than that of one who, as the result of considerable labour, has acquired a moderate amount of theoretical knowledge, but with it a reasonable degree of skill in manipulation and mechanical working that enables him to use his theoretical knowledge in an efficient way.

The ability to translate into mathematical language a problem expressed in ordinary words is of first importance to the engineering student. The difficulty in doing so is very great to the beginner, and nothing but assiduous practice can overcome this difficulty and give the facility required. The solution of so-called problems leading to simple and quadratic equations is one of the most useful parts of the study of elementary algebra, and it would seem that, in cases where the young student has in view a profession or calling in which he will be called upon to make practical use of his mathematical knowledge, this feature of the elementary training can hardly receive undue prominence. This same point should be followed up during the whole of the engineering education, the object being, more or less, to accustom the student to think mathematically, and instinctively see the mathematical bearing of any problem involving magnitude.

Skill in the manipulation of mathematical expressions is, again, of incalculable importance to the engineer if his mathematics is to be of the service to him that it should be. Prof. Perry has very rightly insisted that the elementary student cannot receive too severe a drilling in the transformation of trigonometrical quantities. Skill in manipulation is, of course, of first importance in the process of integration; in fact, this process, which is admittedly one presenting great difficulties, consists almost entirely in the transformation of expressions to certain standard forms. A further direction in which skill of this kind is of the utmost service is in the deducing of approximations. Facility in these processes is, again, only to be obtained as the result of thorough training and prolonged practice. It is true that persons that have a natural talent for mathematics rapidly acquire this facility, and gain an almost supernatural instinct which enables them to see possibilities in the transformation and manipulation of expressions at once, while the ordinary person will arrive at the same result only after considerable toil and calculation. Such persons are, however, very rarely found—most can only obtain any sort of skill in the direction referred to by the comparative drugery of working out examples.

The ability to do the mere mechanical work of the application of the fundamental rules, is by no means as usual as it should be, and it is, moreover, a point the importance of which is liable to the overlooked. The most elementary part of this subject is the simple arithmetical calculation, and it is perhaps to the neglect of practice of this kind that can be traced the fact that many students, who possess quite a good grasp of what are really the more difficult parts of mathematics, are yet most prone to trivial mistakes in the evaluation of their results, that lead to their obtaining inaccurate numerical solutions. This fault is all too common, and is one that can or should have been easily rectified. It is one, however, that will vitiate all the advantages of skill in the other directions referred to. In this connection it may be remarked how valuable is the plotting of curves, both in regard to the immediate object of this study, and also none the less on account of the practice it gives in actual numerical calculation, and the use of logarithms, and other approximate methods.

Mental arithmetic is, as far as one knows, a subject confined to elementary schools. It is, however, one of no small importance to the practical engineer, the advantage of being able rapidly to make approximate mental calculations being very great. It is not suggested that mental arithmetic should figure in the curriculum of the ordinary engineering college, but the advantage referred to might well be borne in mind in connection with the subject of rapid and accurate work in the more mechanical portions of practical mathematics.

The above considerations suggest that the exercise class, which is frequently regarded as somewhat of an addendum to the lecture, is, in the training of engineers in mathematics, the time when most is learnt, and when the greatest benefit can be obtained. It cannot be too strongly urged that for engineers the practical side of mathematics is all-important—by practical, it being intended to convey the actual ability to make use of the knowledge as distinct from a mere intellectual assent to what has been demonstrated. This practical side of the subject can, obviously, only be developed by appropriate training, and it is for this reason that it would seem that the exercise class should be regarded as the normal time, and as providing the normal means, of obtaining the desired knowledge and skill in mathematical practice, the lecture being regarded as more or less introductory and supplementary.

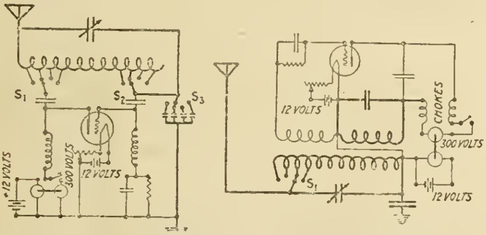
In conclusion, it may be remarked that it is usually assumed from the result of an entrance examination that students commencing a course of instruction in an engineering college have a good grounding in what is usually known as elementary mathematices. It is open to question whether this assumption is altogether justified. The instruction in elementary mathematics has been given during the years of late boyhood, and in all but exceptional cases it is doubtful whether the importance of the subject has been sufficiently grasped by the young student to ensure the firm mental grip on the rudimentary portions of the subject necessary to form a satisfactory foundation for future work. It is more than probable that a short time spent in recapitulating the elementary parts of the subject, having in view the particular direction in which the future training is to be undertaken, would, so far from being a waste of time, be of considerable benefit to the average student.

CONTINUOUS-WAVE LAND WIRELESS SETS.

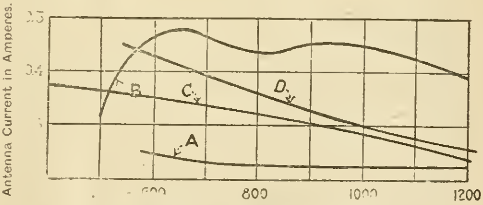
These sets, described by Lieuts. P. T. Weeks and D. G. Little, of the U.S.A. Signal Corps, in the *Electrical World*, were designed for special requirements. The outstanding features are the use of vacuum valves for transmitting, a low-power transmitter with a sensitive receiver, and the elimination of adjustments.

Continuous-wave wireless sets have found application particularly in the intermediate and rear sections of the wireless network at the front. For the intermediate section a range of 10 to 20 miles (16 to 32 km.) is considered sufficient. In the rear section, where larger and more permanent antennæ could be utilised, a range of 50 to 100 miles (80 to 160 km.) was required.

The transmitting circuit, fig. 1, is of the capacity-coupled type. Very satisfactory results have been obtained from this type of circuit in wireless telephone transmitters; it is reliable and efficient in operation over a wide range of antenna constants and requires only simple and non-critical adjustments. Capacity coupling is used, the alternating grid input voltage being obtained from the reactive drop across the series condenser, and the voltage developed in the plate circuit is in effect applied directly to the antenna. Only the one large inductance is required, and the circuit oscillates readily. The three tuning adjustments are indicated in fig. 1; S_1 is the wave-length adjustment; S_2 is the plate coupling adjustment which is required to give maximum power output; S_3, controlling the input voltage, is necessary to avoid overloading the tube. In the actual set the positions of the inductance taps and the values of the input condensers have been so chosen that the three switches are operated by a single handle without the necessity of individual adjustment of the plate coupling and grid input. This arrangement secures nearly enough maximum output and prevents overloading the tubes. The plate and grid are insulated from the antenna by blocking condensers. To supply the D.C. to the plate without short-circuiting the antenna for high-frequency current, the choke coil is introduced into the plate lead. The high-frequency choke and resistance in the grid lead perform a similar function. The by-pass condenser around this resistance is not essential, and even the choke coil could be replaced by added resistance. This resistance in the grid lead, together with the grid current, performs the added function of producing the negative potential on the grid which is necessary for efficient operation and to prevent overheating the tube. The small variable air condenser which parallels the inductance coil is provided to make the wave-length range continuous. A positive plate potential of 300 volts to 350 volts is supplied by a dynamotor operated from a 12-volt storage battery. In the actual set two transmitting tubes are used, their filaments, plates and grids respectively being connected in parallel. Their filaments are lighted by the same storage battery that operates the dynamotor. To secure proper filament current throughout the discharge range of battery voltage, a filament rheostat is provided. The variation of current output with wave length under favourable conditions of low antenna capacity and high antenna resistance is shown in fig. 3A. Fig. 3C shows the variation of output current with antenna resistance when operating with an antenna of approximately average capacity.



Figs. 1 and 2.—Transmitting Circuit with (1) Capacity and (2) Inductive Coupling.



Wave length in metres. Antenna resistance in ohms.

Fig. 3.—A and B = Wave-length Characteristics of Antenna Circuit.

C and D = Effect of Antenna Resistance on Characteristics of Circuit.

The antenna current is much smaller than would be required from a spark set of equal range, but is more than sufficient to give the required range of 20 miles (30 km.). While the transmitter has a low over-all efficiency, it meets the requirement of fairly uniform output over a wide range of wave lengths and antenna constants.

An inductively coupled type of transmitting circuit was substituted for the capacity-coupled circuit in later models shown in fig. 2. The input couplings in the grid circuit and the output coupling in the plate circuit are both entirely inductive. The plate coupling coil with the condenser bridged across it forms a resonant circuit of natural period slightly less than the period of the shortest wave length to which the antenna circuit can be tuned. The coupling is such, however, that this circuit is forced to oscillate at the same frequency as the antenna circuit. The outstanding advantage is that if the coils are properly designed, there is required no mechanical change of coupling for different wave lengths, and the only tuning adjustments necessary are the antenna inductance switch S_1 and the small variable air condenser, which parallels the antenna and makes the wave-length range continuous. The inductance coils, while fixed in position, will give the proper coupling over a wide range of wave lengths and antenna constants. A negative grid potential is obtained by means of a grid condenser and leak. The plate potential is supplied by a dynamotor, which is isolated from the high frequency oscillations by choke coils. The actual set employs two tubes in parallel as in the previous model. The variation of output with wave length when operating on an actual antenna of standard form is shown in fig. 3B, and the variation of output with antenna resistance in fig. 3D. The output is somewhat greater than is obtained with the capacity-coupled circuit.

The most important part of the problem was solved with the development of a high-vacuum valve sufficiently uniform in characteristics and non-critical in adjustment to operate interchangeably under fixed conditions and without being materially affected by small changes in grid, plate and filament potentials.

The receiving circuit combines a vacuum-valve detector and heterodyne with a two-stage amplifier. The circuit is shown schematically in fig. 4. The circuit is of a familiar feed-back type, having a tuned grid circuit and a tickler coil connected in the plate lead. The unique feature is the design of the primary, secondary and tickler coils. These are wound on separate forms, but are fixed in such relative positions that there is required no adjustment of the coupling either between the primary and secondary or the secondary and tickler coils over the entire range of wave lengths. For short waves only a part of the primary coil is used. The only other tuning adjustments are the manipulation of the primary and secondary variable air condensers, and the reception of continuous waves is made simpler even than the reception of damped waves by the ordinary coupled receiver. A single-pole switch enables the tickler coil to be cut out for receiving spark signals. The notable features of the amplifier are the absence of all tube adjustments and the use of the specially designed and highly efficient inter-tube transformers. Control of the amplitude of the signals is obtained by the variable resistance which shunts the primary of the first transformer. This, with the sharp selectivity of the heterodyne receiver, permits the elimination of all but exceptional interference.

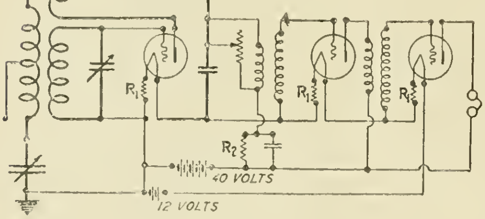


Fig. 4 Receiving Circuit.

The negative grid potential to give the best operation of the tubes is secured by the drop in potential in the series resistances, R_1, in the filament circuit. The use of the large resistance R_2 in the plate lead of the detector tube to reduce the plate voltage to a more suitable value for operation of the detector tube has the advantage of ensuring a sufficiently high initial voltage to start the oscillations. The plate voltage is supplied by two fifteen-cell miniature dry-battery units that weigh only about 1 lb. (0.5 kg.) apiece, and have sufficient capacity to give continuous operation for several weeks.

The complete set is combined in a box. The two circuits are entirely separate except that they employ the same filament battery and antenna. Hence they can be tuned entirely separately, and the complete change from transmitting on one wave length to receiving on the same or a different wave length can be made by throwing a single switch. The adjustments are the same externally for the sets employing the capacitively and the inductively coupled transmitting circuits. The transmitter is set for the approximate wave length by the wave-length switch, and the fine adjustment made with the condenser. The filament rheostat gives control of the filament current. In tuning the receiver the two two-position switches are first set at short or long waves and heterodyne or spark as required. The tuning is then done entirely by the primary and secondary condensers. The amplification switch is operated to reduce the signal strength and to cut out interference. Provision is made for clamping the variable condensers in any position to secure the constancy of wave length and tuning required for heterodyne reception.

Wave lengths are determined by means of a special wave meter carried in the same carrying case as the set box. This wave meter consists of a fixed condenser and variable inductance, and while in over-all dimensions it is approximately only a 5-in. (12.7-cm.) cube, it covers the wave length range of 500 m. to 1,100 m. with an accuracy of 1 or 2 per cent. It contains a buzzer for setting the receiving circuit and a miniature incandescent lamp for indicating the resonance point when measuring the transmitted wave length. By reason of this last feature it operates as well with undamped as with damped waves.

The dynamotor which supplies the plate voltage for the transmitter has what would normally be called a low electrical efficiency, but is particularly valuable because of its reliability and light weight. The dynamotor proper is less than 5 in. (12.7 cm.) in diameter by 9 in. (23 cm.) long and weighs 15 lb. (7 kg.). With its water-tight aluminium carrying case it weighs about 25 lb. (11 kg.). It is a modification of the automobile starting motor.

The storage batteries supplied with the set consist of 4-volt, 100 amp.-hour units, which have an over-all volume of about 1,000 cu. in. (16,000 cu. cm.), and weigh less than 10 lb. (18 kg.). The separate cells are removable, and some have transparent celluloid containers so that the internal condition of the cell can be determined by inspection.

The set when transmitting draws a total of 10 or 12 amp. from the 12-volt battery. The input to the plate circuit is about 30 watts and the high-frequency power delivered to the antenna 5 or 6 watts. When receiving a battery current of only a little over 1 amp. is required. The standard antenna is 20 ft. (6.1 m.) high, and consists of two 100-ft. (30.5-m.) branches making an angle of 60 deg. with each other. With this antenna the working range between two sets is easily 20 miles (32 km.). The set box, dynamotor, wavemeter, and other accessories are contained in a carrying case weighing, complete, a little over 100 lb. (45 kg.). The antenna and earth material weigh complete about the same, and are arranged in convenient carrying units. Light bamboo or spruce masts are employed.

In the Tank Corps experience has proved that ordinary means of communication are insufficient, and wireless has been resorted to. The antenna must be extremely small and inconspicuous, operation with the tank in motion is necessary, and a very loud signal is required on account of the extreme noise within the tank. The fact that the existent wireless network necessitated the use of undamped waves only added to the difficulties. The solution was found in a vacuum-valve set combining a receiving circuit similar to that described with a transmitter somewhat more powerful.

A transmitter of rather unusual design was required to ensure the necessary constancy of emitted wave length, regardless of the motion of the tank, and also to give sufficient antenna current. The necessity for an unusually high antenna voltage is evident when it is considered that the capacity of the antenna is about 60 micro-microfarads, as compared with the 400 to 500 micro-microfarads capacity of the antenna of the set described above. Two forms of antenna are provided, one a jointed fishpole type about 15 ft. (4.6 m.) high, and the other an umbrella type about 3 ft. (0.9 m.) high, with self-supporting folding arms. Both are arranged to be erected easily from within the tank. An antenna current of about 0.3 amp. is obtained, giving a working range of 5 miles (8 km.).

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

An Example of Industrial Co-operation.

With reference to your remarks on the short article on works committees published by the writer in the May number of *Unity*, perhaps you will permit me to point out that the object of that article was to show the good which has been and is being experienced in at least one factory by the operations of a works committee, enabling the manual workers to have a medium through which expression can be given of the thousand and one difficulties incidental to industrial organisations, and not as a complete solution of all the problems at the present time surrounding industry.

The definition of the term "management," I have no doubt, varies with different organisations. The writer's interpretation includes the administrative staff with the management, and at the same time I do believe that it is safe to rely on their support and sympathy with the employers' interests when these interests can and should be common. The members of the works committee who are representatives of the management consist of the works manager and the writer, who are, equally with each manual worker, paid employés.

The object in pointing out that all members of the committee are prominent trade unionists was to show that there was nothing in connection with serving on the works committee calculated to undermine in any way the objects of sane trade unionism.

At the factory referred to by the writer there is also a committee for the staff on similar lines to that set up for the works, though of somewhat later birth, and in many problems which deal with the employés as a whole they work very successfully in unison.

You, Sir, take exception to the statement that the war has been a great teacher; I certainly meant, for good. You point out that the war has taught us nothing new that is good; I think you should define whom you mean by "us," as certainly fundamental truths may be thoroughly well known and admitted by a limited number of people, but up to now this has not interfered with the teaching of these fundamental truths to those who were yet in ignorance of them, and I suggest that the war has brought home to the mass of the population these truths in a way and in a time impossible by most other methods, and therefore has been a great teacher.

I also submit, Sir, with all respect, that what you point out as being a second fallacy is again not a fallacy at all, as *it is necessary* to teach even the truth before the mass of the people, and particularly the rising generation, absorb it, otherwise why do we take the trouble we do to teach what we believe to be the truth of Christianity?

H. Mensforth.

Manchester, *May 27th*, 1919.

[We are interested in the further information supplied by Mr. Mensforth. We made no suggestion that the staff would not support the employers' interests if those interests were common—in other words, we did not impugn their loyalty. But are employers' interests and staff interests alike? Frequently, we fear, they are not. Mr. Mensforth defines himself as an employé, and we accept his definition: but *Unity* headed his article, "An Employer on . . . ," and there can be no doubt that general managers are usually regarded as employers. We have heard of the Westinghouse Staff Committee, but the information at our disposal does not show that all the members are trade unionists, or that the Committee is entrusted with any degree of power, or that its influence is allowed to be comparable with that of the Works Committee.

Mr. Mensforth's view of the function of a teacher is rather one-sided. We admit the necessity of hammering home fundamental truths, however old they may be; every child, for instance, has to learn the multiplication table. But the functions of a teacher also include the more important feature of the revelation of new truths, and we read Mr. Mensforth's article to mean that the war had been a revealer of new good, which is a conclusion we are not able to share.—Eds. Elec. Rev.]

Employés and the Electricity Supply Bill.

In the leading article of you issue of May 16th I much regret the sentence referring to the Conspiracy Act. Inferentially I take it you consider this a good thing, and on this point I beg to differ. While it may have been good policy as a temporary measure in February to avoid a shutdown of London, to carry it on now is an insult. If made applicable to some bodies of public utility men, why not all? Railways, transport, postal, mining, &c. Why are Whitley Boards not given to undertakings covered by this Act?

The object of the Act is to prohibit strikes, which are the perfectly legitimate weapon of all trade unions, and, paradoxical as it may seem, it is only breeding strikes, as it is a distinct infringement of the liberty of the subject. If the Government is desirous of preventing strikes let it produce some form of compulsory arbitration. The term is a misnomer, but conveys the essence of the present-day need, and I am informed it was used by Mr. Lloyd George. Some weeks ago the employés of gas, water, and electricity departments of a town all went out on strike, and the Government did nothing. From this one can conclude the unofficial strike evades the Act. I make bold to say the better sense of a more highly educated public would support the men in defying such antiquated laws, *especially as no substitute has been provided.* Again, why cannot such undertakings have Whitley Boards whose findings could be heard under the Temporary Wages Regulation Act, 1918-19, and made binding by it. To me it appears as if the axe-grinding, honours-selling politician is hanging on to industrial power for political purposes, and delaying the Ministry of Labour.

I am also at a loss how to reconcile the Trade Disputes Act, 1906, which "exempts trade unions from common law relating to conspiracy" with this ancient piece of Prussianism, the 1875 Act.

J. H. Wright.

Dundee, *May 18th*, 1919.

The E.P.E.A. Award.

For a member of the E.P.E.A., your correspondent "Connaught T. Smith" displays a remarkable ignorance of the doing of this Association. His interest in the affairs of the body which he criticises so querulously has evidently not led him to attend any meetings of his local section, or to keep in touch with his corresponding member. Had he done so, he would have learnt that a very considerable percentage of E.P.E.A. members have already received payment in full of the amount due under the award of the arbitrator, *i.e.*, 20 per cent. + £90 as from March, 1918, and also that no effort will be spared on the part of the Association to ensure that every member, without exception, shall receive like treatment.

It is not necessary to use a steam hammer to crack a walnut, and if a satisfactory result can be obtained by the gentler method of moral suasion, surely this is better than to adopt the tactics of a Red Bolshevik, and howl for blood at any cost. Drastic measures, however, are not excluded from the weapons in the armoury of the E.P.E.A., and the sword will be strongly drawn when occasion demands such extreme action. While making every allowance for the sickness of heart that accompanies the consciousness of hope deferred, might I suggest that sneering criticisms such as "Connaught T. Smith" indulges in are hurtful to his cause, offensive to his fellow members, and calculated to weaken the very Association that he affects to deride because of its alleged lack of strength and vigour. The E.P.E.A. is by no means so pusillanimous as your correspondent suggests, for proof of which let me refer him to an announcement on page 648 of the current issue of the Electrical Review.

Shift Engineer.

I am afraid your correspondent, "Connaught T. Smith," has hardly understood my letter of the 17th ult. How can the award apply to Mr. Harding or any of his colleagues who consider it *infra dig.* to join a trade union, and therefore, one naturally concludes, are not members of the E.P.E.A.?

Wessex.

June 1st, 1919.

The Southampton Appointment.

The procedure in connection with this appointment is most instructive. When originally the Committee tried to force the appointment of its favourite upon the Council without advertising, and failed, the Mayor stated "that Mr. Ellis was one of those first-class men who would not apply for the post if it was thrown open to competition." That gentleman, however, evidently put his pride in his pocket, as he did send in his application after the post was advertised, and small blame to him if he did apply, as he evidently coveted the position. It is the Southampton Corporation, and not its new electrical engineer, which is subject to opprobrium owing to its methods of doing things. With regard to the age limit, I thought the war had taught a little sense; if a man over 40 years of age is fit to fight the Germans, surely he is equally fit to control the Southampton alternators, or whatever variety of generators are in use there.

I remember that many years ago the Southampton Corporation required a new official. The post was advertised, while a member of the Corporation, inexperienced in the particular work, resigned from the Corporation to apply for the job. Needless to say, he won hands down.

Evidently the Corporation does not believe in stereotyped methods of doing business.

Not a Candidate.

Sunday Payment in Power Stations.

The vexed question of the Sunday payment is in many cases not settled, as the award, 2,912, is not being read by some of the chiefs as it should be. As a proof of what can be done by a little personal pressure, readers will be interested to know that the North Metropolitan Electric Power Supply Co., Ltd., is paying time and a half to shift workers for Sunday duty in the power houses. This rate was paid prior to the award, but was knocked off; but by the able presentation of the men's case by the Enginemen & Firemen's Union, to which the bulk of the employés belong, the overtime was reinstated and the back money paid. We hear some of the other concerns are wild with the Power Co., but good luck to the officials who are fair-minded, and human enough to read the true spirit of the award, and generous enough to pay without being absolutely forced.

A. B.

Working Speeds in Radio-Telegraphy.

On page 633 of the Electrical Review (May 30th), among the very useful and always appreciated "Telegraph and Telephone Notes," there appear two quoted statements. Though both relate to radio-telegraphic working speeds in practice, and appear within a few inches of each other, these two statements are scarcely mutually corroborative.

First of all, we learn from a *Times* correspondent that "messages from Madrid transmitted over Marconi's system were nine and ten days in transit, reaching London several days after letters confirming them."

Secondly, Mr. Godfrey C. Isaacs has been reported to have said—when referring, in a recent speech, to wireless stations for commercial purposes—that the "capacity for traffic" of such stations was "practically unlimited." Also: "Wireless could do 150 words per minute simplex and 300 duplex." And, "It would require but a very simple mechanical improvement to double or quadruple that number of words."

Now, a very simple question will occur to us all. Are these speeds and these "practically unlimited" possibilities attained, or are they applicable between Madrid and London? If not, the telegraphing public may naturally ask "Why not?"

This is no ill-natured dig at "wireless" by a member of the cable service, but an open and sincere appeal for exact information. Such wonders have been effected by promoters and developers of "wireless" and by devoted men in its many special spheres, that, out of sheer respect for that marvellous means of international intercourse, one seeks facts; and, somehow, it is difficult to see how Mr. Godfrey C. Isaacs's figures and assurances can accord with the *Times* correspondent's complaints. If the two can be reconciled, nobody will be better pleased than the writer: *Magna est veritas*. . .

With regard, now, to the submarine telegraph service, we all know that, from war causes, the cables have had a bad time, in spite of the magnificent and wholly devoted work of the cable-ship staffs and crews. We know, too, that all available cables have been packed with Government traffic, so the delay on the long-suffering public's messages has necessarily been great. In any case, taking into consideration the working circumstances, 10 days' delay on ordinary messages between Calcutta and London is more creditable than the same delay between Madrid and London.

E. Raymond-Barker.

London, *June 2nd*, 1919.

[Obviously, telegraphic delays may occur due to causes quite independent of speed of transmission.—Eds. Elec. Rev.]

The I.E.E. Examinations.

I should be glad to hear what your readers think of the I.E.E. decision to hold no examinations until further notice. No doubt the Council have very carefully considered the matter, but I wonder if they have thought of the case of the engineer who is not yet qualified by experience alone for the A.M.I.E.E. These men have to carry on knowing that finally they have an examination to face, and each year getting less inclined to study general electrical engineering and the other subjects demanded.

Cannot the Institution hold examinations next year as usual, and give the juniors the chance of completing part of their qualifications? They could then settle down to the special study demanded by their occupation. It is to be noted that the Institution of Mechanical Engineers has not discontinued its examinations.

Junior I.E.E.

May 30th, 1919.

LEGAL.

Marconi's Wireless Telegraph Co. *v.* The Crown.

Mr. Justice A. T. Lawrence sat in the King's Bench Division on Monday as an arbitrator to assess the amount of damages due to the Marconi Wireless Telegraph Co. from the Crown for breach of an agreement dated July 30th, 1913, by which the company was to construct an Imperial chain of six wireless stations round the Empire.

In March of last year, Mr. Justice McCardie, before whom the action came, held that the Postmaster-General was not entitled to repudiate the contract, and that the company was entitled to damages for repudiation. He directed that the damages should be assessed by an expert.

Counsel were: For the Crown, the Attorney-General (Sir Gordon Hewart, K.C.), the Solicitor-General (Sir E. Pollock, K.C.), Mr. T. Terrell, K.C., Mr. E. Charteris, K.C., and Mr. Geveen. For the company, Sir E. Carson, K.C., Mr. Leslie Scott, K.C., Mr. Hunter Grey, K.C., Mr. Stewart Bevan, K.C., and Mr. Hildesley.

Sir Edward Carson, in his opening speech, said his Lordship was asked to assess the damages under an order for judgment made on March 18th last year after a trial before Mr. Justice McCardie. The contract provided for a chain of wireless stations to be erected in England, Egypt, East African Protectorate, the Union of South Africa, India, and Singapore, or a neighbouring part of the Malay Peninsula. On December 30th, 1914, a letter was written by the Post Office repudiating the contract. Counsel read the correspondence which passed, including a letter from the company claiming compensation for breach of agreement, and the Post Office reply thereupon cancelling the letter terminating the contract, on account of the war. There was, said counsel, an earlier contract which was terminated for some political reason.

Sir Gordon Hewart remarked that a Select Committee reported on that matter on January 4th, 1913, and on January 14th, 1913, the company wrote asking to be released from the contract.

Sir Edward Carson replied that that was in consequence of interminable delays. Counsel next read the findings of Mr. Justice McCardie, and added that his Lordship now might relieve his mind entirely as to the cost of the undertaking, because the parties had settled that part of the case dealing with the money spent on stations partly erected. The contract provided that the Marconi Co. were to receive a royalty of 10 per cent. on the gross receipts from the stations, as a reward for their patents. The contract was for 28 years, with powers on the Post Office to terminate after 18 years. The patents would run out in 14 years, and his Lordship would have to say whether there would probably be new patents and improvements to keep the contract going for 28 years or any less period. At the end of 28 years the installation was to become the property of the Government. As to how his Lordship was to determine the probable gross profits, counsel said wireless telegraphy was in its infancy, and in considering the company's claim his Lordship would consider the remarkable developments it had made in the last few years. The company suggested that they were entitled to look forward during the contract years to a vast programme of business all over the world. Sir Edward Carson went on to say that there was no serious competitor to the Marconi system, and the Marconi Co. held the controlling interest in the Goldschmidt and Poulsen systems. During the war the Marconi Co. picked up and distributed to the Government and the Press 80 million words and transmitted eight million words. That showed the vast field before wireless. Nearly 3,000 ships were fitted for wireless, and the company had built stations for Governments nearly all over the world. The basis of the company's claim, said counsel, was roughly that for 1916 they would have done a traffic equal to one-third of the cablegram business for that year, and that the wireless traffic would have increased 10 per cent. each succeeding year. Proceeding, Sir Edward Carson gave figures to show the growth of the Marconi Co. The company was spending something like £55,000 a year on work of experimental research. It had high power stations in Wales, Ireland, the United States, and Canada. The more the whole business of the company increased, the more would there be a likelihood of a great increase of business in connection with the Imperial wireless stations. Counsel quoted from a Post Office return figures showing the increase in the telegram business. The claim for the year 1916 was £70,000, based on the Post Office figures. For 1917 the claim was £103,000, and for 1918 the claim was for half the Post Office earnings. Thereafter it was at the rate of 10 per cent. more each year. Counsel explained that the figures which had been prepared were not arbitrary. A great deal depended on the view his Lordship took of probable progression and expansion of business. Assuming that the business remained stationary for 28 years on the 1917 standard the claim of the company totalled £1,819,743. If a 5 per cent. progression was allowed the figure would be £3,610,374, and if 10 per cent. £7,181,774. If a progression of 15 per cent. were allowed the amount would be £15,505,000. With the reduction of charges which wireless made possible came increased business. Cablegrams were at so much greater expense that they could not compete with wireless. Showing how wireless beat the cablegrams, counsel mentioned that wireless had been installed between San Francisco and Honolulu. Between 1914 and 1917 the wireless takings were 300 dollars a day, against the cable company's 250 dollars a day.

The hearing was adjourned till Wednesday.

BUSINESS NOTES.

Import Restrictions.—The President of the Board of Trade, after duly considering the recommendations of the Consultative Council on Imports, has given the following further directions in regard to the Prohibition of Imports. The restrictions on the importation of the following articles is to be removed:—

236. Vacuum cleaners, including electric vacuum cleaners.
244. Small electric motors up to ¼ h.p., rolling mill electric motors for auxiliary driving up to 25 h.p., and single-phase repulsion induction motors.
245. Electrical measuring instruments of all kinds with 4-in. dials and under.
246. Flexible wires for telephony and house wiring.

The importation of the following articles is to be licensed only exceptionally as and when required:—

250. Weighing machines and scales.
252. Wire rope.
253. Drop forgings other than wire-rope sockets.
258. Tachometers or speed indicators other than those required for use on motor-cars.
261. Electric incandescent lamps (meaning complete lamp bulbs with filaments), and filaments supports, contacts, and tubes.
262. Electric house-service meters.
263. Electrical measuring instruments of all kinds, excepting those with 4-in. dials and under.
264. Electrical cooking, heating, and domestic laundry appliances, except electric washing machines and electric vacuum cleaners.
265. Electric cables and wires other than flexible wires for telephony and house wiring.
266. Batteries for pocket lamps.
267. Electric motors and parts thereof other than for renewals, except (*a*) small motors up to ¼ h.p.; (*b*) rolling mill motors for auxiliary driving up to 250 h.p.; (*c*) single-phase repulsion induction motors.
268. Electrical accessories and parts thereof including fan motors.

The importation of the following articles is to be restricted as shown:—

273. Dry cells and primary batteries, except those for pocket lamps are to be admitted at the rate of 20 per cent. of 1916 imports.
274. Bulbs for electric lamps are to be admitted at the rate of 50 per cent. of 1913 imports.

In accordance with the above, general licences have been issued for the articles mentioned in items 236—246.

Applications for special licences should be made as usual to the Department of Import Restrictions, 22, Carlisle Place, S.W. 1.

Mica Control Order, 1918.—The Minister of Munitions has suspended the operation of the above order as from May 30th, 1919.

The Electric Lamp Manufacturers' Association of Great Britain, Ltd.—The Electric Lamp Manufacturers' Association of Great Britain, Ltd., the registration of which was recently announced in our columns, will in future take over the work of the Tungsten Lamp Association. The registered offices of the Association are at 46, Queen Victoria Street, London, E.C. 4, and Mr. J. E. Edgecombe, the director, asks that henceforth all communications shall be addressed there.

Anglo-Italian Industrial Relations.—We have received a copy of the first number of the *Italian Gazette*, a financial, commercial, and economic review published quarterly in Rome. It is in the English language, and its object is to strengthen and develop the economic, political, and commercial relations between Italy and England. There are words of greeting from the British Ambassador in Rome, and an interview with Mr. Capel Cure, Commercial Counsellor to the British Embassy at Rome, on "The Relations between Italy and England." There are many articles by men of eminence in Italy on such subjects as the necessity to the world's civilisation of an intimate friendship between the two peoples, the future of Italy, Italian ports, how to increase trade between the two countries, the future of hydro-electric industry in Italy, public works in Italy, &c. The writer of the article on hydro-electric works (Achille Manfredini) concludes by saying :—"It will be a pleasure to us to see French, English, and Belgian capitalists contribute largely to this intense and rapid diffusion of hydro-electric installations, continuing thus after the war a cordial brotherhood of industrial collaboration similar to that military collaboration which united them on the battlefields." The *Gazette* is edited by Roberto Lombardo, and published at Piazza Cavour 17 Rome.

Italian Trade Inquiries.—For several years past, by courtesy of the British Chamber of Commerce for Italy, we have published periodically a selection of inquiries received by that Chamber from business houses in Italy which were anxious to open electrical and allied trade connections in this country. We now desire also to draw our readers' attention to another list of trade openings with Italy which is published in the *Journal* of the Italian Chamber of Commerce in London (Inc.). This list contains a large number of electrical inquiries from buyers and agents, and is well worthy of study by our manufacturers. Copies of the *Journal* may be obtained at the office of the Chamber, at 4, Queen Street Place, E.C. 4, where the secretary is able to give particulars of the name and address of any Italian inquirer, where such may be desired.

The Metric System in Belgium.—The local Syndical Chamber for machine tools, industrial products, &c., of Liége is complaining of the difficulties caused by the almost universal British habit of quoting for goods in other than metric measures. The honorary British Vice-Consul at Liége is repeatedly having his attention drawn to the same subject, and he points out that if United Kingdom firms wish to develop their trade in Belgium, quotations under the metric system are essential.—*Board of Trade Journal.*

The Appointment of British Agents Overseas.—Firms who are contemplating embarking on extended export trade schemes, may be interested in the following notice published in the last issue of the *Board of Trade Journal* :—

"Attention has been repeatedly drawn by Trade Commissioners and Consuls to unsatisfactory agency arrangements of British firms in overseas markets. It does not seem to be generally known that His Majesty's officers abroad representing this Department are able to afford valuable assistance to British firms who may desire information respecting agency arrangements, (*a*) by suggesting the names of firms likely to be suitable as representatives or agents in their areas, and (*b*) by answering inquiries as to local firms concerning whom information is desired. British firms who are seeking representatives or agents overseas are requested, in the first instance, to apply to the Department of Overseas Trade (Foreign Office and Board of Trade). Mr. Hamilton Wickes, H.M. Senior Trade Commissioner, who is attached to the headquarters of the Department, is prepared to interview firms requiring assistance and advice. It is advisable that the applicant desiring representation abroad should furnish information, when applying, on the following points :—

"1. Whether the goods of the applicant have been exported to the indicated territory ; and if so, in what manner.

"2. Whether the agent required is to be paid a commission, and how far financial responsibility on the orders secured is to be borne by the agent.

"3. Whether the representative required is to act as buyer for his own account.

"4. Whether the agent or representative required is to act in some other capacity."

Auction Sales.—Messrs. Edward Rushton, Son and Kenyon will offer for sale by auction, in one lot as a going concern, on June 17th, at the Thatched House Hotel, Manchester, the freehold land, premises, machinery and plant, and goodwill of the business of Messrs. Connolly Bros., Ltd., insulated wire manufacturers, Blackley Vale Mill, Manchester. By direction of the Disposal Board Messrs. G. N. Dixon & Co., will offer on June 17th and three following days, at Oldham Aircraft Factory, Hollinwood, Manchester, new electrical plant and material, including two 350-K.V.A. transformers, switchboards, motors, cables, &c. Particulars are given in our advertisement pages to-day.

Russian Ports not yet Open to Trade.—The following ports in Russia are not open to trade for the present :—

1. All Russian ports north of a line drawn from the estuary of the Dniester to the Gulf of Peretcop.
2. All Crimean ports, except Kertch, now in the possession of the Volunteer Army.
3. All ports on the northern shore of the Sea of Azof.

Further information on the above may be obtained from the Russian and Scandinavian Section, Department of Overseas Trade, Sunderland House, Curzon Street, Mayfair, W.—*Board of Trade Journal.*

Employment in the City.—The City of London Employment Committee is directing attention to the special facilities of the City of London Employment Exchange for filling vacancies of the professional, clerical and commercial type. This Exchange is the only London Exchange dealing exclusively with this class of labour, and is, therefore, able to place every week about 500 applicants, drawn from all parts of London.

The various Sections of the Exchange are as under :—

Men's and Disabled Soldiers' Section.—9, New Bridge Street, E.C. 4. Telephone Nos.: City 3485-6-7-8.
Women's Section.—50-52, Ludgate Hill, E.C. 4. Telephone Nos: City 3485-6 7-8.
Juveniles' Section.—5, Tudor Street, E.C. 4. Telephone Nos: City 1910-1.

Names of Belgian Importers.—During the past two months several thousand names of Belgian importers and agents have been received from the British Consul-General in Antwerp, and firms desirous of developing their trade with Belgium should communicate with the Belgian Trade and Reconstruction Section, Canada House, Kingsway, specifying the articles they wish to export.

Reconstruction Problems.—No. 26 of the grey Pamphlets (2d.), issued by the Ministry of Reconstruction, deals with the subject of "Natural Science in British Education."

Output of Iron and Steel.—The following statement as to production of iron and steel in the United Kingdom is issued by the Ministry of Munitions for the week ending May 3rd, 1919 :—

Pig Iron.

	Output in tons.	No. of furnaces in blast.
Hematite	56,000	99
Basic	44 000	74
Foundry, forge and other qualities ..	45,000	104
Alloys	6,000	13
Total.. ..	151,000	290

Steel ingots and castings, 157,000 tons.

New Swedish Company.—A new company has lately been formed at Malmo, Sweden, with a maximum capital of approximately £20,000, with the title Sydsvenka Kabelfabrik Aktiebolag, to establish works for the manufacture of electric cables.

Sir Auckland Geddes and Permanent Trade Policy.—The last meeting of the Consultative Council on Imports was held on Monday, June 2nd, at the Board of Trade, when Sir Auckland Geddes took the opportunity of thanking the Council on behalf of the Government, for the very arduous work which they had performed. He told them that, in the opinion of the Government, the work which they had done had proved to be of the greatest value to British trade, and had contributed substantially to securing employment throughout the country. He also informed them that, while they had been working at a transitional policy, other minds had been occupied in working out a permanent policy for the country, and that just as this was the concluding meeting of the Council, he hoped that, later in the day, he would attend the concluding meeting of those who had been working out in detail the proposals for a permanent policy. Sir Auckland said that it was obviously impossible for him at that time to indicate in any way the nature of the solution which had been arrived at of the many problems involved. He could, however, give them one indication of the complexity of the position. It was this, that the Exchanges were now roughly capable of division into two classes viz., those that were heavily against us, and those that were heavily in our favour, and that the difference was in some cases very great. Whatever policy was adopted would have to take full account of this great change in our economic position in comparison with what existed in 1914.

French Companies.—Z. Meeroff et Cie is the title of a company formed at Paris with a capital of 150,000 fr., for the manufacture of insulating substances in galenine and ebonite.

Under the style of Morel, Caramanos et Cie a company has been formed at Paris to carry out electric installations. Capital 70,000 fr.

By the issue of shares, the Société Etablissements Parvillée Frères purposes increasing its capital from 1,890,500 fr. to 4,000,000 fr.

The Licensing of Electrical Imports.—In reply to a question in Parliament by Mr. G. Lambert, Sir Auckland Geddes stated that bulk licences for the importation of electrical devices are issued by the Board of Trade to the British Electrical and Allied Manufacturers' Association for the importation of specified classes of articles up to specified amounts, and the Association distributes the licences among importers, whether members of the Association or not, but any individual has the right to make independent application for a licence. The importation of Autocall telephone apparatus is not at present prohibited. Examination of the decisions already published will show that no articles are refused admission if they are required for manufacture in this country and are unprocurable here.—*The Bulletin of the F.B.I.*

Copper.—The Cape Copper Co., last week, informed its shareholders that in consequence of the fall in the price of copper and the prevailing abnormally high working costs, resulting in heavy loss to the company, instructions had been given to suspend mining operations in Cape Colony. It is intended to carry out a certain amount of prospecting work during the period of suspension. Owing to the adverse conditions under which the company's operations have been carried on, no interim dividend can be paid on either the ordinary or preference shares.

Never Again! A French Electrical Reply to German Traders. *L'Electricite* publishes a letter received by one of its readers from a German firm offering to supply its specialities in a certain class of machinery. The reply of the French firm, the head of which is one of the most eminent of French electricians, was severe and conclusive. Recalling the fact that the law against trading with enemy firms still remained unrepealed, it stated that, with or without such law, no German machine would ever be received into the works of the firm in question at least unless such machine were delivered in exchange for one of the many machines stolen by the Germans from the French departments of the North. The German firm has not continued the correspondence.

End of a Johannesburg Strike.—Our Cape Town correspondent states that the building-trade strikers at Johannesburg, after one of the longest strikes in the history of South Africa have decided to return to work, having accepted the terms of the employers, viz.:—3s. 3½d. per hour for a week of 44 hours. When the men came out on strike they were receiving £7 10s. for a week of 48 hours. They resume work at £7 1s. 10d. for a week of 44 hours.

The 44-Hour Week in the Engineering Trade.—It is reported in *The Times* that the ballot taken by the Federation of Engineering and Shipbuilding Trades on the question of approaching the employers for a 44-hour week without a reduction in earnings has now been completed. The final figures were:—For the 44-hour week, 513,000; against, 15,000. The Negotiating Committee of the Federation is to meet this week to decide the policy to be adopted for giving effect to the above decision.

Our contemporary stated, on Saturday, that a scheme for amalgamating 14 Trade Unions in the engineering and allied industries, with 450,000 members and a capital of over 3½ millions, was adopted at a Conference at York. It will be balloted upon by members of the Unions concerned.

Peace Preparations at Beardmore's.—Sir Wm. Beardmore, in his speech at the annual meeting of William Beardmore and Co., Ltd., at Glasgow, after giving an account of the immense operations contributed by the company's different works to war productions of all kinds, referred to the various developments that had been arranged for in the manufacture of motor vehicles, tools and jigs, special steels and steel castings, all types of shafting, railway material and locomotives, &c. They had secured the rights to manufacture marine Diesel engines, and had undertaken a fresh campaign with the improved "Beardmore" marine crude-oil engines. Arrangements had been made for the adequate representation of the company in all parts of the world, which should ensure their obtaining a fair share of colonial and foreign trade.

Advertising British Goods for Export Trade.—It having been reported that the American Government were providing a large sum of money for advertising American goods throughout the world, a question was asked in the House, last week, whether the Board of Trade was prepared to take similar action in regard to the goods manufactured in the United Kingdom, so that our own manufacturers might not suffer in the markets of the world.

In reply it was stated that, in the opinion of the President of the Board, specific advertising of particular goods should be left to the firms individually concerned. The President was, however, considering, in conjunction with the Foreign Office, the general, but important, question of attracting attention in foreign markets to British industry.

A Strike Prevented.—A Berlin dispatch states that a threatened strike of employés at the Crefeld municipal electricity works was averted by the Commander of the Belgian troops in occupation taking strong action. He announced his intention, if there was a strike, of immediately putting 30 of the men with their backs to a wall and having them shot. The Workmen's Committee were to be first selected for this privileged treatment.

Social Evening.—The staff and foremen of the Edison-Swan Electric Co., Ltd., spent a delightful evening in the Staff Café at Ponders End Works, on Friday. The first part of the evening was devoted to a whist drive, prizes being successfully carried off by Messrs. J. R. Sells, J. S. Child, and J. Terrington. Subsequently a smoking concert was held under the chairmanship of Mr. J. Bacon, who explained that the gathering was in the nature of a "Victory" celebration, but was also designed to mark the merging of the old Committee responsible for the social side of the "Ediswan" Works into the newly-formed "Ediswan" Staff Association. Mr. J. W. Elliott next toasted the Committee. There was a good musical programme, and refreshments were served during the evening.

Trade with Brazil.—The British Chamber of Commerce in Brazil (Inc.) has issued the first number of its *Monthly Bulletin*. It is on the lines of the *War Bulletin* issued by the British Chamber of Commerce in Paris, and contains information on various matters of interest to manufacturers and exporters. The offices of the Chamber are at 51-53, Av. Rio Branco, Rio de Janeiro.

Book Notices.—Circular No. 76 of the Bureau of Standards "Aluminium and its Light Alloys." The physical properties of aluminium and its light alloys are described, and the effects of temperature, different manufacturing operations, and impurities upon these properties are discussed. Washington: Government Printing Office. Price 20 cents.

"*Journal* of the Franklin Institute." Vol. CLXXXVII. No. 5. May, 1919. Philadelphia: The Institute. Price 50 cents.

Trade Announcements.—Messrs. Wolseley Motors, Ltd., announce that Messrs. Vickers, Ltd., who hold the controlling interest in the company and in the Electric and Ordnance Accessories Co., Ltd., have decided to amalgamate certain departments of the two businesses, as from June 1st, 1919. Wolseley Motors, Ltd., have taken over the land, buildings and plant comprising the Ward End Works of the Electric and Ordnance Accessories Co., Ltd.; Wolseley Motors, Ltd., have taken over the motor-car, ordnance, and timken bearing departments of the Electric and Ordnance Accessories Co., Ltd.

The E. and O. Accessories Co., Ltd., will pay all accounts for goods delivered to that company, in connection with these departments, up to May 31st, 1919, but as from that date all goods already ordered will be received and paid for by Wolseley Motors, Ltd.

The E. and O. Accessories Co., Ltd., will collect all accounts due to that company for goods supplied up to May 31st in connection with these departments, but after that date all goods will be supplied and invoiced by Wolseley Motors, Ltd., and payments should be made direct to Wolseley Motors, Ltd., at Adderley Park.

Mr. T. Edwards, late of the R.A.F., has commenced business as an electrician at 1a, Chester Road, Winchester.

Mr. T. W. F. Day, who has served in Mesopotamia in the Electrical and Mechanical Section of the R.E., has recommenced business as an electrical engineer at 10, Union Street, Dewsbury.

Mr. C. R. E. Sinclair, who has been released from the Army, has commenced business as an electrical engineer at 25, Liverpool Lawn, Ramsgate.

Mr. H. Gardner announces that he has taken out a licence under the Non-Ferrous Metals Industry Act, and will deal in metals under his own name at 2, Metal Exchange Buildings, E.C. 3. He will have the co-operation of his son, Walter Gardner, and of several of his former associates in business. Last week Mr. Gardner's application for a licence was before the King's Bench Division, the Board of Trade having declined to grant one owing to Mr. Gardner's long and intimate business connections with enemy corporations. Evidence was given in detail, and, in the result, the Court unanimously decided in Mr. Gardner's favour. The Lord Chief Justice said that on the facts it appeared that he had done everything on the outbreak of war to divest himself of all enemy influence and association, and his object was now to carry on an English trade with English or British associations.

Mr. E. M. Munro has ceased to act as representative of Messrs. Brecknell, Munro & Rogers, in the London area, as from May 31st. He will, however, continue to act in an advisory capacity to the firm. Mr. A. M. Willis has been appointed as their representative in the London area, and all communications should in future be addressed to the head office in Bristol (Thrissell Street).

On being demobilised, Mr. George H. Yeo, 21, Abbotts Walk, Fleetwood, has re-started in business as an electrical engineer and contractor.

Catalogues Wanted.—Mr. Percy Jackson has recently started business as an electrical engineer and contractor at 104, Oldham Road, Manchester, and desires to receive trade catalogues.

Catalogues and Lists.—Alloy Welding Processes, Ltd., 149, Leadenhall Street, London, E.C. 3.—Advance copy of 20-page illustrated catalogue dealing with electric arc welding in general and the "A.W.P." electrode system (the Coated Electrode) in particular. Prices of the electrodes are tabulated, and the illustrations show repairs effected by the system and a micrographic examination of an "A.W.P." weld. Two Bulletins also received are as follows: No. 6, containing an expert report on the microstructure of electric arc welds made with these electrodes; No. 8, setting forth the superiority of "A.W.P." electrodes and alloy welding rods, and other matters.

Messrs. Belling & Co., of Edmonton, London, N. 18.—Several new illustrated and priced folders dealing respectively with electric kettles, boiling rings, and bath-water heaters. Space is left for printing in the name of trader.

Broom & Wade, Ltd., Hyatt Roller Bearing Department, High Wycombe.—Illustrated circular B 44, showing various types of standard fittings for their roller bearings for line shafting.

Sentinel Instrument Co., Ltd., 49, Shields Road West, Newcastle-on-Tyne.—Circulars relating to a series of new industrial instruments—Short "Rama" tank and standard thermometers, Short "Rama" steam pyrometer, Short "Rama" flue or oven pyrometer, "Rama" temperature alarms. Full catalogues are in preparation.

British Thomson-Houston Co., Ltd., Rugby.—Descriptive list No. 5,652 (8 pages) giving full particulars, with illustrations, of their automatic contactor panels for starting non-reversing direct-current motors.

Plant for Disposal.—Offers are invited for a complete suction gas plant installed at the Picturedrome, Tonypandy, Rhondda, consisting of one 32-h.p. Fielding & Platt gas engine, self-starting compressor, with gas-producing plant, water tanks, dynamo, and switchboards, &c. Rotherham Corporation has for sale a quantity of cast-iron valves and pipes in good condition. The Northampton Corporation tramways department has for disposal one 450-kw. Brush turbo-generator, Worthington-Simpson surface condenser, 250-cell Premier battery, two W. & R. direct coupled sets, two Paxman economic boilers, feed pumps, track and battery booster, switchboard, &c., &c. Full particulars, &c., in our advertisement pages to-day.

Bankruptcy Proceedings.—Wilson, H. W., consulting engineer and director, Liverpool.—First and final dividend 4⅜d. in the £, payable June 9th, at the office of the Trustee, 19, Castle Street, Liverpool.

Uncertainty and Unemployment.—The National Union of Manufacturers (Inc.) held a conference at the Central Hall, Westminster, on Friday last, at which the following resolution was passed on the motion of Mr. Neville Chamberlain, M.P., and Mr. George Balfour, M.P. :—

"This meeting, viewing with alarm the widespread unemployment throughout the country, the vast sums which are being paid weekly for unemployment pay, and the grave national loss occasioned thereby, desires to urge upon the Government that these conditions are largely due to uncertainty as to the future economic policy of the country in the absence of definite steps for the prevention of dumping, and the protection of key industries, which were promised by the Government at the recent General Election."

The chairman, Mr. Geo. Terrell, M.P., said that the difficulty had been to get the Government to make a move. A Committee had been restricting the importation of foreign goods. Its powers expired on September 1st, and we did not know what was to happen at that date.

Mr. Neville Chamberlain, in moving the above resolution, referred to the importance of the matter to the whole mass of the workers, and to the country which desired to preserve its equilibrium and its position among the nations. The expectations of the revival of industry after the arrival of Peace had not been fulfilled. The wheels were clogged. Returning men found that industry was at a standstill, and there was nothing for them to do. They could not continue taking unemployment pay without becoming demoralised in the process, and mentally and physically unfit for industry. Why was it that there was all this work crying out to be done which could not be commenced? Merchants, manufacturers and consumers were holding up their orders and their specifications. *The cause was uncertainty as to the future.* Uncertainty as to whether if they placed their orders the floodgates would not be opened before they could execute them, and other countries which had not had the same experience to pass through, would come in and flood the markets with goods, leaving them with high-priced and unsaleable stocks on their hands. The Government policy of import restrictions was partially satisfactory temporarily, but the transitional period was coming to an end in September. We could not expect people to put capital into new industries if they did not know what the conditions relating to those industries would be. Mr. Chamberlain mentioned among other matters the British cable-making industry, which employed 33,000 hands. Before the war they exported their cables, which had a high reputation, to all parts of the world—among other places, to Japan. They had been unable to do that during the war, and, as a result, the Japanese had built great factories, and, taking advantage of our inability to ship our goods, had made considerable inroads upon our trade in India and the Colonies, and to-day they were threatening our trade at home. It was not even fair competition. He had seen labels from Japanese cables which showed that they imitated our cables and marked them "C.M.A."—the mark of the British Association, with words inscribed almost identical, only they put in a little "not," which might very easily be overlooked. We wanted to give our men higher wages, but how was it possible to give 30s. to women and 56s. to men for a 47-hour week if we had to face unrestricted competition from those who received 6d. a day for 12 working hours? During the war the import of vulcanised fibre was restricted, and a British firm trebled its output and doubled the number of its hands, but as soon as the Armistice was signed and shipping became available, fresh imports came in at a lower price, and that firm had to discharge 90 of its employés. Take away uncertainty, and extensions now proposed would be put in hand, and we could give employment to a large number of additional workers. A later speaker, Mr. G. Balfour, M.P., said that orders for steam engines and pumps were being placed in Switzerland, and these were being manufactured there for delivery in this country. Negotiations had been going on for several weeks relating to a big order for rolling stock for South Africa. The American price was still 40 per cent. under the British price! Mr. A. Johnston said that we were asked to reconstruct industry, but we were not told how we could build industry on a shifting foundation. Japanese products must not be sold here at prices which would be profitable in Japan, but which were only about one-third of the production cost here.

Liquidations.—Bonecourt Surface Combustion, Ltd.—Winding-up voluntarily. Meeting of creditors held June 4th, at Parliament Mansions, London, S.W. Liquidator, Mr. E. J. Pilcher.

Canadian British Engineering Co., Ltd.—Meeting, July 3rd, at 20, John Street, Adelphi, London, W.C. 2, to hear an account of the winding-up.

Mirfield Garage and Electric Works.—Meeting, July 7th, at Prudential Buildings, Market Place, Dewsbury, to hear an account of the winding-up from the liquidator, Mr. H. Appleyard.

Officers' Guide to Civil Careers.—The Ministry of Reconstruction has issued No. 27 of its series of pamphlets on Reconstruction Problems. It is an officers' guide to civil careers, and contains a great deal of general information which should be useful to demobilised officers who have no occupation to which they can return.

Fire.—Damage estimated at £500 was caused by an outbreak of fire, on Friday, in the electric store at Parkhead Forge, Glasgow.

Non-Ferrous Metals Industry Act.—Additions to the list of licences granted under this Act appear in the *London Gazette* for June 3rd.

LIGHTING AND POWER NOTES.

Accrington.—L.G.B. Inquiry.—The L.G.B. is to hold an inquiry into the application by the T.C. to borrow £85.000 for extensions at the electricity works.

Year's Working.—Accounts of the electricity undertaking for the year ended March 31st, 1919, show a loss for the year of £1,698, as against a profit in 1917-18 of £2,169.

Price Revision.—The price of electricity is to be increased by a further 10 per cent., commencing at the end of the present quarter.

Australia.—The report of the Queensland Railways Works Commission recommends that an electric lighting system be adopted to supersede the present inadequate lighting arrangements, and that plant of sufficient power be installed to supply power and light for use in the yards and workshops.—*Tenders.*

Ballynahinch (Co. Down).—E.L. Scheme.—The electric lighting scheme is now before the L.G.B. for sanction. Excellent support is being given to the new company, which has a capital of £5,000, divided into £10 shares.

Belfast.—Extensions Scheme.—Sir John Snell's position in regard to his contract with the Corporation as consulting engineer for the extensions scheme was discussed at a special meeting of the Corporation on May 21st. A letter from Sir John Snell was read, stating that, in the event of the Electricity Supply Bill becoming law, the Government desired him to accept the position of Chief Electricity Commissioner and Chairman of the Commission, and asking the Council to agree to release him from his personal contract for this purpose. He added that, under the present difficulties of the situation, he would advise the retention of his partner, Mr. Rider, to see the present work through to its completion, as he knew more about present-day details than anyone else, and had designed the station and system. After some discussion the following resolution was passed :—"That the request of Sir John Snell to be released from his contract with the Corporation in the event of the Electricity Supply Bill passing into law be acceded to, subject to the adjustment to the satisfaction of the Corporation of all details as to the work done and fees payable covered by the said contract, and to his liability to the Corporation thereunder."

The Council then considered the tenders for the foundations of the new station, that of W. J. Campbell & Son, Ltd., being accepted.

Birkenhead.—Loan Application.—The electrical engineer has reported as to the necessity for installing high-tension plant in the vicinity of Beaufort Road and Woodside Ferry; application is to be made to the L.G.B. for sanction to borrow £21,300 for plant, including rotary converters, switchgear, transformers, and cables.

Birmingham.—Nechells Station.—Satisfactory progress is being made with the building work at the new generating station at Nechells. The foundations are almost completed, and a start will shortly be made on the steel superstructure. It is hoped to open the first instalment of 30,000 kw. of generating plant by the beginning of next winter.

Year's Working.—During the year the total units sold amounted to 140,938,720, as compared with 160,275,400 units in the previous year, valued at £942,819 and £852,554 respectively. The supply to the tramways totalled 28,168,169 units, valued at £185,384, as compared with 28,945,649 units and £164,232 in 1918. The increases in charges for electricity supplied account for the advance in the gross revenue: expenditure and costs per unit sold show substantial increases. The gross profit, with bank interest, £2,735, amounts to £272,896. After providing for all capital charges (including £99,990 for redemption), which absorb £180,571, and making provision for the calculated profit on the plant supplied by the Ministry of Munitions at Nechells, there remains a balance of £79,507. Of this the Committee has transferred to renewals and special expenditure fund £9,500 towards meeting capital charges accruing during the construction period in connection with the Nechells permanent station. After placing a further £50,000 to renewals and special expenditure, there remains a net surplus of £20,007, which it is proposed to transfer to the credit of the borough rates. The renewal and special expenditure fund now stands at £98,275, after the payment of £52,349 for special expenditure during the year.

Bolton.—Rate Relief.—Out of the profits for the year ended March 31st last, £2,000 are to be allocated towards the relief of the rates.

Price Increase.—The charges for electricity are to be increased by $\frac{1}{10}$d. per unit to general consumers.

Brighouse.—Year's Working.—The electricity undertaking accounts show a net profit for the past year of £114. Energy is taken in bulk from the Yorkshire Electric Power Co.

Burnley.—Proposed Loan.—The Electricity Committee is to borrow £2,500 for boiler extensions at the electricity works.

Mr. Lacey, retained as consulting engineer in regard to a scheme for new electricity works, has been asked by Sir John Snell to report to the Government Department on the general situation as it affects Burnley.

Chorley.—Loan Application.—The B. of G. has made application to the L.G.B. for sanction to borrow £10,000 for various improvements, including an electric lighting installation.

Continental.—France.—Under the style of the Union Française d'Electricité, a company has been formed at Paris, with a capital of 1.000,000 fr., for the distribution of electricity, the construction and working of electricity works, &c.

The mining and blast furnace, machinery, and electrical construction industries, have, by an agreement arrived at between the employers' and men's Unions, adopted the eight-hour day, which was to come into operation on June 1st.

The methods of handling goods at the Port of Marseilles are to be modernised. The whole system of cranes and travellers is to be worked electrically, electric vehicles are to replace hand-driven trucks, &c.

Spain.—*La Energia Electrica* gives the text of a Royal Order prescribing the establishment of a national network of electric distribution, fed from hydroelectric stations, and supplemented by poor coal steam generating plant at pit mouths, to make good the shortage in the dry seasons of the year. The scheme is expected to stimulate the growth of industries: allow of the conversion of the national railways, and render obligatory unification of voltages (three-phase at 50 periods) throughout Spain, with the concomitant gain of unification of types of material. Figures attached to the Order show the present available hydroelectric power to be 2,000,000 kw.

The Sociedad Hydro-Electrica Espanola, of Madrid, has recently secured a concession to put down plant to utilise the water power of the River Guadazon at Enguidanos (Province of Cuenca), to generate electricity.

Darwen.—Price Revision.—From the June meter readings, the scale of charges to power consumers are to be as follows:—With guaranteed quarterly consumption of 1,000 units up to 2,000 units, 1¼d. per unit, plus 95 per cent.; over 2,000 units per quarter, ¾d. per unit, plus 95 per cent.; 10,000 units and over, ½d. per unit net, plus 95 per cent.

Dundalk. — Electricity Charges. — The scale of revised electricity charges is as follows:—Power, from 1¾d. to 3¾d. per unit. Lighting: Private consumers, by meter, present rate of 9d. to stand, but existing discounts to be cancelled; small houses, from 1s. 4d. to 3s. per month per lamp, according to size of lamp in use; and heating and cooking, up to 400 units quarterly, 3d. per unit, and exceeding 400-units quarterly, 2d. per unit.

Loan Application.—Application is to be made to the L.G.B. for sanction to a loan to cover the cost of renewing the storage battery, and to include an amount to recoup the department for sums expended out of revenue to cover extensions of plant, mains, and services carried out during the past three years.

Dutch East Indies.—Water Power.—In Sumatra it is understood that the Tangga Falls, on the upper waters of the Aashan river, are to be utilised for generating electricity. The river issues from Lake Toba, and has a fall of nearly 300 yards in its run to the sea on the east coast of the island. The river and its possibilities were recently surveyed by an expedition.

Farnworth.—Street Lighting.—The T.C. is considering installing electricity for street lighting in a number of side streets in which cables are laid.

Fife.—The deputation from Kirkcaldy T.C. which visited the B. of T. in connection with the proposed extension of the electricity works, has reported to the Tramway and Electric Lighting Committee as follows:—The Committee's report states that Sir John Snell recommended that the T.C. should consent to the Fife Power Co. supplying Messrs. Hendry, provided the town's rights of distribution were preserved. He also suggested that a small addition to the plant in the present station should be made at a cost of from £17,000 to £20,000, and that in order to meet the existing demands of present customers while the alterations are going on, the Fife Power Co. might meantime be asked to supply 1,000 kw. The E.L. Committee is to ask the Fife Power Co. if it is in a position to give the supply mentioned.

Halifax.—Mains Extension.—The Tramways and Electricity Committee proposes to extend the E.H.T. main at Club Lane, Ovenden Road, up Ovenden Road to Cousin Lane, and thence with an overhead line to Mixenden, at an estimated cost of £1,746, subject to Messrs. E. Armitage & Son agreeing to pay half the cost.

Lichfield.—E.L. Scheme.—The R.D.C. has granted consent to electricity being supplied to Streetley by Sutton Coldfield T.C.

Llandudno.—Bulk Supply.—The Electricity Committee is in negotiation with the North Wales Power and Traction Co. with a view to taking electricity from the company in bulk for lighting, power, and heating purposes in the town.

London. — Loans. — The L.C.C. Finance Committee recommends the sanction of the Council to the borrowing of £3,902 by the Bethnal Green B.C. for electricity substation buildings; £7,618 by the Hammersmith B.C. for electrical plant, machinery-house services, mains, meters, &c.; and £18,390 by the Poplar B.C. for electrical plant at the generating station.

Portumna (Co. Galway).—A capital of £4,000, in £1 shares, is being raised for the local electric lighting scheme, and already over £1,000 has been subscribed.

Presteign.—Proposed E.L. Scheme.—A proposal is under consideration for the formation of a company to provide the district with electric lighting.

Manchester.—Barton Scheme.—The T.C. is to be asked to sanction the expenditure of £1,042,000 for the new electricity station at Barton. The Treasury having now removed the prohibition on the borrowing of £30,000 for the purchase of the land, it is proposed that application be made to the L.G.B. for sanction to borrow the whole of the money required for the new undertaking. It is expected that building operations will commence during the autumn

Peterborough. — Loan.—The Corporation is seeking powers to borrow £600 for the provision of a centrifugal pump and motor combined, and electrical control gear, for use at the electricity works.

In view of the proceedings in Parliament with respect to the Electricity Supply Bill, the Corporation has deferred for a month the question of appointing a consulting engineer to report on the proposed reconstruction of the electricity works.

Reigate.—Proposed Price Increase.—The T.C. has applied to the B. of T. for sanction to increase the maximum price of electricity by 1d. per unit, as from July 1st next. This would bring the price up to 50 per cent. above pre-war rates.

South Molton.—E.L. Scheme.—The T.C. has obtained the services of Mr. Padfield, Barnstaple Corporation electrical engineer, to advise the Council with reference to the installation of electricity in the borough.

St. Helens.—Loans.—The Local Government Board has sanctioned the borrowing of £2,650 for the purchase of additional equipment at the Burton Head Road sub-station of the electricity works. Application is to be made to the L.G.B. for sanction to borrow £1,700 to extend the mains in consequence of the increase in the load required for the Pocket Nook area.

Sussex.—Bulk Supply.—Proposals for a scheme for the supply of electricity in bulk in an area in East Sussex, embracing Hastings, Bexhill and district, were considered by the Bexhill T.C. last week. The E.L. Committee reported having received a letter from the Town Clerk of Hastings referring to a proposal now being considered by the Hastings Corporation for the acquiring of powers for the supply of electricity, from a bulk supply station to be erected at Hastings, to an area extending from Rye Harbour to Pevensey Sluice. The letter inquired whether the Council would be prepared to support an application by the Hastings Authority for the necessary powers in the event of its being decided to proceed with the scheme. The Committee was of opinion that the project was one which the Council should in principle approve, leaving for future deliberation all matters of detail. The recommendation was adopted.

Warwick.—L.G.B. Inquiry.—A B. of T. inquiry was held, last week, relative to the proposal of the Leicestershire and Warwickshire E.P. Co. to erect a generating station in the borough to replace the one at Emscote. The T.C. opposed, on the ground that the site was in a residential area and close to the King's School, and objection was taken to the smoke and grit emitted from such works and to the noise that would be created. There was also opposition on the part of residents in the locality.

Weobley.—E.L. Scheme.—The P.C. has passed a resolution in favour of electricity being supplied to the town from the munition works at Hereford by the Corporation.

Worcester.—Year's Working.—The accounts of the electricity works for the year ending March 31st, 1919, show an income of £32,235, an increase of £831. The costs of generation and distribution totalled £19,137, leaving a gross profit of £12,950, equal to 6·3 per cent. on the capital expended and 17·7 per cent. on the capital outstanding. After payments for interest, redemption, and income-tax charges, there was a profit of £1,808. £27,095 has been expended on new plant and cables since 1914; the outstanding debt has been reduced from £115,033 to £73,319. The total output of the year was 4,294,168 units, compared with 4,637,269 units last year, and the total works cost for the year was 1·04d. per unit sold, compared with ·77d. per unit last year.

York.—Loan Sanction.—The L.G.B. has granted the T.C. consent to the following loans:—Mains, £10,685; services, sub-station, and transformers, £4,315.

TRAMWAY AND RAILWAY NOTES.

Argentina.—Strike.—The tramway strike continues. Merchants and industrialists consider that energetic and immediate measures are called for

Australia.—Melbourne Railway Electrification.—On May 28th the first public electric service on the Sandringham-Essendon section of the Melbourne Surburban Railways was publicly inaugurated, and everything worked with perfect smoothness. This first section is 20 miles in length, but the whole system of railways being electrified includes some 150 route miles. It will be remembered that German manufacturers made a great effort to have the single-phase system adopted, but when it came to a comparison based on actual tenders, the 1,500-volt, D.C. system, which was ultimately chosen, proved much the cheaper, both in first cost and in operation. The work began in 1913, and has been carried out under the supervision of Messrs. Merz & McLellan, Westminster.

Birmingham.—Year's Working.—The report of the year's working of the Corporation tramway undertaking shows a gross profit of £318,741 plus £16,962 on motor-'buses account, making with sundry receipts a total of £337,720. Sinking fund and other charges absorb £148.862, leaving a net surplus of £188,408. Of this amount the Committee has placed £156.446 to reserve, and £16,962 to suspense account, leaving a balance of £15,000 to be credited to the borough fund. Fifty additional cars are on order, which it is hoped will be in service by the end of the year. The cost of the cars is estimated at £125,000, and the Committee recommends that the necessary steps be taken for borrowing that amount.

Blackburn.—Year's Working.—The annual report shows a net profit of £6,650, compared with £6,791 in the preceding 12 months. This balance is to be carried to the renewal account. The income from revenue was £94,992, against £80,361.

Bolton.—Rate Relief.—Out of the profits for the past year the Corporation Tramways Committee has decided to contribute £15,500 to the rates.

Buenos Ayres.—Strike.—The Anglo-Argentine Tramway Co.'s employés have demanded conditions which cannot be conceded unless fares are raised. The municipality was inclined to consent, but the employés demanded that the fares should not be raised, and a strike was called. On May 29th very few cars were running, and those were in charge of inspectors.

Canada.—Railway Electrification.—The Montreal Harbour Commissioners have decided to proceed with the electrification of the harbour railway tracks, and plans are now being arranged. This year the electrification will be pushed on as far as possible, and it is expected that the part of the system between Victoria Pier and Montreal East will be in operation by September 1st.

Continental.—Italy.—Under the style of the Societa Idroelettrica Cesalpina, has been formed at Milan a limited company for the purpose of supplying electricity for railway, tramway, and river traction purposes. The capital is 2,000,000 lire, extensible to 20,000,000 lire.

Belgium.—The Antwerp tramway employés were to resume work on May 26th, their dispute with the tramway company having been submitted to abitration.

Spain.—Application has been made by the Sociedad T. Fierro e Hijos, of St. Esteban de Pravia, for a concession to construct and work an electric tramway from Rebolleda to Ujo Taruelo, with branches from Figaredo to Turon and from Mieres to a station of the Ferrocarril del Norte.

The Sociedad Anonimà Tranvias Electricos de Granada has applied for a concession for the construction and working of a light railway, without State guarantee of interest, between Granada and La Zubia, the line to be worked by electricity.

The Compania Minera de Decido, of Bilbao, which some time ago acquired the iron mines of Decido, has introduced electricity into the mine for the transport of the ore from the galleries to the dump, use being made of accumulator locomotives for the purpose.

Application has lately been made to the Spanish Government for a concession for the construction and working of a "diagonal" electric tramway to connect the North and Meridional railway stations in Madrid.

The Sociedad Ferrocarril Electrico de Guadarramo has applied for a concession to construct and work an electric railway between Cercedilla and Puerto de Navacerrada.

France.—Paris is again in the throes of strikes, which are threatening to become general. The strikers include employés of the Metropolitan and Nord End Electric Railways. The former company has offered to consider a new pension scheme, but has given no decision with regard to the employés' demands for a minimum wage of 450 fr. per month and an eight-hour day under conditions laid down by the Union. Few trains were running on Tuesday morning, stopping at one station in about six; the entrances to the stations which remained open were guarded by police, and police officers rode in every train.

An electric train, travelling at nearly 40 miles an hour, crashed into a buffer-stop on Sunday night. Two people were killed and three injured.

Hastings.—Overhead System.—The Tramway Co. having asked the T.C. to consent to the overhead system being installed on the Seafront line, has represented to the Corporation that the present petrol-electric system is not reliable and is unsatisfactory, that the previous stud system is unworkable and condemned by the B. of T., and all other systems which have been carefully considered show no prospect of greater success, and that the overhead system has been proved in numberless towns to be the only method of providing satisfactory transport.

London.—Traffic Inquiry.—The following members have been appointed to serve on the Select Committee of the House of Commons to investigate the congestion in the existing means of transport in the metropolitan area, together with the question of fares:—Lieut.-Col. Sir F. Hall, Lieut.-Col. A. Pownall, Mr. Kennedy Jones, Mr. W. Lane Mitchell, Lieut.-Col. Archer-Shee, Mr. G. Balfour, Mr. Clement Edwards, Mr. J. D. Gilbert, Mr. C. F. Higham, Mr. H. Foreman, Mr. C. W. Bowerman, Mr. J. Jones, Mr. A. E. Newbould, Sir R. P. Goff, Major J. Nall. Mr. Kennedy Jones has been appointed chairman. The Committee was to commence its sittings yesterday to hear official witnesses from the B. of T. and from the Assistant Commissioner of Police, who is the licensing authority for public vehicles. The Committee will meet one day next week and four days the following week.

L.C.C.—The Highways Committee is to report on the question of tramway fares. The maximum number of women employed as conductresses on the Council's tramway system was 1.715, the number to-day being 1.250, and no women have been engaged as conductresses since the signing of the Armistice. Practically all the women who have left have done so voluntarily, and conductors are being replaced by returning men according to their seniority of service, and irrespective of sex.

Signal Failure.—Through the failure of an electric signal at Minories Junction, westward-bound passengers from Southend on the District Railway were stopped for nearly half an hour on Saturday morning near Bromley-by-Bow Station. Some got out and walked along the line to the station.

St. Pancras.—An alternative route to one proposed for linking up the tramways in the North and South of London was to be submitted to the St. Pancras Borough Council on Wednesday. Having refused its consent to the L.C.C. scheme to run tramways down Tottenham Court Road, the Borough Council discussed the matter with the Council. For the Borough it was pointed out that such a system would involve crossing Euston Road, where there is a constant through traffic, and would also congest Tottenham Court Road itself. The Council is prepared to consider as an alternative the construction of tramways connecting up with those at High Street, Camden Town, down Eversholt Street, Seymour Street, Woburn Place, and Tavistock Square. These, if continued down Woburn Place, Russell Square, and Southampton Row, in the Metropolitan Borough of Holborn, could be linked up with the surface tramways in Theobald's Road and the underground shallow tramways running down Kingsway to the Embankment, thus connecting the Northern and Southern systems.

Manchester.—The B. of T. has extended the time till August, 1920, for the completion of certain sections of the Corporation tramways.

Penge. — Railway Electrification. — The District Council has passed a resolution urging the Government to consider compelling the electrification of suburban lines, to relieve traffic congestion.

Preston.—Year's Working.—For the year ending March 31st last, there was an increase in the traffic receipts of the Corporation tramways of £14.452 over the previous year, the total receipts being £77,549. Working expenses increased £9.384, making a total of £52.877. There was a net surplus for the year of £8.876, and out of this £5.000 is being utilised for the relief of rates, and £1,500 has been added to the reserve fund, which now stands at over £56,000.

St. Helens.—It is necessary to renew three miles of trolley wire in the Rainhill Section of the tramway system from Brown Edge to Hanging Bridge Farm, and the necessary works are to be carried out.

Sunderland.—Track Points.—The Tramways Committee is now paying £70 5s. a ton for track points, compared with £16 a ton before the war.

United States.—The Broadway Association, formed some time ago to carry out a movement to improve New York's famous thoroughfare, recently sent out 15,000 invitations to business men asking them to offer suggestions. One proposal, of which more will be heard, is that of removing the tramway-cars as part of the general idea of beautifying the street.

Walthamstow.— Second-hand Cars. — The tramway manager has been asked to report as to the possibility of purchasing or hiring second-hand tramcars.

York.—New Car Shed.—Plans are to be prepared for a new tramcar shed to be erected on a site in Piccadilly.

TELEGRAPH AND TELEPHONE NOTES.

Atlantic Cables.—The Commercial Cable Co. now has all five lines working, a breakdown of one of its cables, last week, having been repaired. Another company was able to put a broken cable into service on May 29th, and the c.s. *Faraday* is engaged upon repair work in the Atlantic at the present time.

Austria.—The official summary of the Allies' peace terms to Austria states that the wireless station at Vienna is to be used only for commercial purposes, under supervision, for three months, during which Austria is not to build high-powered stations.

Canada.—The general strike at Winnipeg continues, and is said to be spreading to other cities. Postal and telephone operators refused to return to work, in spite of threats of dismissal. Wireless telegraphy has been used to communicate with other towns.

China.—In pursuance of the clauses of the wireless telephone agreement concluded in August last, the Marconi Co. on Monday signed a contract with the Chinese Government whereby both parties agree to form the "Chinese National Wireless Co.," with a capital of £700,000, each party subscribing half of this sum, for the purpose of setting up factories, probably at Shanghai, with auxiliary factories at Peking or Tientsin, for the maintenance of wireless equipment already installed, or to be installed, in the future. The Government will grant a special charter to the company.

London Telephones.—Telephone calls have now reached the highest pre-war figures, states the Postmaster-General. At the end of 1918 the daily number of calls in London was about a million ; it is now over 1,200,000. In March 3,196 new telephones were provided in London, and in April 6,417.

Wireless Direction-Finding Stations.—The *London Gazette* of May 30th contains an Admiralty notice to mariners (No. 1,019) as to wireless direction-finding stations. The notice gives regulations for these stations in Canada and Newfoundland, in the United Kingdom, and in the United States.

United States.—An ultimatum threatening a strike of all telegraphists, linemen, and telephone operators in the United States, on June 2nd, unless certain telephone operators recently discharged were reinstated, was presented by the officials of the Southern Bell Telephone and Telegraph Co. The Trade Unionists declared that the operators were discharged because they joined the Union. This is denied by the officials of the company. One of the latter is quoted by the Trade Unionists as saying that the question of reinstatement is "up to Burleson" (the Postmaster-General), referring to the fact that the telegraph and telephone systems of the country are operated by the Government as a war measure. The Trade Unionists later stated that they had received a telegram from Mr. Burleson asking them to take no decisive action pending investigation. Their reply, they said, was that the only way to avoid a strike would be the reinstatement of the discharged operators by noon on Monday. If a strike is called, they say it will affect many hundred thousand men and women.

On Monday 150 operators came out at Atlanta.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Aberdare.—U.D.C. Supplying and laying of cable. (May 30th.)

Atherton.—June 10th. U.D.C. 2,360 yd. ·1 × ·1 × ·141 in. twin-concentric, paper-insulated and plain lead-sheathed cable. (May 30th.)

Australia.—SYDNEY.—June 23rd. Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.*

Ballinasloe.—June 7th. Renewal of electric accumulator plant at District Asylum for Joint Committee of Management. Particulars from Resident Medical Superintendent.

Bethnal Green.—June 19th. Electricity Committee. L.T. cables and pipes, section pillars, house services and roadwork. (See this issue.)

Dublin.—June 5th. Electric Supply Committee. Supply and erection of one 1,200-amp.-hours storage battery, and removal and disposal of the old one. (See this issue.)

June 10th. Electric Supply Committee. Transformers and A.C. slot meters for two years. (May 30th.)

Edinburgh.—June 13th. Corporation. Excavating, &c., concrete work, steel re-inforcement, concrete piles, &c., in connection with the new generating station, Portobello. Mr. J. A. Williamson, Public Works Office, Edinburgh.

Eccles.—June 23rd. Electricity Committee. Supply and laying of three-way underground ducts ; supply and drawing-in 2,733 yd. of ·20 sq. in., E.H.T., three-core cable. (May 30th.)

Glasgow.—June 7th. Clyde Navigation Trustees. Electrical stores. Superintendent of Stores, No. 1 Graving Dock, Govan.

Heywood.—June 11th. Electricity Committee. One 400-KW. rotary converter, transformer, with switchgear and cable work. (May 23rd.)

Ilford.—U.D.C. Electricity Department. Supply of 350 yd. L.T. rubber-insulated, and 75 yd. E.H.T., 3-core, paper-insulated, lead-covered cable. (May 30th.)

Manchester.—June 10th. Tramways Committee. Supply, &c., of (*a*) 2 and 3-ton motor engines and chassis ; (*b*) light motor vans suitable for parcels delivery ; (*c*) motor car. Mr. J. M. McElroy, General Manager, Corporation Tramways, 55, Piccadilly, Manchester.

Middleton.—June 12th. Electricity Committee. One 1,000-KW. motor converter. (May 30th.)

Paris.—July 10th. Administration des Postes et Télégraphes. Supply of multiple commutator switchboards. Particulars from Direction de l'Exploitation Téléphonique, 4, Bureau, 103, Rue de Grenelle, Paris.

Tasmania.—LAUNCESTON.—July 28th. City Council. Sub-station equipment, battery, reversible booster, switchgear, &c. City Electrical Engineer.

West Hartlepool.—June 17th. Corporation. H.T. switchgear ; two 1,500-KW. transformers ; two 500-KW. rotary converters ; one cooling tower. (May 30th.)

Woolwich.—June 18th. Electricity Department. One 5,000-KW. steam turbine, with condensing plant and accessories. (See this issue.)

CLOSED.

Batley.—E.L. installation at the new picture house in Bradford Road. H. Hainsworth, Ltd.

Birkenhead.—Corporation :—

¾ mile ·2 sq. in., 1 mile ·1 sq. in., and ½ mile ·05 sq. in. cable, £864.—W. T. Henley's Telegraph Works Co., Ltd.

Glasgow.—Tramways Committee :—

Two 5-ton electric vehicles.—Electromobiles (Leeds), Ltd.
Cable.—Liverpool Electric Cable Co.
Steel plates.—P. & W. McLellan, Ltd.

Contracts for six months :—

Chilled iron brake blocks.—Miller & Co.
Iron castings.—D. King & Sons, Ltd. ; British Hydraulic Foundry Co. ; Carron Co. ; R. & A. Main, Ltd.
Malleable iron castings.—Alexr. Shanks & Son, Ltd. ; R. & A. Main, Ltd.
Steel castings.—Carotyne Steel Castings Co. ; Dickson & Mann, Ltd.
Springs.—L. Sterne & Co., Ltd. ; George Turton, Platts & Co., Ltd. ; Lion Spring Co., Ltd. ; Cocker Bros. Ltd.

Electricity Committee :—

Lift at Dalmarnock power station, £1,014.—Austin & Co.
Telegraphs, &c., £1,595.—Chadburn (Ship) Telegraph Co., Ltd.

Stores for 12 months :—

Cast-iron boxes, section pillars &c. Falkirk Iron Co. ; Lion Foundry Co. ; J. Allan, Sen. & Co. ; Carron Co. ; M'Callum & Hope.
Malleable iron tube and fittings.—Scottish Tube Co., Ltd.
Arc lamp carbons.—Beacon Carbons, Ltd.
Single cables, concentric and triple-concentric cables, E.H.T. cables.—Callender's Cable Co., Ltd.
H.T. cables.—W. T. Glover & Co., Ltd.
Rubber-covered cables and flexibles.—Craigpark Electric Cable Co., Ltd.

Halifax.—Tramways & Electricity Committee. Accepted :

500 tons of tramrails and 14 tons of fish-plates. Walter Scott, Ltd.
Three tons of fish-plate bolts.—Ibbotson Bros., Ltd.
Nine tons of tie bars.—Bayliss, Jones & Bayliss, Ltd.
1,000 fulcrum clips.—Ames, Costa, Ltd.

Recommended :—

1,500-KW. rotary converter, transformer and switchgear, at £7,486.—B.T.H. Co., Ltd.
Gravity bucket coal conveyor, at £3,414. Babcock & Wilcox, Ltd.

London.—HACKNEY.—Recommended. A.C. motor to drive dynamos (ex. No. 4 set) :—

	1,000 K.V.A. motor.	710 K.V.A. motor.
Bruce Peebles & Co., Ltd. (recommended)	**£2,662**	£2,412
Brush Electrical Engineering Co.	2,650	2,250
Vickers, Ltd.	2,596	2,212
Electric Construction Co., Ltd.	2,840	2,510
Siemens Bros. Dynamo Works, Ltd.	3,320	2,780
General Electric Co., Ltd.	3,445	2,730
British Westinghouse E. & M. Co., Ltd.	3,452	3,100
British Thomson-Houston Co., Ltd.	3,614	2,800
English Electric Co., Ltd.	4,990	3,700
Estimate	£2,660	

E.H.P. sub. switchboard at generating station :—

A. Reyrolle & Co., Ltd. (recommended)	**£1,041**
Ferguson & Pailin, Ltd.	1,094
Johnson & Phillips, Ltd.	1,120
British Thomson-Houston Co., Ltd.	1,132
Estimate	£1,500

Sub-station buildings :—

R. N. Marrable & Sons, Ltd. (recommended) **£5,617**

Sunderland.—Tramways Committee :—

200 tons of nails.—Bolckow, Vaughan & Co.
Uniforms.—H. Zokery & Co.

West Ham.—Education Committee :—

E.L. installation, Knox Road Special Schools. Commercial Telephone Co., £315.

FORTHCOMING EVENTS.

Royal Institution of Great Britain.—Friday, June 6th. At 5.30 p.m. At Albemarle Street, W. Lecture on "Atomic Projectiles and their Collisions with Light Atoms," by Sir E. Rutherford, F.R.S.

North of England Institute of Mining and Mechanical Engineeers.—Saturday, June 7th. At 2 p.m. At the Wood Memorial Hall, Newcastle-on-Tyne. General meeting.

Industrial Reconstruction Council.—Tuesday, June 10th. At 5.30 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "The Benefit to the Workman of Scientific Management," to be opened by Major Pells, R.E.

Wednesday, June 11th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture on "Social Work in Industry," by Sir Chas. Stewart.

Chief Technical Assistants' Association.—Thursday, June 12th. At 7 p.m. At Anderton's Hotel, Fleet Street, E.C. Paper on "Modernisation of Street Lighting," by Messrs. Young & Ingram. Discussion on "Condenser Problems," by Messrs. Callander & Heaviside.

Physical Society of London.—Friday, June 13th. At 5 p.m. At the Imperial College of Science, South Kensington, S.W. Special General Meeting.

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*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

NOTES.

Pay of Electrical Ratings in the Royal Navy.—The Jerram Committee's finding on the pay of lower deck ratings having been conformed by the Admiralty and the Government, the following increase in the daily pay of electrical ratings has come into effect :—Chief electrician, from 8s. 1d. (10s. 7d.) to 12s. 6d. ; chief electrician, second-class, 7s. 7d. (10s. 1d.) to 11s. 6d. ; electrical and Whitehead artificers, first-class, 7s. 1d. (9s. 7d.) to 11s. ; second-class, 6s. 7d. (9s. 1d.) to 10s. 6d. ; third-class, 6s. 4d. (8s. 10d.) to 10s. ; fourth class, 6s. 1d. (8s. 7d.) to 9s. 6d. ; fifth class, 4s. 3d. (6s.) to 6s. 6d. Telegraphists—Chief petty officer telegraphist, 4s. 11d. (7s. 5d.) to 9s., with triennial increases of 6d. ; petty officer telegraphists, 3s. 9d. (5s. 9d.) to 7s. 6d., and 7s. 10d. after one year, if recommended, and after three years in any case, and to 8s. 2d. after another three years ; leading telegraphist, 2s. 9d. (4s. 6d.) to 5s. 9d. after three years, and eventually to 6s. ; telegraphist, 2s. 1d. (3s. 7d.) to 4s. 3d., and eventually 4s. 9d. ; ordinary telegraphist, 1s. 3d. (2s. 3d.) to 2s. 9d. ; and boy telegraphist 9d. (1s. 3d.) to 1s. 9d. per day. The figures in brackets are the pre-war pay, plus bonus granted in February last.

London Unions for Joint Action.— An agreement between the Associated Society of Locomotive Engineers and Firemen and the London and Provincial Union of Licensed Vehicle Workers was confirmed at the annual conference of the former body. The object is to enable the two Unions better to protect the interests of their members employed by the London "combine" of tramways, omnibuses, and electrified railways. The two Unions have agreed, in the event of any dispute with the employers, or any section, to call out all their members. Before a strike is decided on by either Union it must notify the other with a view to joint negotiations for the purpose of avoiding a dispute if possible. —*The Times.*

British Oil.—"I am glad to be able to inform the House that the Government has struck oil at Hardstoft, in Derbyshire, one of the areas being tested by Messrs. Pearson in connection with the Government oil development scheme," said Mr. Kellaway, in Parliament, last week.

Work on the boring began in October last : on May 27th a depth of 3,075 ft. had been reached, and traces of oil were found. When work was resumed on the 28th the oil rose rapidly to a height of 400 ft. Boring had to be stopped to ensure the oil being kept under control and prevent flooding. The oil is of a light gravity and of good quality. The oil-bearing rock has been penetrated only a few inches. Seven wells are being sunk in the Chesterfield area, and it is hoped to touch oil any time now at Brimington, two miles north of Chesterfield, and at Renishaw, midway between Chesterfield and Sheffield.

Mr. Kellaway added that it was too early to base any sanguine estimates on what had been discovered, and it was impossible to form any definite conclusion as to the success of the discovery or whether oil existed in paying quantities, but the experts in charge of the work expressed themselves as satisfied with the prospects.

National Illumination Committee.—In view of the imminent resumption of international co-operation in the study of questions connected with the art of illumination and the sciences related thereto, a meeting of the National Illumination Committee of Great Britain was held on May 27th, at the Institution of Civil Engineers, when vacancies in the Executive Committee, due to the decease of Mr. W. Duddell, F.R.S., and Prof. Silvanus P. Thompson, F.R.S., were filled. The Executive, with the Institutions represented, is now as follows :—Chairman, Mr. A. P. Trotter (Illuminating Engineering Society) ; vice-chairmen, Mr. John Bond (Institution of Gas Engineers), and Mr. Kenelm Edgcumbe (Institution of Electrical Engineers) ; hon. sec., Mr. Haydn T. Harrison (Institution of Electrical Engineers); hon. treasurer, Mr. W. J. A. Butterfield (Institution of Gas Engineers) ; representatives on the Executive Committee of the International Commission on Illumination, Dr. Harold G. Colman (Institution of Gas Engineers), and Mr. Leon Gaster (Illuminating Engineering Society). The resumption of research work, &c., was considered, and a programme for further discussion at a meeting at an early date was settled.

Institution and Lecture Notes.—Institution of Electrical Engineers.—On Monday last the last of the "informal meetings" to be held this session took place, Mr. W. E. Warrilow presiding. The attendance was good. Major Kenelm Edgcumbe, R.E., opened the discussion on "The Vicious Circle of Increasing Prices," referring, first, to the fact that prior to the war this country's income from foreign investments totalled about 100 millions sterling, and the income received for services rendered by British shipping reached a similar sum, so that imports could exceed exports by about 200 millions sterling without danger. Now, however, conditions had changed, and it was imperative to increase the country's exports by at the very least 25 per cent. if stable conditions were to be maintained. Increased frugality was of the greatest importance so that the country could produce more ; increased productivity was imperative. With regard to profit-sharing, he mentioned that in some instances it had been found possible, after paying 5 per cent. on capital, to distribute profits amongst the workers. Before 1909 wages had increased, and the value of money had increased with them, now, unfortunately, it was otherwise, and wages continued to increase without a corresponding increase in purchasing power. He then proceeded to show that high wages did no real harm to the country itself, but, on the other hand, they were bound to react on the selling price of materials exported. Decreased hours, although possessing certain advantages, reacted on all, and had a tendency to lead to harm It was to be regretted that there were signs of certain trades attempting to browbeat the Government into giving them more favourable terms to the detriment of others. With regard to over-production, in his opinion, there was no fear of any such thing with modern manufacturing conditions. Finally, there were three partners in every concern—capital, labour, and management, and it should be realised that all must work together for the good of the community at large.

A spirited discussion followed, in which the question was discussed from all sides ; the need for better education, which should commence with the supervising class, was emphasised.

Referring to the projected visit to the National Physical Laboratory, the chairman announced that the visit was to be on a Saturday afternoon either this month or next, and the Committee was trying to arrange for the visit to coincide with that of the Students. In the afternoon there would be a trip up the river, about which particulars would be issued later. Next session the meetings would be resumed ; the time at which the first meeting would take place would be altered to 7 o'clock, and at that meeting the views of members would be ascertained as to whether it was most convenient to meet at an early or a late hour.

In view of the cessation of hostilities, the Council has decided to resume the annual dinner and conversazione of the Institution. A conversazione "to meet members of the Institution who have served in H.M. Forces during the war" will be held on Wednesday, June 25th, at the Natural History Museum, Cromwell Road. The annual dinner will be held at the Connaught Rooms, Great Queen Street, on Thursday, June 26th. Early application should be made for tickets.

Capt. L. B. Turner's paper on "The Oscillatory Valve Relay : a Thermionic Device," will be read and discussed on Monday, June 30th, instead of Thursday, June 26th.

Housing Scheme.—Work has been commenced on 26 houses that are being built at Lincoln under the Government's housing scheme. The houses are intended mainly for employés of Messrs. Barton & Hornsby, who have found part of the funds, and it is proposed to use waste heat and steam from the firm's works, and to have a system of central heating and hot-water supply to each house. Electricity will be used for lighting, cooking, street lighting, laundry power, and sewage pumping.

The British Science Guild.—The annual meeting will be held on June 17th, at 4.0 p.m., at the Goldsmiths' Hall. Speakers will be :—The Right Hon. Lord Sydenham, G.C.M.G., F.R.S., President of the Guild ; Major-General the Right Hon. J. E. B. Seely, C.B., D.S.O., M.P. ; Sir Joseph Thomson, O.M., President of the Royal Society ; and Sir Robert Hadfield, Bart., F.R.S. Cards of invitation to the meeting may be had on application to the Secretary, British Science Guild, 199, Piccadilly, W. 1.

American Society for Electrical Development.—The annual meeting of this Society was held at the Engineering Societies' Building, New York City, on May 13th. The main feature of the report was the review of the work done and an outline of the greater activities which the proposed expansion of the Society will permit. Although with reduced staff and expense, the Society continued its work during 1918. This was done largely through the daily newspapers, popular magazines, and the trade Press. Materials and data on electrical subjects were furnished to news agencies, special co-operative aid was rendered to moving-picture manufacturers, and prominent daily newspapers published special articles. In addition to this education of the public, the Society has distributed many interesting and instructive booklets direct to the industry.

Canadian Strikes.—The Cabinet has been in conference with representatives of the employers and labour, endeavouring to avert a general strike. The men insist on a 44-hour week, to which the employers will not agree. The Government claims that it has no power to enact an 8-hour day, as demanded, as the question is one for the provinces to decide. A strike at Toronto was declared on the morning of May 30th. The employers have offered the metal-workers a 46-hour week. Industries at Fernie, B.C., which are dependent on electrical power, were forced to suspend work owing to the strike of electrical workers in sympathy with the miners who have struck at Crow's Nest. The railway shops closed down also. The strike at Crow's Nest threatens materially to deplete the supply of soft coal in West Canada. At Winnipeg, where the strike first commenced some time ago, some employés are said to be returning to work, but the strike is still in progress.

Appointments Vacant.—Junior shift engineer (64s. 6d.) for the Dundee T.C. electricity department ; technical assistant (£300—£350) for the Salford Corporation electricity undertaking ; shift engineer for the Liverpool Corporation electricity works ; assistant instructor (£220) for wiring and installation work for Disabled Soldiers' and Sailors' Classes for the Croydon Corporation Education Committee ; cable jointer for S. Shields Corporation electricity department ; Professor of Physics (£500), two lecturers in civil and mechanical engineering (£400), lecturer in electrical engineering (£400) for the University of Hong-Kong ; city electrical engineer (£600) for the Carlisle Corporation ; chief clerk (£175 + £105) for the Walthamstow U.D.C. electricity department ; instructor for evening classes in electrical engineering (7s. 6d. per hour) for the Kingston-on-Thames Corporation Technical Institute ; teacher of electrical engineering (£230) and electrical wiremen's work for the day and evening classes, Barnsley Technical and Mining School. See our advertisement pages to-day.

Electrical Hospital Closed.—The *Times* states that the Dowager Lady Furness, 21, Grosvenor Square, announced that her electrical hospital for the treatment of officers and men, which had been running since October, 1915, was to close at the end of May.

Fatalities.—Before Sheriff Moffatt and a jury at Falkirk Sheriff's Court, an inquiry was held respecting the death of James Doig, switchboard attendant. According to the evidence, deceased was at work in the electric power station at Carron Works, when he came into contact with some live metal bars. Some of the switchboard lamps were not required, and had not been lit for some time. At the back of the switchboard there was a space of about 3 ft., guarded by a wire door, which was kept locked, but the key was left in the lock. One had to stretch over this space in order to adjust the connections for the lamps in front of the switchboard. Although it was not his duty to do so, Doig had wished to fix the connections for the lamps which were not lit, and asked a young apprentice to tell him how it should be done. The apprentice pointed out that he would require to be very careful, for if he touched the metal bars, he might get a shock. Doig evidently wanted more light, and when in the station himself had tried to make the necessary connections, and in doing so had apparently put his hands on the bars, and had thereby met his death. Verdict "Accidental death."

At the Yorkshire Copper Works, Stourton, near Leeds, last week, Thomas Armison (16), a labourer, employed there, received a shock and died in a quarter of an hour. He was carrying two long brass tubes, which came into contact with the electric circuit.

Educational.—The year ending July, 1918, was a memorable and trying one, but, in spite of that, the Borough Polytechnic Institute kept up its many activities, and did much good work, including war service. In number of students it has suffered, but the annual report shows that there were 2,094 students and members during the year, and out of 325 examination papers worked by evening students, 209 qualified for passes. Over 850 students and members voluntarily joined the Army, and of these over 100 had made the great sacrifice. Many distinctions were gained and many commissions obtained. The Board of Education having given up its examinations, the Governors have drawn up a scheme of Institute Exmaminations, the diplomas of which will, it is believed, be recognised outside the Institute as being of real value.

Early in the war the Farriery Institute, in Bermondsey, proved of service to the Army in training over 1,500 men belonging to the R.F.A., the R.E., and A.S.C. in cold shoeing. The Institute was also lent for the reception, inspection and dispatch of horse-shoes required by the Army. Instruction was given at the beginning of the war in telephony, wheelwrights' work and saddlery to 100 men of the R.F.A. and R.H.A. Over 30 men of the R.A.M.C. were trained in water analysis, and the chemistry staff took an active part, with other Polytechnics, in the preparation of drugs for local anæsthetics not previously made in this country, and also rendered services in utilisation of waste products, for which letters of thanks had been received. The engineers' workshop, with the staff, was given up to munition work, and over 10,000 inspection and other high-class gauges were manufactured, and successfully passed the tests of the N.P.L., and, finally, considerable attention had been paid to the training of disabled soldiers.

The Industrial League.—On Tuesday evening the Technical Press was entertained at dinner by the Executive of the Industrial League; the Right Hon. G. H. Roberts, M.P., Food Controller, and President of the League, was chairman, and welcomed the guests. Mr. H. E. Blain, Vice-President, Mr. E. J. P. Benn, and others, spoke. A report will appear in our next issue.

The Association of Consulting Engineers.—The annual dinner of this Association was held at the Connaught Rooms, London, on Friday evening last week, Mr. Frank Gill, Chairman of the Committee of the Association, presiding. Nearly 80 members and guests partook of an excellent menu, after which the usual toasts were honoured. The toast of "The Association of Consulting Engineers" was proposed by Mr. E. Honoratus Lloyd, K.C., who, in the course of his remarks, inquired what was meant by "reconstruction," about which so much was being heard at the present time. Did reconstruction mean nationalisation? In some quarters that interpretation appeared to be accepted, and if that were the case he would point to one or two organisations run by the Government, and ask whether the results of bureaucratic control had been a success. For instance, he did not think that anyone could be found who would admit that the telephone system had been anything but unsuccessful since it was taken over. Then there was the telegraph system and many others that could be instanced. Such results should be guarded against and avoided if possible, and it was the engineers who were counted upon to save the situation.

The Chairman, in responding to the toast, pointed out that in speaking of the evil results of Government control, it should not be forgotten that a Government department could not do things that a private concern could do. He had some experience at the Ministry of Munitions; that department had been given very wide powers, powers that no other Government Department had ever been able to wield; nevertheless, it was not possible to do all they would have wished to do. With regard to the Association, it was quite a young concern—that was their second annual dinner—but it had already justified its existence. The Association had not been formed with any antagonistic idea against similar institutions The Civil, Electrical, and Mechanical Institutions were all excellent as far as they went, but they were separate and individual bodies, and it was therefore felt that the present Association would find a useful sphere of activity. Its objects were co-operation and standardisation.

The "Future of British Industries" was proposed by Prof. Comfort A. Adams, President of the A.I.E.E., who, in the course of his remarks, said that the Americans regretted, and perhaps felt a little shame at, not having been able to take a greater share of the burdens of the world-war. America appreciated what Great Britain's share had been, and the engineers' contribution to the winning of the war had been a very great one. They all had great admiration for the achievements of the engineer during the last few years, and just as the successful issue of the war had depended on those achievements, so also would peace industries depend on them. It was appreciated in the States that British and American industries were bound up with one another, and that was the object of his visit to this country. Mr. Hobart and himself had come over on a mission of co-operation.

In replying to the toast, Sir John Snell said that after all that had been said about bureaucratic control, he was a little diffident in responding, seeing that he was there as a bureaucrat himself. Nevertheless, they did think there was some good in the Government Electricity Bill. In spite of all that had been said against it, they did really think that good results would be brought about. There were two fundamental points in connection with the scheme: they were the development of new industries and of agriculture. Fertilisers would have to be produced in the future by electricity if agricultural development was to be carried on in an adequate manner. Prior to the war Germany had numerous large factories producing fertilisers, and if it had not been for the nitrates which those factories had produced, Germany would not have been able to manufacture high explosives with which to carry on the war. Unfortunately, this country was not in a like position, but the conditions would have to be altered in the future. This country would have to make itself independent of foreign imports of nitrates, so that if the need should ever again arise, it could be defended against enemies, and in the meanwhile agriculture could be developed and intensified. Another matter was that of water power. In most other countries much hydro-electric power had been developed, but here nothing to speak of had been done; it had never even been thought of, and he thought the reason was to be found in the ridiculously low price of coal. So long as abundant supplies of coal at low cost were available no one had thought it worth while to trouble about water power in this country. The time had now come, however, when this matter should be given the serious consideration that it deserved. As an instance, Sir John mentioned that it would be possible to shut down the whole of the steam power in the Clyde Valley, with a consequent saving of something like 2,000,000 tons of coal per annum, if hydro-electric power were developed on proper lines.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station & Tramway Officials.—The Leeds Trades Council passed a resolution opposing the granting of £500 per annum increase to Mr. J. B. HAMILTON, the tramway manager. The chairman pointed out that the Labour members had agreed that a case for an increase had been made out. Unless Leeds paid a sufficiently high salary for such municipal offices the city would lose her best men, and be put to the expense of training other and less valuable men to take their places. One speaker said that Leeds easily spared Mr. Hamilton during the war to do other work, and they could do without him now.

Brighouse B.C. Special Wages Committee has been recommended to increase the salary of Mr. AMOS ASPINALL, electrical engineer, from £229 to £260 per annum, to include the present war bonus of £60 per annum.

The Dublin Electricity Supply Committee has recommended to the Council that Mr. MARK RUDDLE, late city electrical engineer, be granted, by way of superannuation, the usual two-thirds allowance of his earnings, which were £844 per annum.

The London County Council General Purposes Committee recommends that Mr. W. J. SQUIRES, Lieut.-Col. A. C. H. KENNARD, and the general manager of the Council's tramways represent the Council on the Metropolitan Municipal Tramways Council.

Captain H. M. TAYLOR, late borough electrical engineer, Middlesbrough, is now demobilised. Commissioned early in 1915 in the Royal Marines, he spent two and a half years submarine mining. He was then seconded for service with the Anti-Submarine Division of the Navy, and was in charge of one of their experimental stations. He resigned Middlesbrough at the end of 1915 in favour of his chief assistant, who was carrying on.

On the occasion of his leaving the Aberdeen Corporation electricity department, in order to proceed this week to Alberta to take up the position of accountant with the Calgary Electric Power Co., Mr. Stewart Robertson, formerly of the G.N. of S. Railway Co., was last week presented with a leather suit case as a parting gift from his fellow employés. Mr. J. A. Bell, the city electrical engineer, who made the presentation, referred to the work of Mr. Robertson in the office and in the runnig department during the past eight and a half years, and congratulated him upon his new appointment.

It is proposed to increase the salary of Mr. J. H. Cowell, tramway manager at Blackburn, from £500 to £600 a year.

General.—At the meeting of the Franklin Institute, on May 21st, the Franklin Medal was presented to Major-Gen. James Douglas McLachlan, C.B., D.S.O., on behalf of his Britannic Majesty's Government for Sir James Dewar, D.Sc., LL.D., F.R.S.; also to Major-Gen. George Owen Squier, Ph.D., of the U.S. Army. Major-Gen. Squier delivered an address on "Some Aspects of the Signal Corps in the World War." The address was illustrated by still and moving pictures, showing Signal Corps activities in France, and a number of Signal Corps communication devices were exhibited.

Lieutenant H. H. Gresswell, A.M.I.E.E., late I.O.M., R.A.O.C., who relinquished his commission on account of ill-health, has joined the Titan Electrical Co. as manager and engineer.

Mr. E. T. Driver, on demobilisation from the R.A.F., has taken up a position as technical expert in the Toronto office of the British Aluminium Co., Ltd.

Second-Lieutenant J. Watson, North Riding Fortress Engineers (Electric Lights Company), has relinquished his commission owing to ill-health, and retains his rank.

Captain H. Sherlock, Tyne Electrical Engineers, has been restored to the establishment, to which he was a supernumerary officer whilst employed with the Royal Engineers, of which he was an adjutant.

Lieutenant W. H. T. Norburn, Hants Fortress Engineers (Electric Lights Company), has been given the acting rank of captain whilst second in command of a field company, from January 21st last.

Second-Lieutenant J. P. Monson, City of Dundee Fortress Engineers (Electric Lights Company), and Second-Lieutenant J. Paton, Renfrew Fortress Engineers (Electric Lights Company), have been promoted lieutenants after the qualifying service of 18 months.

Mr. Arthur H. Pott, M.Inst.C.E., M.I.E.E., has resigned his position as general manager and engineer to the Metropolitan Electric Tramways, Ltd., and the London United Tramways, Ltd., and is starting in practice as a consulting engineer. He is still retained by the above companies in an advisory capacity. His address temporarily is c/o. Messrs. F. W. Hayne & Co., 80, Bishopsgate, E.C. 2.

Mr. Francis D. Larcombe, A.M.I.E.E., recently control engineer for the Yorkshire Electric Power Co., has resigned his position as assistant manager with the British Carbide Factories, Ltd., in order to take up a position with the contracts department of Callender's Cable & Construction Co., Ltd.

Captain E. A. Nash, who left Faraday House to join H.M. Forces, has obtained his discharge from the R.A.F. in order to join the staff of Industrial Publicity Service, Ltd., where he will be engaged in the preparation of the Federation of British Industries' export register.

Major C. M. Forster, Tyne Electrical Engineers, has been restored to the establishment of the regiment. Major Forster was commissioned in the Tyne Electrical Engineers in 1911, got his third star in October, 1914, and his "crown" in June of last year by brevet. He was promoted brevet-major for services during the war, and was recently attached to the Royal Engineers.

Lieutenant F. E. Burnett, East Riding Fortress Engineers (Electric Lights Company), has been transferred to the Territorial Force Reserve of Officers in the same rank, with effect from May 29th.

Lord George Hamilton has resigned the chairmanship of the Underground Rly. Co. of London, Ltd., and Sir Albert Stanley, M.P., late President of the Board of Trade, has been appointed in his place. Sir Algernon West has resigned his seat on the board. Sir Albert Stanley left on Saturday morning last for a visit to the United States. Mr. H. A. Vernet, the deputy-chairman, who filled the office of Paper Controller under Sir Albert at the Board of Trade, is acting as chairman of the company during Sir Albert's absence.

On Friday last, at the offices of the Harland Engineering Co., 196, Greengate, Manchester, a presentation was made to Miss Preston, typist, who had been in the service of the company for some little time, on the occasion of her approaching marriage.

With the approval of H.R.H. the Duke of Connaught, President of the Royal Society of Arts, the Council have awarded the Society's Albert Medal for 1919 to Sir Oliver Lodge, D.Sc., F.R.S., in recognition of his work as the pioneer of wireless telegraphy. The presentation will be made by the Duke of Connaught at Clarence House on 6th inst.

Miss W. Stroud has severed her connection with the Newman Electrical Co.

Last Friday, at the head offices of Messrs. Foote & Milne, Ltd., 66, Victoria Street, Westminster, the staff made a presentation to Mr. A. E. Catchpole, manager of the maintenance department, who is leaving to enter into partnership with Mr. C. B. Maurice (trading under the name of "Catchpole & Maurice," wholesale and export suppliers of electric cables, accessories and conduit fittings) at Albion House, New Oxford Street, London. Mr. K. Jolivard, in the absence of Mr. Milne, presented Mr. Catchpole with an attaché case, and a pipe, from the directors and staff.

The Portuguese Government has conferred upon Lieut. Egerton J. Ward, A.M.I.E.E., the Royal Irish Regiment, the Military Order of Aviz (Cruz de Cavalleiro).

Birthday Honours.—Congratulations to Mr. Charles Bright, F.R.S.E., M.Inst.C.E., whose name appears in the Colonial Office List in the Birthday Honours. The honour of Knight Bachelor is conferred upon him. Others who should be congratulated are:—

Mr. R. Meredith, C.I.E., Chief Engineer of Telegraphs in India, who is appointed C.S.I.

Mr. James Bailey, Deputy Controller, C.T.O., G.P.O., who is appointed a Companion of the Imperial Service Order.

Mr. W. Kingwood, director, Indo-European Telegraph Department, Persian Section, who is made a C.B.E.

Mr. W. F. S. S. Symes, electrical engineer, Delhi, Punjab, who becomes an O.B.E.

Roll of Honour.—Private E. C. Smith, Lancashire Fusiliers, who is now presumed killed, was previously employed by Messrs. Whipp & Bourne, Castleton.

Obituary.—Mr. Duncan McDonald.—The *Canadian Electrical News* records the death in Canada, after a long illness, of Mr. Duncan McDonald, former manager of Montreal Tramways, and inventor of the P.A.Y.E. car, at St. Agathe. He was in his early years a driver of the old horse cars in Montreal. In 1886 he went to St. Paul and Minneapolis, and secured a practical knowledge of the operation of electrical railways. On returning to Montreal he became superintendent of the Street Railway Co., and later went to Paris as engineer and managing director of 500 miles of lines in and around that city. He again went to Canada, and was appointed general manager of the Montreal Tramways Co., a position he resigned in 1912. Mr. McDonald served as controller for the city for two years. He was a member of the Institute of Civil Engineers of France, and of the English Institution of Electrical Engineers.

Dr. T. Erhard.—The death is announced from Freiberg, Saxony, of Dr. Theodor Erhard, Professor of Physics and Electrotechnics at the Freiberg Mining Academy.

Private G. Hutchinson.—We read in the *Times* that Private G. Hutchinson, Royal Defence Corps, electrician in the *Lusitania* when she was sunk, died at Cardiff on Monday.

Sir B. Redwood.—Sir Boverton Redwood passed away suddenly on Wednesday morning, in his 74th year.

REVIEWS.

Scientific Industrial Efficiency. By Dwight T. Farnham. Chicago: *Brick and Clay Record.*

If Mr. Farnham's book had applied exclusively to the brick and clay industry no apology would have been necessary for bringing it to the attention of the electrical public at a time when much new work depends on the provision of building materials for housing some hundreds of thousands of families needing accommodation. There is, however, much in the way of general principles to interest any "executive" contemplating the adoption of scientific management

A point that cannot too often be repeated here is that "a number of . . . educational institutions are preparing men to apply the principles and methods to the industries of the country" (*i.e.*, America).

The efficiency of a workman or of a factory is not, Farnham points out, a matter of opinion, but "the result of a careful application of certain scientific formulæ to existing conditions," and when the expert has finished his study and calculations, he "is able to tell you that a certain workman is, say, 70 per cent. efficient." Again "knowing that the exact amount of work he can do has been determined in such a way that attempts to deceive would be futile and that *rates once set will not be cut*, the workman is not afraid to let himself out and do his utmost. . . . In addition, time-saving and quality-improving innovations on the part of the workman are encouraged and rewarded, so that the workman is just as much in business for himself as the small shopkeeper . . . in that his reward is directly proportional to his application, foresight, and ability."

The author gives an interesting example of the Emerson bonus system of payment, whereby the workman's bonus increases .01 for each 1 per cent. increase in efficiency; efficiency being based on the "standard" time, *i.e.*, time fixed, by unit-time-study of work, as being necessary for, say, an average workman to do an operation. The formula is, of course,

$$\frac{\text{standard time}}{\text{actual time taken}} = \text{efficiency.}$$

Farnham is at one with every other scientific management engineer in emphasising the importance of the attitude of mind of the "owners" and "executive." The personalities of the management and of the consulting engineer are much if not everything. As to the latter, "*beware of the man who begins by recommending an immediate outlay for equipment* Efficiency doesn't mean a lot of new machinery. *It means first of all getting one hundred per cent. use out of everything you have.*"

There is much of value on the elimination of waste, and his question "how many . . . know what proportion of their coal is reaching the dump partially or wholly unconsumed?" would appear to apply to more than the brick industry!

The comparative ease and speed with which the system would appear to have been applied to the brick and clay industry, resulting in a doubled output, will arouse the envy of engineers manufacturing a more complex product, but the author's warning—"Successful results are secured not by youngsters fresh from college, or by hide-bound and prejudiced superintendents trying to apply half understood principles read in some book. *The work must be done slowly, carefully, and understandingly by trained men*" should be borne in mind.

A book for every manager of a brick, sewer-pipe, or hollow-ware factory—and for many more.

Frank J. Maurice.

NEW COMPANIES REGISTERED.

British Engineers' & Traders' Syndicate, Ltd. (155,402). Private company. Registered May 23rd. Capital, £50,000 in £1 shares (14,000 pref.). Objects: To carry on in the U. K., British Dominions, and foreign countries the business of manufacturers, merchants, brokers, factors, importers and exporters of electrical and mechanical machinery, apparatus, implements, rolling stock, hardware and general merchandise, manufacturers of and dealers in acids, oils, chemicals, metals, minerals and ores, &c., and to enter into agreements (a) with H. C. Siddeley and (b) S. I. Landau. The subscribers (each with one ord. share) are:—J. A. Hirst, Douacloney, Degenwy, North Wales, electrical engineer, E. N. Humphreys, 9-11, Old Bank Buildings, Chester, chartered accountant; C. H. Pearson, 7-8, Bury Court, St. Mary Axe, E.C., merchant; H. C. Siddeley, Australia House, W.C., engineer. The first directors are: J. A. Hirst, E. N. Humphreys, J. D. Hutchison, S. E. Landau, C. H. Pearson, and H. C. Siddeley. Messrs. Hirst, Humphreys, and Siddeley are appointed by the allottees of shares numbered 1 to 5,000, known as the "Engineering Group," and Messrs. Hutchison and Pearson are appointed by the allottees of ord. shares numbered 7,001 to 12,000, known as the "Strachan group." All new shares other than the first 12,000 ord. must before issue be offered to the existing shareholders. The qualification of a director is £250. The profits are to be applied first in paying a cum. pref. dividend at 7 per cent. on the pref. shares; and secondly, in paying a cum. pref. dividend at 10 per cent. on the ord. shares. Any surplus is to be divided into three parts one to be set aside as reserve, one to be paid to the directors as remuneration, and one to be applied at the discretion of the directors in paying a further dividend on the ord. shares, or for reserve or others. As regards the portion paid to the directors, one-third is to be paid to the Engineering Group, one-third is to be paid to S. I. Landau so long as he is employed by the company under a contract for whole-time employment, and one-third is to be paid to the Strachan Group. Solicitor: I. Turner, 26, Old Bank Buildings, Chester.

C. Oertling, Ltd. (155,506).—Private company. Registered May 24th. Capital, £20,000 in £1 shares. Agreement with H. R. A. Oertling, and to carry on business as manufacturers of balances, weights, and weighing and scientific instruments, &c. The subscribers are:—H. R. Oertling, The Hermitage, Barnes, balance and weight manufacturer; F. H. Nabler, 97a, Dalston Lane, Dalston, electrical engineer. Governing director: H R Oertling. Registered office: Turnmill Street, Farringdon Road, E.C.

Bandon Milling & Electric Lighting Co., Ltd. (4,715).—Private company. Registered in Dublin May 22nd. Capital, £25,000 in £1 shares (20,000 ord. and 5,000 cum. pref.). Objects: To take over the business of a miller and corn merchant now carried on by Joseph Brennan of Bandon, Co. Cork, at Coolfadda Mills, Bandon, and to carry on the business as indicated by the title. The subscribers (each with one share) are: J. Brennan, Bandon, merchant; M. C. Hickey, Bandon, merchant. First directors: J. Brennan, M. C. Hickey, and T. Brennan. Registered office: 27, South Mall, Cork.

Barraclough, Parker, Ltd. (155,443).—Private company. Registered May 24th. Capital, £5,000 in £1 shares (2,500 pref.). Tool makers, ironfounders, mechanical, electrical, and consulting engineers, manufacturers of dynamos, motors, motor vehicles, aeroplanes, airships, and engines, &c. The subscribers (each with one ord. share) are:—J. H. Barraclough, Dalemoor, Thornton, Bradford, general dealer; G. H. Barraclough, Dalemoor, Thornton, Bradford, electrical engineer; W. H. Parker, A.M.I.E.E., 18, Taunton Street, Shipley, Yorks. First directors: J. H. and G. H. Barraclough, and W. H. Parker. Registered office: 59, Market Street, Thornton, Bradford.

Leeds Autocars, Ltd. (155,496).—Private company. Registered May 27th. Capital £10,000 in £1 shares. To acquire the business of electrical engineers, motor-car agents, garage proprietors, &c., heretofore carried on as a branch business of Electromobile (Leeds), Ltd., at Neville Street, Leeds. The subscribers (each with one share) are:—F. E. Popplewell, Pinfold Lane, Halton, near Leeds, electrical engineer; J. Eastwood, 14, St. Ives Mount, Armley, motor engineer. Directors: J. W. Jessop, Harwood, Park Avenue, Roundhay, Leeds, grocer; J. A. Popplewell, The Grove, Halton, Leeds, grocer; F. E. Popplewell, and J. Eastwood. Registered office: 33, Neville Street, Leeds.

Victor Engineering Co. (Cullingworth), Ltd. (155,567).—Private company. Registered May 28th. Capital, £3,000 in £1 shares. To take over the business carried on at Cullingworth, near Keighley, as the Victor Engine Co., and to carry on the business of electrical, mechanical, sanitary, motor, civil railway, hydraulic, mining, and general engineers, aeroplane and airship manufacturers, &c. First directors: J. H. Southwell, Morningside, Denholme, Yorks, engineer; W. Holden, 26, Drewry Road, Keighley, Yorks, engineer. Solicitor: H. E. Smith, 33, Highgate, Bradford.

Mylan & Smith (Engineers), Ltd. (155,595).—Private company. Registered May 29th. Capital £5,000 in £1 shares. Agreements (1) with G. H. Smith, and (2) W. F. M. Mylan, and to carry on the business of electrical, mechanical, civil, and constructional engineers. The subscribers (each with one share) are.—G. H. Smith, 27, Cobham Road, Kingston-on-Thames, engineer; W. F. M. Mylan, 42, Meadow Bank Avenue, Sheffield, engineer. The first directors are: G. H. Smith and W. F. M. Mylan. Registered office: 10, East Parade, Sheffield.

Louis Dernier & Hamlyn, Ltd. (155,461).—Private company. Registered May 26th. Capital, £50,000 in £1 shares. To take over the business of lamp shade manufacturers carried on by W. Last and E. Dunand at 23, Newman Street, W., as Louis Dernier & Co., to purchase from the said W. Last and E. Dunand 2,201 shares in Kerswell, Faulkner and Hamlyn, Ltd., and to carry on the business of lamp shade and lamp manufacturers, makers of all accessories for electric, gas, or other lighting, workers in silk and other fabrics, &c. The subscribers (each with one ord. share) are: W. Last and E. Dunand, both lamp shade manufacturers, of 23, Newman Street, W.1. First directors: S. W. Hamlyn, Hanway Street Works, London, and the two subscribers. Qualification: 500 pref. and 500 ord. shares. Registered office: 23, Newman Street, W.1.

CITY NOTES.

Electric Construction Co., Ltd. The annual meeting was held on May 29th, at Winchester House, E.C. Mr. P. E. Beachcroft, the chairman, said that the improved results experienced during the last few years had been maintained, and the net profit showed an increase of £1,845, over that of the previous year. In 1917-18 the gross profit from manufacturing and contracting amounted to £112,644, and last year it was £121,364—an increase of £8,720—while the net profit had increased from £66,826 to £68,680. A larger proportion of gross profit was absorbed last year; in point of fact, there was an increase of £7,496 on the expenditure side of the profit and loss account. The amount brought forward, after payment of £22,819 for excess profits duty for the year ended March 31st, 1918, was £9,067, making with the net profits a total of £77,747. With the proposed transfer of £12,263 to the general reserve that fund would stand at £85,000, and constituted a very substantial safeguard, especially as three-fourths of it was invested in first-class negotiable securities. No serious dislocation arose in the works after the signing of the Armistice, but, of course, considerable inconvenience and delay occurred in changing over from war contracts to their ordinary commercial work. The volume of orders that they had since obtained had been beyond their capacity, and they had been obliged to name long periods for delivery. After giving the matter very careful consideration, the board had decided to proceed with an extension of the works, and when the additions were completed they would have one of the largest and best equipped workshops under one roof in this country. Proceeding to refer to the Government Bill for the establishment of Electrical Commissioners, who would have the power to create districts, and constitute for each district a District Electricity Board, the Chairman explained that every Board would be charged with the duty of providing a cheap and abundant supply of electricity, and for that purpose a number of very large generating stations were to be erected. Those stations would not only give rise to a large demand for electrical machinery, but would render practicable the electrification of the main lines of the railway companies, which, in turn would require a large amount of electrical apparatus. It followed that if supplies of electricity were available at lower prices than hitherto, the demand for power for ordinary commercial purposes would be largely increased, necessitating a large number of motors and accessories. Some time might elapse before the scheme developed, but the directors considered that their immediate requirements and the prospects in the future warranted them in making provision for a large and permanent demand for their products. To provide the necessary funds, last March an issue of 78,500 ordinary shares, the balance of the authorised share capital, was made at 21s. 6d. per share, and the issue was fully subscribed. If necessary, the contractors would be able to complete the extension in the autumn. Referring, in conclusion, to the labour situation, he said that the necessity of increased production could not be too strongly urged, and he was confident that employers would be only too pleased to see the present high rate of wages maintained permanently, if they could get a corresponding increase in output. The report was adopted.

Bombay Electric Supply & Tramways Co., Ltd. The total revenue for 1918 was £512,756, an increase of £72,907, or 16.57 per cent. Total expenditure £217,805, an increase of £34,348, or 18.72 per cent. Net receipts from the year's working £294,951, an increase of £38,559, or 15.04 per cent. Deducting interest on debenture debt (£33,388), provision for depreciation account (£56,667), capital amortisation fund (£16,350), Indian super tax (£644), contribution to officers' and employés' provident fund (£6,989), there remains an available balance of £180,914; £6,768 was brought forward, making £187,682. The directors recommend a dividend for the year on 6 per cent. cumulative preference shares, and a final dividend for the half year on Ordinary shares at the rate of 14 per cent. per annum and a bonus for the year at the rate of 2 per cent. per annum, making 16 per cent. for the year (both free of income tax to shareholders domiciled in India), to set aside as bonus to officers and employés £6,167, and to carry forward £12,716. Gross receipts from the company's traction branch amounted to £261,594, an increase of £33,534, or 14.70 per cent. Working expenses were £118,682, an increase of £16,541, or 16.19 per cent. Net receipts amounted to £142,912, an increase of £16,993, or 13.49 per cent. Gross receipts from electric supply, including the amount represented by sale of current to the tramways, amounted to £234,805, an increase of £26,784, or 12.87 per cent. Working expenses were £97,702, an increase of £17,990, or 22.56 per cent., net receipts being £137,102, an increase of £8,793, or 6.85 per cent. Capital expenditure during the year amounted to £137,062. The premium realised on the issue of the 11,000 additional ordinary shares at £20 per share amounting to £110,150, less expenses, has been carried to the reserve fund, and it is proposed to meet the excess profits tax for the year, after it has been assessed, out of that fund. —*Financial Times.*

Delhi Electric Tramways & Lighting Co., Ltd.—For 1918 the gross receipts of the tramway undertaking were £14,828, and those of the electric supply undertaking £28,736, an increase in each case of approximately 11 per cent. over 1917. The combined undertakings show a net revenue of £18,010, against £15,119 for 1917, a satisfactory increase considering the adverse conditions. The profit for the year, after charging general expenditure in London and Delhi, and debenture interest, and after providing £6,000 for depreciation of plant and equipment, and a reserve of £1,500 for taxation in India, was £6,767, plus £1,508 brought forward. There is written off preliminary expenses £1,000, 6 per cent. is paid on the preferred share capital, and £1,275 is to be carried forward. The plant and equipment, including rolling stock, have been maintained in good condition, having regard to the difficulty of obtaining spare parts of all kinds. Additions to plant during 1918 cost £1,137. The provision of further plant, equipment and mains required to meet the growing demands is receiving consideration.

Peel-Conner Telephone Works, Ltd.—For the year ended March, 1919, the profit and loss account shows a net profit of £39,469, less £3,999 written off goodwill. There has been put to general reserve £10,000 and to depreciation reserve £5,000, leaving £20,470, plus £5,090 brought forward. The preference dividend (5 per cent.) absorbs £5,000, a dividend of 2s. and a bonus of 1s. per share on the ordinary shares, free of tax, requires £12,000, and £8,560 is to be carried forward. (The ordinary shares are 1s. shares, numbering 80,000 = £4,000.) The works have been fully employed throughout the year, which accounts for the satisfactory results. The outlook for the coming year is most encouraging. Mr. M. J. Railing has been appointed an additional director.

Companies Struck Off the Register.—The following companies have been struck off the Register, and are accordingly dissolved :—

Amp Welding Co., Ltd.
Bergasse Rotary Engine (Parent Co.), Ltd.
Electrical Watch Cases Works, Ltd.
Industrial & Engineering Trust, Ltd
Launa British Electrical Co., Ltd.
Nottingham Boiler Scale Dissolving Co., Ltd.
Power & Traction, Ltd.
Railway & Tramway Trust, Ltd.
Thermal Metal Separation, Ltd.
Wall Power Unit Co., Ltd.

Auckland Electric Tramways Co., Ltd.—Mr. Tegetmeier presided at a special meeting held in London, last week, at which approval was given to the proposed sale of the undertaking to the Auckland Corporation. The amount which will be paid in Corporation debentures will enable debenture and preference holders to be paid in full, and ordinary shareholders are practically certain to receive something in excess of par value.

Mexican Northern Power Co.—Meetings of holders of the 6 per cent. prior lien bonds and the 5 per cent. first mortgage bonds are to be held in Toronto on July 16th to consider a scheme of arrangement prepared by the First Mortgage Bondholders' Committee. It is proposed to sell the assets to a new company, the Northern Mexico Power & Development Co.

Barcelona Traction, Light & Power Co.—The "Times" states that in accordance with the reorganisation scheme 1 per cent. will be paid on June 2nd next, in full discharge of the half-year's interest due June 1st, 1919, on the 5½ per cent. first mortgage 50-year bonds.

Aluminium Corporation, Ltd.—The "Financial Times" states that funding certificates are to be issued for three years' arrears of dividend on the preference stock. The funding certificates will amount to £22 1s. per £100 stock held, or 4s. 4.92d. per £1 stock.

Doulton & Co., Ltd.—After providing for debenture interest and income tax, and including £51,203 brought forward, there is a balance on revenue account of £69,032. Out of this has been paid the Preference dividend for one year (1917), and £51,532 is to be carried forward.

Colombo Electric Tramways & Lighting Co., Ltd.—For 1918 the profit was £40,965, and after putting £19,700 to general reserve and renewal fund, and paying a dividend of 10 per cent., free of tax, £8,181 is to be carried forward.

Castner-Kellner Alkali Co., Ltd. Interim dividend at the rate of 12 per cent per annum for the half-year ended March

Kalgoorlie Electric Power & Lighting Corporation, Ltd.—Profit for 1918 £10,622, against £15,910 for 1917 This large decrease is a matter of anxiety to the board It is largely the result of conditions prevailing on the goldfield, there is now some improvement in these.

Siemens Bros. & Co., Ltd.—Profit for 1918 £229,647, plus £134,920 brought forward. Interim dividend 5s.; final dividend 5s., free of tax. The £5 shares are to be divided up into £1 shares.

Hydro-Electric Power & Metallurgical Co.—According to the financial Press, details of a scheme to put this company on a sound financial basis and to carry out the proposals of the ordinary shareholders in London have been issued to the London shareholders. The scheme includes the creation of 115,000 preference shares of £1 each, of which 70,000 will be issued in Australia in exchange for the existing 70,000 preference shares, and 45,000 are to be on the London register for issue in England.

Stock Exchange Notices.—The following are to be officially quoted :—

British Westinghouse Electric and Manufacturing Co., Ltd. —185,000 8 per cent. cumulative preference shares of £2 each, fully-paid (Nos. 200,001 to 275,000 and 575,001 to 685,000).

Application has been made to the Committee for the following to be officially quoted :

General Electric Co., Ltd.—46,500 ordinary shares of £10 each, fully-paid (Nos. 57,501 to 90,000 and 106,001 to 120,000).

Brazilian Traction, Light & Power Co.—Quarterly dividend 1½ per cent. on the preference shares.

Canadian General Electric Co.—Quarterly dividend of 2 per cent. for the three months to June 30th on the common stock.

STOCKS AND SHARES.

Tuesday Evening.

Immediately after Whitsun is the time generally accepted as likely to see the advent of the new Consolidation Loan. The boards are being prepared and the stage dressed for what will no doubt be described (and correctly) as the greatest financial event in history. Meanwhile, no secret being made as to the imminence of the issue, the investing public, and some of the speculators too, are not eager to embark upon other, and existing, channels of enterprise, pending the Government's appeal. For, if rumour prove correct in having attached a premium-bond flavour to the new Loan, there will certainly be a lively rush for the stock, and a corresponding neglect of other things.

The market for electricity supply shares has steadied, and no further fall has taken place by reason of the Electricity Bill. From what can be ascertained from circles interested in London, the impression is that the Bill will be amply amended in several directions, and that holders in the companies will be no worse off than they were before. Conceivably, the change might be to their advantage, if it removed the insecurity that has handicapped the market through the fact of the companies' tenure being determinable, upon uncertain terms, in 1931. Were some broad scheme of working evolved, whereby the London undertakings' lives were extended for a good long period, it is as likely as not that this in itself would be held a strong bull point from the standpoint of the patient proprietor.

Little sympathy was shown in the Stock Exchange to the materialist who lamented the coming of peace at the particular season of the summer time when illuminations would bring in least profit to those providing artificial light.

The manufacturing group is quiet, and shows few variations of consequence. Babcock & Wilcox recovered to 4, on consideration of the report. A fairly widely-circulated tip has gone round the provinces to buy British Aluminium, but the price is unchanged at 45s. Castner-Kellners gave way rather sharply on disappointment that the interim dividend is 6 per cent. actual, against 9 per cent. a year ago. India-Rubber shares have risen to 17⅝, and Henley's hardened to 2 7/16, although the preference eased off to 75s.

Home railway stocks are slightly better as a whole. Buying is said to have been inspired by the oil discoveries at Chesterfield—a rather fantastic idea. There are men, however, who assert their belief that if the cost of coal goes much higher, and there is any serious fear of further shortage, even the conservative British railways may take up the question of oil-fuel as offering a solution of their coal difficulties. This would be, of course, no entirely novel departure, and if oil is proved to exist as a commercial proposition in this country, it and the Trade Unions might work an unexpected revolution in the railway world.

The handing back by the United States Government of the telegraph and telephone companies to their own shareholders has coincided with threats of a huge strike involving all the telegraphists, linemen, and telephone operators throughout the country. There is not much stock of these companies now held over here, but shareholders in some of the Anglo-American cable concerns are beginning to ask how far such a strike might affect their interests. The rapid spread of movements of this kind is familiar in our own country, as well as abroad Anglo-Argentine Tramways first preference have weakened on the strike that seems to have involved half of Buenos Aires, which is the more unfortunate in that the Anglo-Argentine Tramways has started to recover its position, and the recent traffics have shown satisfactory expansion

The recent big rises in British Columbia Electric Railway stocks, on the declaration of a 2½ per cent. dividend on the preferred, lends peculiar interest to a circular issued by the company on the subject of its fares. The company claimed the right to charge a six-cent fare, and now, to quote the board's notification, "the company is required to deposit in a bank the difference between the five-cent and six-cent fare, pending determination by the Commission as to what is a just and reasonable fare to be charged in Vancouver. If the Commission decides in favour of the six-cent fare the whole amount will be released to the company, but if the rate determined be less than six cents the difference between the fare allowed and the six cents is to be paid to the Vancouver General Hospital, and the balance, if any, to the company."

Marconi shares dipped a little below 6 on sales by those who felt somewhat nervous as to the result of the action, the last stage of which opened on Monday in this week, brought by the company against the Crown, to recover compensation for breach of agreement to erect a chain of six wireless stations round the Empire. Sir Edward Carson, for the Marconi Co., said the basis of the claim was that, roughly, for 1916 they would have done a traffic equal to one-third of the cablegram business for that year, and that the wireless traffic would have increased 10 per cent. each succeeding year. Prices of the subsidiaries are almost unchanged, Marines keeping hard at 3½, while Americans and Canadians drooped to 29s. and 16s. respectively.

Mexican matters are once more in the melting pot in consequence of the reappearance of the guerilla chief, General Villa. Prices of the Utility issues have not gone back much, despite sharp declines in some of the Mexican railway and mining descriptions. Brazilian Tractions are easier at 61½. Calcutta Tramways ordinary are 5s. higher at 7⅝. The Canadian labour troubles have made some of the Canadian Utility shares give way slightly.

Rubber shares remain a languid market, and there is not much doing amongst armament descriptions. Mining markets exhibit a heavy tendency, in which tin and copper shares participate.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1917.	Dividend 1918.	Price June 3, 1919.	Rise or fall.	Yield p.c.
Home Electricity Companies					
Brompton Ordinary..	10	8	6¾	—	£5 8 18
Charing Cross Ordinary	4	4	8½	—	6 3 1
do. do. do. 4½ Pref...	4½	4½	8¼	—	6 18 4
Chelsea	6	8	8⅝	—	4 2 9
City of London	8	8	11⅞	—	6 14 6
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	5¾	—	5 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref...	6	6	3⅞	—	7 14 10
Metropolitan	4	5	8⅛	—	8 0 0
do. 4½ per cent. Pref. ..	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	5	6	2¾	—	7 5 6
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	9	8	6⅛	—	6 10 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	100	+1	6 0 0
do. Def.	1½	83/6	22¼	—	7 8 0
Chile Telephone	8	8	7	—	6 14 4
Cuba Sub. Ord.	7	7	11	—	*8 4 5
Eastern Extension	8	8	16⅜	—	*4 17 9
Eastern Tel. Ord.	8	8	166½	—	*4 16 1
Globe Tel. and T. Ord.	7	8	16⅛	—	*4 19 3
do. do. Pref.	8	6	10⅝	+⅛	6 13 0
Great Northern Tel.	22	22	82	—	6 17 6
Indo-European	13	13	55	—	6 18 2
Marconi	20	20	6	−⅛	3 6 8
Oriental Telephone Ord.	10	15	2⅜	—	6 6 4
United R. Plate Tel.	8	8	8 3/16	+¼	*4 17 9
West India and Panama	1/3	1/3	1 7/16	−3/32	*4 6 4
Western Telegraph	8	8	17¼	—	*4 12 9
Home Rails.					
Central London Ord. Assented ..	4	4	83½	—	8 6 0
Metropolitan	1	1½	26½	—	4 14 4
do. District	Nil	Nil	24½	−½	Nil
Underground Electric Ordinary..	Nil	Nil	3⅞	—	Nil
do. do. "A" ..	Nil	Nil	10/9	+3d.	Nil
do. do. Income ..	4	5	95½	—	*5 3 8
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	8⅝	−⅛	—
do. do. 2nd Pref. ..	—	—	8¼	—	—
do. do. 5 Deb... ..	6	5	68½	—	7 8 5
Brazil Tractions	—	—	61½	−½	—
Bombay Electric Pref.	6	6	10¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	63½	+1	7 17 6
do. do. Preferred	Nil	2½	47½	+1	5 5 8
do. do. Deferred	Nil	Nil	44½	+1	Nil
do. do. Deb. ..	4½	4½	62	—	6 17 4
Mexico Trams 5 per cent. Bonds..	Nil	Nil	63½	+1	Nil
do. 6 per cent. Bonds..	Nil	Nil	52½	−1	Nil
Mexican Light Common	Nil	Nil	87	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	70	—	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	4	+⅛	3 15 0
British Aluminium Ord.	10	10	1 11/16	—	5 18 6
British Insulated Ord.	25	12½	2¼	—	5 11 1
British Westinghouse Pref. ..	7½	8	2 5/16 xd	—	6 4 9
Callenders	25	25	10¼	—	6 3 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	8xd	−⅛	6 13 4
Edison-Swan, "A"	—	—	1 9/32	—	5 17 0
do. do. 5 per cent. Deb. ..	4	5	75½	—	6 12 8
Electric Construction	10	10	1 9/32	—	7 16 0
Gen. Elec. Pref.	8	6½	10½	—	6 3 10
do. Ord.	10	10	21½	—	*4 13 0
Henley	25	25	2 7/16	+1/16	6 2 6
do. 4½ Pref..	4½	4½	3¾	−⅛	6 0 0
India-Rubber..	10	10	17⅝	+⅛	*6 13 6
Siemens Ord...	—	10	6 13/16	—	*7 4 0
Telegraph Con	20	20	25½	—	4 13 6

*Dividends paid free of Income Tax

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 4th.

CHEMICALS, &c.		Latest Price.	Fortnight's inc. or Dec.
a Acid, Oxalic	per lb.	1/5	..
a Ammoniac Sal	per ton	£80	..
a Ammonia, Muriate (large crystal)	,,	£78	..
a Bisulphide of Carbon	,,	..	..
a Borax	,,	£39	..
a Copper Sulphate	,,	£42	..
a Potash, Chlorate	per lb.	1/3	3d. dec.
a ,, Perchlorate	,,	1/3	..
a Shellac	per cwt.	£16 10/-	10/- inc.
a Sulphate of Magnesia	per ton	£15	..
a Sulphur, Sublimed Flowers ..	,,	£28	..
a ,, Lump	,,	£40	..
a Soda, Chlorate	per lb.	10d.	..
a ,, Crystals	per ton	170/-	..
a Sodium Bichromate, casks ..	per lb.	..	..
METALS, &c.			
c Brass (rolled metal 2" to 12" basis)	per lb.	11⅝d.	..
c ,, Tubes (solid drawn) ..	,,	1/2¼ to 1/2½	..
c ,, Wire, basis	,,	1/-	..
c Copper Tubes (solid drawn) ..	,,	1/3¾	..
g ,, Bars (best selected) ..	per ton	£114	..
g ,, Sheet	,,	£114	..
g ,, Rod	,,	£114	..
d ,, (Electrolytic) Bars ..	,,	£83	..
d ,, ,, Sheets ..	,,	£161	..
d ,, ,, Wire Rods	,,	£91	..
d ,, ,, H.C. Wire	per lb.	11 9/16d.	..
f Ebonite Rod	,,	8/-	..
,, Sheet	,,	2/6	..
n German Silver Wire	,,	2/6	..
h Gutta-percha, fine	,,	11/-	..
h India-rubber, Para fine	,,	2/5½	..
i Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l ,, Wire, galv. No. 8, P.O. qual.	,,	£40	..
g Lead, English Pig	,,	£21	..
g Mercury	per bot.	£18 to £19	..
e Mica (in original cases) small ..	per lb.	9d. to 4/6	..
e ,, ,, ,, medium	,,	5/- to 10/-	..
e ,, ,, ,, large ..	,,	12/6 to 25-/& up	..
d Silicium Bronze Wire	per lb.	1/4	..
r Steel, Magnet, in bars	per ton		..
g Tin, Block (English)	,,	£231 to £232	£4 dec.
n ,, Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

The Royal Society.—Sir J. J. Thomson, O.M., the president, received the guests and Fellows of the Royal Society at Burlington House, on Wednesday last week, at the first *conversazione* held since the outbreak of war. These used to be pleasant reunions, a feature being the exhibition arranged to illustrate recent advances of science. A large company was present, the exhibits arranged for inspection covered a wide field, and many of the exhibits were of a semi-official character, coming from official bodies. Science always has something new with which to stimulate the lay imagination.

The medical exhibits were of particular interest, as also were those of the Royal Astronomical Society. Sir Wm. Garforth illustrated his prolonged research into explosions of coal dust, and the Meteorological Office, which has expanded enormously during the war, had much of interest. The Air Ministry showed many new instruments designed to assist the pilot in various ways. Another exhibit, by Major G. W. C. Kaye and Dr. R. Knox, disclosed how valuable X-rays have proved in the detection of hidden defects in materials. A wireless apparatus was on view with an aerial on the roof, which records lightning flashes, and recently, in combination with direction-finding apparatus, a thunderstorm was located in Southern France. Prof. MacGregor-Morris exhibited his instrument for the measurement of air currents, and in its section the Munitions Invention Department illustrated war research on the fixation of nitrogen. This was in three sections, and the three exhibits, all of which were at work, may be said to represent the main tangible results of three years' work on the part of the Nitrogen Products Committee of the Ministry of Munitions.

The National Physical Laboratory had two exhibits, one consisting of apparatus for measuring and inspecting screw gauges, and the other including an apparatus designed by Mr. J. H. Hyde for determining the absolute viscosities of liquids at high pressures, a three-electrode vacuum tube by Mr. F. E. Smith, arranged to produce oscillations of telephonic frequency, and a chronograph by Dr. W. Rosenhain for plotting the heating and cooling curves of metals and alloys.

There were two demonstrations in the meeting room, in one of which Major G. W. C. Kaye illustrated the use of X-rays for the detection of defects in aeroplane timber.

MARCONI WIRELESS TELEPHONY.

Two applications of wireless, in which great strides were made during the war—telephony and direction finding—were the subject of an interesting series of demonstrations by Marconi's Wireless Telegraph Co., Ltd., last week at Chelmsford.

The morning was occupied in inspecting the works of the company in that town, where many most interesting processes of manufacture, as well as the testing of apparatus and materials, were witnessed. During the afternoon there were demonstrations of the wireless telephone and direction-finding systems developed by the company. A motor lorry, carrying portable wireless apparatus, set off from the works, with which it established communication when about 20 miles away, at an unknown spot, near Colchester. By means of direction-finding apparatus the position of the lorry was located and marked on the map, which on verification was found to be within 500 yards of the exact spot where the lorry was actually standing.

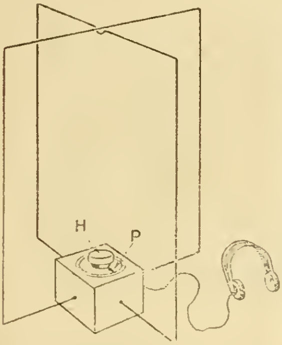

Fig. 1.

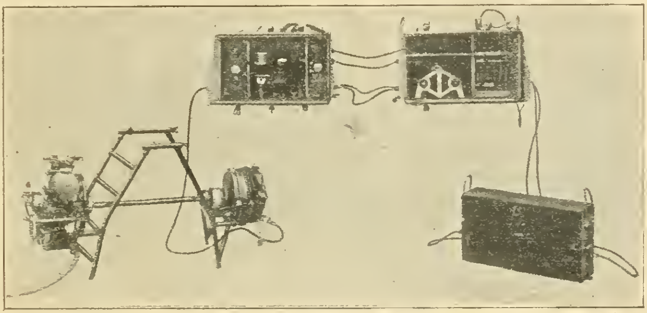

Fig. 2.

Whilst the vehicle was in motion, conversations between passengers and various stations in the neighbourhood took place by wireless telephone. Communication between London and Broomfield was intercepted; ships transmitting ordinary wireless messages at sea were heard, and, by way of interlude, the visitors listened to gramophone selections transmitted from Chelmsford. At Marconi House, London, there is a wireless telephone installation with a range of 150 miles, and by its use the experiments between Chelmsford and Colchester were followed. Also, direct conversations were held between London and Broomfield, the articulation being quite as clear as, if, indeed, not more so, as with the ordinary telephone.

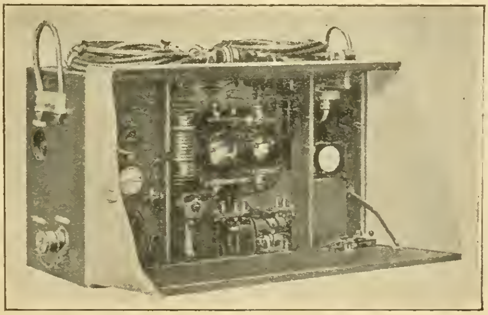

Fig. 3.

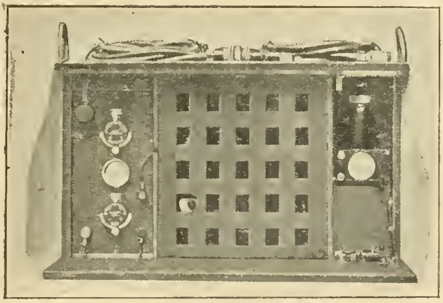

Fig. 4.

When speaking by wireless telephone it is necessary for the operator to remember to move a switch to one position when speaking and to another when listening. This becomes quite an easy operation after a little practice, but it is confidently expected that with further development this switching will become unnecessary. A possible way of eliminating it would be by the use of two waves, one for sending and the other for receiving, each differing in characteristic from the other. Community of conversation may at first sight also appear to be a bar on the wide adoption of the system, but there are ways of securing privacy, by means of tuning and modifying the character of the waves employed. It is now also possible to very greatly eliminate interference, and quite recently directional transmission has been achieved.

Wireless conversation has already been held across the Atlantic, from Ballybunion, on the West Coast of Ireland, to Nova Scotia, and this was achieved with a surprisingly low-powered installation. The Chinese Government has ordered 200 sets, which are to be conveyed across mountainous districts by aeroplane, and the Marconi Co. is about to commence the erection of two high-power stations, one in this country and one at Buenos Aires, which it is hoped will be ready to be opened for wireless telephonic communication in two years' time.

The Marconi Co. has developed several methods of generating and controlling the steady high-frequency currents which form the basis of wireless telephony. Where hundreds of horse-power are required, machines driven by large electric motors are used; for medium powers a special form of electric arc generator is available, while for lower powers the oscillating valve holds the field. Progress is being made in connection with the commercial use of the oscillating valve for larger powers, and as this form of generator is pre-eminently suited to the requirements of wireless telephony further important developments may be anticipated.

In the telephones used for the demonstration the oscillating valve formed the source of energy, the control was by the ordinary microphone, and the speech was received and amplified by means of the standard Marconi receiving valve. An interesting point arises from the capacity of the human ear and brain to recognise the individual words of a sentence, even when one or more may be only partially heard. Under adverse conditions, *e.g.*, when atmospheric disturbances are unusually strong, this fact is of considerable value, enabling speech to be carried on with a small expenditure of power compared with that necessary for telegraphy under similar conditions. Perhaps one of the most striking facts is that the articulation is not affected by the distance over which it is transmitted. The wave form leaving the transmitting aerial does not change on its way to the receiving aerial, no matter what the distance may be. In wire telephony distortion takes place, and it is only by means of expensive artifices that speech can be carried on over very long distances by land, while long-distance speech by submarine cable may be regarded as impracticable.

The movement of aerials of any size in the manner requisite for direction finding is not practicable, and in actual work, this method is confined to cases in which very small aerials wound on frames will suffice. The direction-finding system which has been developed by the Marconi Co. permits the use of relatively large stationary aerials.

In this system two independent triangular or rectangular aerials are erected with their planes at right angles, and connected to an instrument which may be said to reproduce the external conditions in a small space and, as it were, in a relatively concentrated form. A "search coil" of quite small dimensions, which is within the instrument, may be regarded as a diminutive direction-finding aerial under the influence of the large fixed aerials. Rotation of this coil is equivalent to the rotation of a large aerial, but its size and weight is such that it can be manipulated in the convenient manner necessary for quick and accurate work

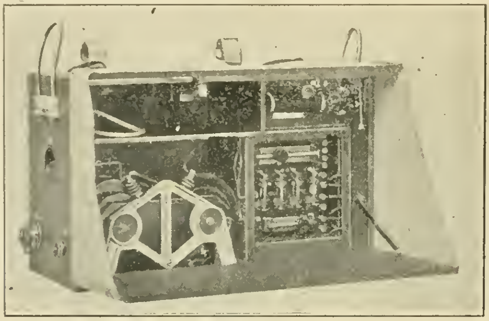

Fig. 5.

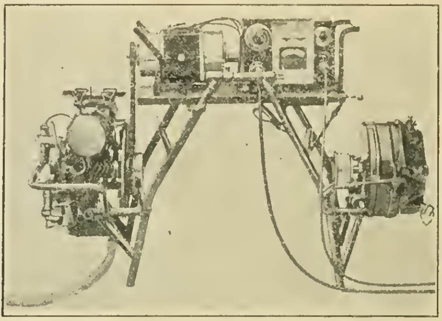

Fig. 6.

Fig. 1 is a diagram illustrating the Marconi method with fixed aerials. Rotation of the handle H at the top of the instrument is equivalent to rotating a large aerial. The direction is found by reading the position of the pointer P on the scale, the zero of which is arranged to point to the north, so that 90 deg. would correspond to west, 180 deg. to south, and 270 to east.

Marconi's portable station (Type YC1), suitable for pack or wheeled transport is arranged as a combined telephone and telegraph set. As a telegraph set, it can transmit either continuous wave or tonic train signals. The guaranteed range of the station over normal flat country is as follows:—For telephone communication, 60 miles; tonic train transmission, 100 miles; and C.W. transmission, 200 miles. The guaranteed range is approximately half the maximum range obtainable in favourable circumstances.

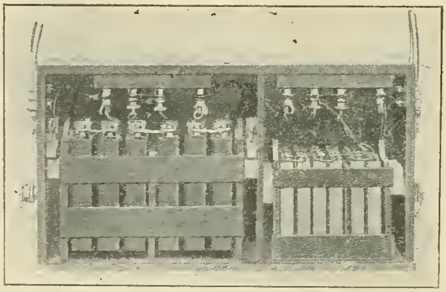

Fig. 7.

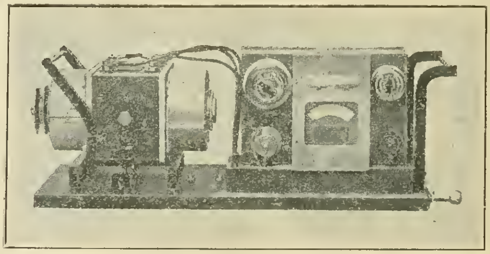

Fig. 8.

The personnel normally consists of six men, who can erect the station in ten minutes; a minimum of two men, however, can erect and work the set. The masts are of steel, 30 ft. in height, and support a single horizontal aerial of the simplest possible type. The earth connection is also of the simplest possible type, consisting of metal gauze laid directly on the ground; the gauze may be laid on top of tall grass, not actually in contact with the ground, and yet work efficiently.

The generating set consists of a two-cylinder petrol engine as the prime mover, driving a high-frequency ½-KW. alternator, which is entirely enclosed and proof against all conditions of weather. A governor is fitted to keep the speed of the engine constant as the load is thrown on and off.

The transmitting and receiving apparatus is self-contained in two cases. The connections between the instruments and the generator are made by a system of non-interchangeable plugs and sockets, so arranged as to make it impossible for the apparatus to be wrongly connected. A simply-operated barrel switch connects the apparatus at will either for transmitting or receiving.

It is unnecessary to stop the engine while signals are being received. The apparatus set up for transmission and reception is shown in fig. 2.

When carried on horse-back the first or mast load consists of a strong waterproof case containing mast gear, halyards, stays, pegs, &c., and steel sections forming one part of the mast are strapped outside. A second case contains earth nets and aerials, and the steel sections forming one of the masts are strapped outside.

The second or instrument load consists of a transmitter box containing the transmitting valves, high-frequency transmitting circuits, microphone, &c., mounted in a case, as shown in figs. 3 and 4, and a receiver box containing the receiving circuits, high-frequency amplifier, telephones, and the power transformer, shown in fig. 5.

The third or engine load is the 2¾-H.P. engine fitted with fuel tanks, automatic lubricating system, driving shaft, &c. (fig. 6) and the high-frequency generator.

The fourth or battery load is made up of a battery box containing a 6-volt accumulator battery for feeding the filaments of the receiving valve, a 20-volt accumulator battery for feeding the high-tension circuits and the receiving valves (fig. 7), and the sundries box, containing spare parts, tools, testing instruments, &c.

The above forms the complete equipment necessary for communication, but if it is desired to make the station independent of its base for any length of time, a fifth load containing charging plant and spare accumulators is provided.

The fifth or charging load consists of the charging dynamo with switchboard, cut-outs, &c. (fig. 8), and a battery box containing two spare 6-volt filament batteries.

The engine, being fitted with a governor and automatic lubrication system, requires practically no attention. The power transformer steps up the potential generated from 100 to 10,000 volts, and this current is rectified by a Fleming valve, and converted by a system of condensers and chokes into a uniform continuous current which feeds the main transmitting valve and energises the aerial circuit.

Another transformer steps down the E.M.F. generated to some 8 or 10 volts, and supplies the filament of the Fleming valve; the third transformer feeds the filament of the main transmitting valve. Connection from the alternator to the various transformers is controlled by the main change-over (transmitting to receiving) switch, which at the same time connects the aerial either to the transmitter or to the receiver. This switch is the only part of the apparatus which it is necessary to operate during conversation.

For the transmission of speech the amplitude of the oscillations generated in the aerial are controlled by the microphone acting on a transformer connected in the grid circuit of the transmitting valve.

For tonic train transmission a smaller switch connects the microphone transformer to a buzzer, which in turn is controlled by a manipulating key, thus the Morse code can be transmitted in the ordinary way by operating the manipulating key. For the transmission of c.w. signals a further switch is provided by means of which the manipulating key is connected across a portion of the aerial-tuning inductance, thereby enabling the aerial to be thrown in and out of tune in much the same way as an arc transmitting station is operated.

The receiver itself consists of a simple tuning arrangement which is connected by means of the change-over switch to the aerial. Provision is made for accurately tuning this circuit to the wave length of the communicating station. The oscillatory currents produced by the received signals are amplified by a series of oscillatory valves. The last of these valves rectifies these currents and feeds the telephones through a suitable transformer. Once the receiver has been adjusted for the incoming signals no further adjustment is necessary, and except for the operation of the change-over transmitting to receiving switch, conversation can be carried on between two stations in exactly the same way as on an ordinary telephone line.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

Annual General Meeting.

The annual general meeting of the Institution of Electrical Engineers was held in the Hall of the Royal Society of Arts, Adelphi, on May 29th, to receive and consider the accounts for the year ended December 31st, 1918, and the annual report of the Council, and to elect auditors.

The President, Mr. C. H. Wordingham, C.B.E., introduced the report (see our last issue) of the Council with a running commentary, in the course of which he referred to the small attendance noticeable at such meetings, which indicated lack of interest on the part of members. During the year he had visited all the Territorial Centres, including Ireland, and it was gratifying to see the amount of good work that had been done by the local centres. The Irish Centre was no exception to the rule, and they hoped to inaugurate another Irish Centre very shortly at Belfast. During the year a large number of Council meetings had been held, and he had made it a rule to attend practically all such meetings. Only those who were in close touch with the Council could realise the amount of work that individual members of the Council had got through during the session. Referring to the various joint meetings that had been held, he said they had been welcomed by all concerned, and it was hoped that more such meetings would be held in the future. The regulations for the electrical equipment of ships had been completed, and would be published in a few weeks' time in pocket-book form. The regulations embraced the whole electrical installation of a ship, and not merely the wiring. Shipowners attached much importance to the regulations, and, in fact, certain builders had already commenced equipping ships in accordance with the rules, advance copies of which had been supplied to them.

Referring to the Electrical Development Association, Mr. Wordingham said that it had been well received, and, together with the Electrical Research Committee, would prove of great value to the industry. They were fortunate in having Mr. J. W. Beauchamp as director of the E.D.A., and Mr. E. B. Wedmore as director of research; they were the right men in the right places. He regretted that no definite announcement could be made as to when they would be able to return to their own building. It was lamentable that the Government, although not only admitting, but emphasising, the importance of the industry, could not see its way to restore the building, without which the Institution could not carry on its work adequately. A point that had not been mentioned in the report was that of the informal dinners. When first inaugurated they had been a very great success, but had now, for various reasons, almost been dropped. In his opinion it would be regrettable if they were allowed to be dropped; the social side of the Institution, which perhaps appealed more to the younger members, needed development. Col. Crompton had taken this matter up, and it was to be hoped that it would be carried forward next session.

Seconding the motion to adopt the report, Mr. Rawlings said that its contents bore witness to the immense amount of work that had been done, both by the President himself and the Council.

Mr. Barton, referring to Sir R. Hadfield's scheme of a central library, said that they were very much in need of some such central library in this country. What they wanted was some central bureau where one could apply for and receive information.

The President pointed out that the lending library was still at the disposal of members. Any further consideration of the matter would have to be deferred until they were back in their own building.

Mr. Rayner remarked upon the time at which meetings were held; he thought the Institution should ascertain the most convenient time for members, and some definite statement should be made. He commended the practice of announcing from the chair from time to time what the Council was doing. That helped to keep the ordinary member interested in the Institution's affairs and work, and, in his opinion, the practice should be continued. Although he recognised and appreciated the motives leading to Mr. Wordingham's acceptance of a second year of office, he deprecated the practice, and thought some rule should be framed to that effect.

The President, in reply, said he was quite in accord with the remarks in favour of one year's presidency. He, personally, would not have accepted a second year's term of office had it not been for the fact that it would have been difficult to carry out certain work had he not done so. He strongly deprecated any rules being made to govern the term of presidency, because circumstances altered the case. He agreed that it was desirable to let ordinary members know more of the Council's work, and with regard to the hour of meeting, about half the members were in favour of a late hour and the other half in favour of an early hour. To alternate the hour as had been suggested would, he thought, lead to endless confusion, and, on the whole, he thought a later hour was to be preferred.

The report was then adopted unanimously, and Mr. J. E. Kingsbury, moving the adoption of the accounts, said that the increase of membership was very gratifying, and there was a substantial balance to the good. They could not expect to get as much for their money in future as they had done in the past; therefore the Council had put £5,000 to reserve.

Few comments were made, and the accounts were adopted unanimously. Votes of thanks were afterwards accorded to the Institution of Civil Engineers, the Royal Society of Arts, and the honorary officers of the Institution at home and abroad.

Address to the Territorial Centres.

By C. H. WORDINGHAM, C.B.E., *President.*

(*Concluded from page* 624.)

The scheme itself is founded on the action I have already referred to, namely, the Institution serving as an umbrella under which other Associations can meet. They have already come together with most satisfactory results, and have been able to take useful action in a number of cases. There can be no question of that. It seems to me that there is thus indicated the line we may profitably take, and that we should endeavour to get the Institution recognised as the body under whose wing all other Associations may come, and which will provide a common ground on which they can discuss matters affecting the industry.

Instead of calling *ad hoc* conferences all these associations should regularly meet together under one grand council, which would be the Council of the Institution. In this way matters affecting the industry could be discussed in all their bearings, and when some question was raised outside there would be only one voice of the electrical industry to answer it. With such a question arising under the scheme I am about to outline, the matter would be received by the Supreme Council and would be referred to the Association concerned. In most cases, I believe, it would be possible to secure agreement of all interests, and that the supreme body could deal with the matter. There would quite possibly—most probably—remain certain matters on which agreement could not be secured, and then the individual association would have to act by itself. But I believe it would be an enormous gain to get these various interests together round one table to discuss matters. Where interests at first appeared to be antagonistic, one would very soon find that there was a great deal to be said about each of them, and I believe that by full discussion in that way, as a matter of course and periodically, it would be found that agreement was greatly facilitated, and in most cases would be possible.

Constitution of Grand Council.

From Diagram No. 1 (p. 676) you will see that I propose the Institution should become the Royal Institution of British Electrical Engineers, or the Royal Institute of Electrical Engineers, the "British" being assumed, and that it should be governed by a Grand Council. That Grand Council would have sent to it representatives of all important associations, and there would be under it a series of councils, as indicated on the diagram as follows:—

A Professional Council.

A Manufacturers' Council.—The backbone of this would naturally be the B.E.A.M.A. and the Cable Makers' Association.

A Company Power Supply Council.—The foundation of this would be the Incorporated Association of Electric Power Companies, the Power Supply Companies of Great Britain, and the Conference of Chief Officials of the London Supply Companies.

A Municipal Power Supply Council.—This would naturally be furnished by the I.M.E.A.

A Railways and Tramways Council.—This would be drawn from the Tramways & Light Railways Association and the Municipal Tramways Association, with representatives from the Railways.

A Mining Engineers' Council drawn from the Institution of Mining Electrical Engineers.

A Telegraph Council, which would be drawn from the present Institution of Post Office Engineers and from the Submarine and Wireless Engineers.

A Plant Installers' Council.—The Electrical Contractors' Association would naturally furnish the members of this.

A Research Council dealing with all matters of research, which would be practically the present Electrical Research Committee.

A Commercial Development Council, which would be the new body I have mentioned as having been recently started under the auspices of the Institution.

A Protective Association Council which would be drawn from the E.P.E.A. and any other protective association recognised by the Institution, as, for example, the S.T.E.

All these Councils would send representatives to the Grand Council in proportion to their importance. Every one of the different Councils would be autonomous, as now, and they would continue to act, as at present, independently in regard to the interests of their own members, but they would each send representatives to the Grand Council before which all important matters affecting the industry would naturally come. We have, in fact, during the past session on some half-dozen occasions, as I have already indicated, acted really as the Grand Council by means of *ad hoc* conferences. We have invited all these different bodies to be represented at a conference called to consider and deal with a particular object, and in every case something useful has resulted. When the representatives have met round a table they have found much common ground, and have been able to take joint action. Any matters which came up from outside and affected the industry would come before the Grand Council; the Grand Council would refer the matter to the subordinate constituent Council for consideration and report, and I am confident that in 99 cases out of 100 it would be possible to get the Grand Council to adopt the report of the Constituent Council and reply to the outside authority in the name of the whole industry. There would thus be one recognised authority to which all matters which affected the electrical industry would be referred by the Government or by any individuals or concerns, and they would get an authoritative answer to whatever question they put to the Grand Council.

One effect of the scheme which I have outlined would be to prevent overlapping. At the present time practically every new electrical association that is formed for any purpose takes powers to deal with a number of matters which are already well looked after by existing institutions. My view most strongly is that, for example, a protective association should confine itself to protecting the commercial and material interests of its members, and should not dabble in research or education or matters of that kind. Research should be left to the Research Council, and similarly in regard to other matters.

Functions of Professional Council.

I will now return to the Professional Council and describe its functions in some detail. This Council would deal with the following matters:—

1. It would provide papers and organise discussions on scientific, technical, and professional subjects generally.
2. It would have a well-qualified staff, with adequate Press experience, to run all publications of the Institution.
3. It would have the care of the library, the lending library, and all periodical journals.
4. It would publish bibliographies on all subjects of interest as well as digests, abstracts, and memoirs, so that it would be possible for the members to obtain a comprehensive and up-to-date account of all that is known up to the present of any particular branch which they wished to study or develop.
5. It would confer the right to practise in the different branches of electrical engineering.
6. It would deal with educational questions affecting electrical engineers, and would hold examinations.

While the other Councils represent associations formed for convenience to look after the material interests of particular sections of the electrical community, the Professional Council represents the whole of the members of the electrical industry in their individual capacity of electrical engineers, irrespective of the branch to which they belong, and for this reason the Professional Council should have a preponderating representation on the Grand Council.

Constitution of Professional Council.

In view of the outstanding importance of the Professional Council, its constitution calls for careful consideration. My proposals are shown diagrammatically in Diagram No. 2. First I would require that every member of this professional body should declare himself to belong to one particular branch of the industry. He would have a perfectly free choice, and for good cause shown could change his classification from time to time if desired. There would be practically no difficulty in this course; a man knows whether he is a manufacturer, a power-station man, a consulting engineer, a professor, or what not. On the Professional Council there would be a strictly proportionate representation of each of the groups under which it was decided to classify the industry; the groups suggested are those shown in the diagram, *i.e.*, Manufacturers; Power Supply Engineers, including Railway and Tramway Engineers; Installation Engineers; Electro-Chemists; Telegraph Engineers, including Submarine Cable Engineers; Wireless Engineers; Scientific Instrument Makers; Consulting Engineers; Scientific and Teaching; and lastly, Junior Members. All these groups would be represented in proportion to the numbers in each group.

Now in the past, whenever the Council of the Institution has made any attempt at proportional representation in that Council, it has been met by one very serious difficulty which so far has never been overcome. You may arrange that every section of the industry shall be represented at what I may call the general election in May, but the balance may be upset by the Chairmen of the Territorial Centres. I take it that in every case the man who is elected chairman of a Centre is selected on his personal qualifications because he is the best man for the purpose in the district, and in no way because he represents any particular interest. It seems to me that the following arrangement would get over the difficulty I have mentiioned. Suppose we require that the Chairmen of the Territorial Centres should always be elected in January, that is to say, well before what I call the general election; it would then be known to what section of the industry they belonged, and those sections would be required to take the Chairmen of the Territorial Centres as a portion of their representation. For example, suppose the manufacturers were entitled to send 10 members to the Council at the general election, and three Chairmen of Territorial Centres were manufacturers; the manufacturers would only be entitled to elect at the general election seven members.

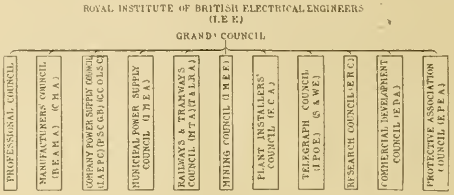
ROYAL INSTITUTE OF BRITISH ELECTRICAL ENGINEERS (I.E.E.)
GRAND COUNCIL
PROFESSIONAL COUNCIL
MANUFACTURERS' COUNCIL (B.E.A.M.A.) (C.M.A.)
COMPANY POWER SUPPLY COUNCIL (I.A.E.P.C.) (P.S.C.G.B.) (C.C.O.L.S.C.)
MUNICIPAL POWER SUPPLY COUNCIL (I.M.E.A.)
RAILWAYS & TRAMWAYS COUNCIL (M.T.A.) (T. & L.R.A.)
MINING COUNCIL (I.M.E.E.)
PLANT INSTALLERS' COUNCIL (E.C.A.)
TELEGRAPH COUNCIL (I.P.O.E.) (S. & W.E.)
RESEARCH COUNCIL (E.R.C.)
COMMERCIAL DEVELOPMENT COUNCIL (E.D.A.)
PROTECTIVE ASSOCIATION COUNCIL (E.P.E.A.)

Diagram No. 1.

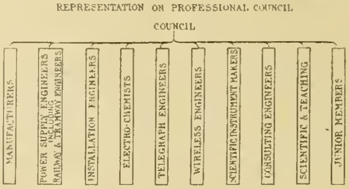

Diagram No. 2.

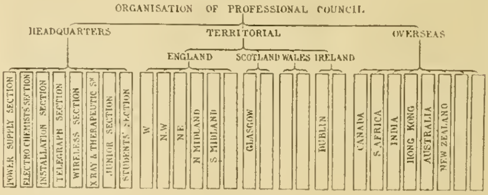

Diagram No. 3.

Organisation of Work of Professional Council.

So much then for the way in which the Professional Council would be elected. We have now to consider the organisation of its work. I wish to make quite clear before doing so that once having got the Professional Council elected on a representative basis, the individual members work together as a whole, and the work of the Council is sub-divided by subjects and not by sectional interests. Again, unlike the other constituent councils in which each member is a delegate representing a firm in the case of the B.E.A.M.A. or the C.M.A., or a company in the case of the Power Companies' Association, or a Corporation in the case of the I.M.E.A., each member of the Professional Council acts in his own personal capacity, and carries on his work to the best of his judgment as an individual. The sub-division of the work of the Council which I suggest is based upon what is convenient for carrying that work on, and in each of the branches of the work all interests are merged together, *e.g.*, in a Territorial Centre no attempt is made to discriminate between manufacturing, power station, telegraphic, and other interests; the work of the Council as affected by the particular district only is considered.

The organisation of the work of the Professional Council which I suggest is shown in Diagram No. 3.

The work falls broadly into three divisions of Headquarters, Territorial, and Overseas.

The work of Headquarters would be looked after by a number of Committees dealing with the subjects shown in the diagram, and would be sectionalised on the lines I have indicated earlier in my address in speaking of the present Institution. There would be a Power Supply Section which would organise papers and discussions on power supply and allied subjects, such as railways, tramways, and mining; an Electrochemistry Section dealing with furnace, electrodeposition, and electrochemical work generally; an Installation Section, dealing with wiring, both ashore and afloat, for lighting, power, and general purposes; a Telegraphic Section, dealing with telephony and ordinary land and submarine telegraphy; a Wireless Section dealing with wireless telegraphy and allied subjects; a Therapeutic Section working in close association with the Royal Society of Medicine; a Junior's Section, looking after informal meetings and gatherings for the younger class of member; and finally the Student's Section. I do not say that all these sections need necessarily be started in the first instance. I believe in conceiving a scheme upon the broadest and most extensive lines, and then putting in force just so much of it as may be necessary at the time, thus ensuring that all parts shall fit together, and that the arrangements have not to be altered as time goes on. Though you may provide for developments that may never be required, no harm ensues, but if those developments are necessary, they are made according to an ordered plan.

The Territorial Division would be divided broadly into England, Scotland, Wales, and Ireland, England being subdivided into Western, North-Western, North-Eastern, North-Midland, and South-Midland. A blank is left in the diagram in certain cases, not for any one section, but for as many as may become necessary in course of time; thus Scotland is divided into Glasgow, space being left for further Centres, and Wales might very well have several Sections later. Only Dublin is shown for Ireland, but there might well be a Section at Belfast also.

The Overseas Division would comprise Canada, South Africa, India, Hong-Kong, Australia, and New Zealand. Some blanks are left in this section for very obvious reasons.

Conclusion.

Such, gentlemen, in broad outline is the scheme of which I invite your discussion. It does not profess to be complete or perfect, it will require months of hard work by a competent committee to make it either perfect or complete, but I think it is sufficiently detailed to enable you to express an opinion on its merits. Our Institution has in the past given every evidence of its vitality and willingness to adapt itself to developments. Everyone must admit, I think, that the industry has outgrown the present Institution, and unless the latter be developed on much bolder and broader lines it will run serious danger of wilting and decaying.

In 1871 we were the Society of Telegraph Engineers. Twelve years later we developed into the Society of Telegraph Engineers and Electricians, and in 1883 we became the Institution of Electrical Engineers. I submit, gentlemen, that the time has now come when we should claim official recognition, and seek to be known as the Royal Institute of British Electrical Engineers, with a Royal Charter conferring on us the rights for which we ask.

ELECTRIC FURNACE PRACTICE.

(Continued from page 592).

Electric Iron and Steel Furnaces.

By J. BIBBY.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The author confines his remarks in this paper to some of the recent developments in the manufacture of iron and steel by means of electric furnaces. He first considers the application of electricity to the reduction of iron ores, namely, to the manufacture of pig iron. (See Elec. Rev., January 31st, 1919.)

The general appearance of the electric reduction furnace follows that of the blast furnace fairly closely. The stock charging and hoisting gear are the same. The shaft is similar, except that it is only about 30 ft. high instead of 80 ft. At the point corresponding to the tuyere belt in the blast furnace, the shaft proper of the electric furnace ends, and, in place of the narrow blast furnace hearth, there is provided in the electric furnace a wide, shallow hearth or crucible, the shape of which is characteristic. This crucible forms the melting and refining chamber, and it is with the occurrences in this chamber that the electrical engineer is chiefly concerned.

Commercially the smallest furnace is one of 2,500 h.p., using 4 electrodes, and with an output of 7,000 tons of pig per year. The next size is that of 4,000 h.p., requiring 6 electrodes, and with an output of 11,500 tons. The third size is one of 6,000 h.p., which has 8 electrodes, and an output of 15,000 tons. For many reasons it appears that this is destined to be the most popular size. The fourth size is that of 10,000 h.p., having 12 electrodes, and an output of 31,000 tons.

The general electrical scheme of a 4,000 h.p. six-electrode furnace is shown in fig. 7, which is fairly self-explanatory. A motor-generator set is fitted for operating the fans. The single-phase transformers are of 1,200 k.v.a. each, shell type, water-cooled, with connected neutrals.

One of the most important points for consideration on the electrical side is the arrangement of the low-tension leads; each lead has to take a current of the order of 20,000 amperes, and therefore the greatest care must be taken to avoid induction. It was found, in a test on an early furnace, that the output from the transformer was about 4,000 kw., but the input to the electrodes was 3,400 kw., showing a loss of 600 kw. The losses were distributed as follows:—

In the contact clamps at the electrodes, 120 kw.; in the resistance of the leads, 165 kw.; by induction, 315 kw.; total losses, 600 kw.

The heavy induction losses were chiefly caused through the leads having to pass near the structural ironwork of the furnace. By re-arranging the leads and inter-leaving the bars the induction losses can be brought down to about 50 kw. On well-designed plant a power factor of 90 per cent. is obtained, and a load factor of 80 per cent.

The power consumption per ton of pig iron produced depends chiefly on the percentage of iron in the ore, on the percentage of CO_2 in the waste gas, and on its temperature. In a good case of 33 per cent. CO_2 and 70 per cent. iron content, the consumption was only 1,320 kw.-hours per ton. The average obtainable, however, is 22 per cent. of CO_2, and with, say, 60 per cent. iron content the consumption is about 1,500 kw.-hours per ton. The consumption of fuel is given in the lower table (fig. 8), where the bottom line indicates the consumption of pure carbon, and the top line that of coke per ton of pig. For 22 per cent. CO_2 the consumption of coke is only about 6 cwt. per ton of pig, excluding that required for carbonising the iron, and this is a common figure in practice.

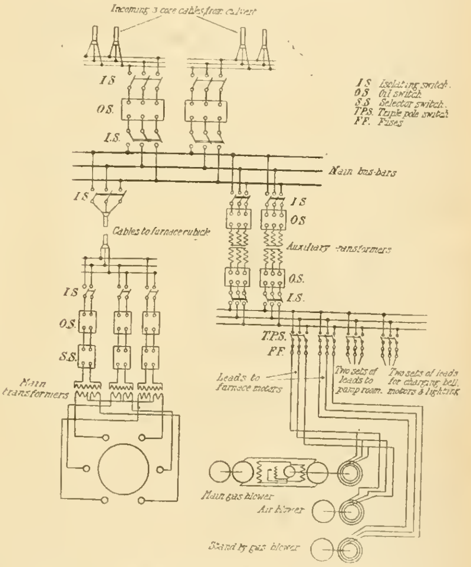

Fig. 7.—Connections for six 4,000-h.p. Electric Reduction Furnaces.

The working of the electric reduction furnace requires quite as much skill as the working of the blast furnace, but it is under better control and has greater possibilities for the production of various grades of iron.

In the second half of the paper the author deals with some of the features connected with the application of electricity to steel refining. (See Elec. Rev., February 7th and 14th, 1919.)

The main field for small two-arc electric furnaces is in small foundries manufacturing better-quality castings. The castings made from the electric furnace are superior to those made from small converters. These small electric furnaces are also rapidly displacing the ordinary crucible furnaces for the manufacture of higher quality steels, and they are able to manufacture accurately to specification all kinds of steel from the cheapest raw material.

There is an important use for the small furnace of about a half-ton capacity, in the melting of ferro-manganese for use in conjunction with open-hearth furnaces. Ferro-manganese can be melted in a small furnace which has been specially designed for this purpose, and in which the manganese loss is not more than 5 per cent. The saving soon pays for the cost of the furnace, and the steel product is of higher value.

These small furnaces have a capacity of 10 cwt. and will deliver molten ferro-manganese at the rate of 400 lb. per hour. The power consumption is 1,000 kw.-hours per ton of ferro-manganese delivered.

Although there are profitable fields for small furnaces, the principal technical developments will take place in larger furnaces.

Large furnaces are then dealt with, and a furnace is described which has four upper electrodes, these being sufficient for furnaces up to 30 tons' capacity. Two furnaces of this size are about to be started up on the Continent.

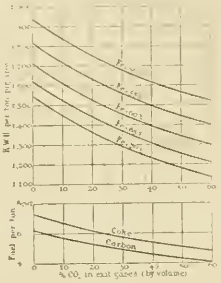

Fig. 8.—Fuel and Energy Consumption for Electric Reduction of Magnetite ($Fe_3 O_4$).

The nature of the arc load is now the subject of interesting investigation.

In the development of any transformer system for arc loads, the effect of the third harmonic must be taken into account, as it is necessary that the third harmonics in the primary should be as nearly as possible in phase with the fundamentals at the maximum, so that the curves will not be too unsymmetrical. Dr. Chapman has analysed one of these current waves on a Scott group (fig. 9), and finds it can be represented by the following equation:—

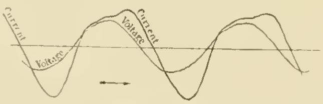

Fig. 9.—Oscillogram Showing Voltage-Current Relationship.

$$i = 2{\cdot}34 \sin \theta + 0{\cdot}202 \sin 2\theta + 0{\cdot}168 \sin 3\theta + 0{\cdot}566 \cos \theta - 0{\cdot}43 \cos 2\theta - 0{\cdot}17 \cos 3\theta.$$

This oscillogram shows the voltage-current relationship, and indicates a power factor of about 0.8. The small 27th harmonics on the voltage curve are from the transformer.

Fig. 10 shows the capacities of transformers which must be supplied for given sizes of furnaces. The capacity of the transformer required per ton decreases as the size of the furnace increases, because the radiation losses are proportionally greater in the smaller furnaces. Also the consumption of energy per ton decreases as the size of the furnace increases. On a well-designed furnace the power factor is in the neighbourhood of 0.8, but it is necessary to have a large reactance, say 10 per cent. or 12 per cent., in the system to choke the unavoidable fluctuations of current in the arc. From the electrical standpoint the most severe trial to which the plant can be put is when it is required to melt rough cold scrap, and when working on this duty momentary overloads of from 50 to 70 per cent. may occur, so that the transformers must be designed for such an emergency. The load factor on a single furnace working night and day is about 35 per cent., but when working two furnaces it is 50 per cent. It is unlikely that there will be much decrease in the consumption of energy in the steel furnace of the future, since the thermal efficiency of a modern plant is about 65 per cent. Improvements will rather tend toward mechanical reliability and more durable refractories, especially for the roof. The metal will be melted in large plant by Bessemer or open-hearth processes and then charged into electric furnaces for refining and alloying. The electric furnace is not a cheap melter, its value being in its refining properties. When hot crude metal is charged into the electric furnace the energy and time required for refining is about one-third of that required for melting and refining, so that a furnace charged with hot metal has three times the capacity of one charged with cold stock.

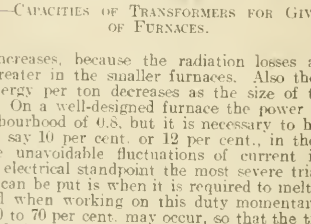

Fig. 10.—Capacities of Transformers for Given Sizes of Furnaces.

With respect to refractories, a basic hearth shows up to greater advantage in desulphurising. The average life of the roof is 100 heats, melting and refining, or about 400 working hours. During the war, when the cost of refractories was abnormally high, it was found that the average total cost refractories, including periodic relining, amounted to less than 3s. per ton of metal melted and refined.

(To be concluded.)

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

Rolling Commutators.

An article by Mr. B. M. Babcock in the *National Engineer*, quoted by the *Mechanical World*, reads as follows:—

We had been troubled with mica creeping out from between the commutator bars on our generator, which burned the bars and produced flat spots, and which necessitated the turning of the commutator quite frequently. After we had performed this operation for the fourth time, I conceived the idea of rolling it after turning to harden the copper bars and cramp the mica between them.

The accompanying sketch illustrates the tool used for this purpose. The wheel should be made of tool-steel, and the bolt case-hardened. This was placed in the lathe head and fed across the commutator in the same manner as the tool used in turning, but under slight pressure. This was repeated eight or ten times, each time adding a little more pressure on the roller. The result was a very highly polished commutator surface, very hard, and the mica was tightened, so that after four years of continuous service none of it has worked out as it formerly did, and the commutator shows absolutely no wear.

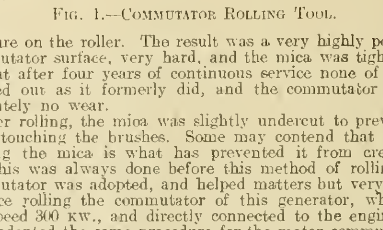

Fig. 1.—Commutator Rolling Tool.

After rolling, the mica was slightly undercut to prevent it from touching the brushes. Some may contend that undercutting the mica is what has prevented it from creeping, but this was always done before this method of rolling the commutator was adopted, and helped matters but very little.

Since rolling the commutator of this generator, which is low-speed 300 kw., and directly connected to the engine, we have adopted the same procedure for the motor commutators, of which we have 1,625 h.p., ranging in size from 1 to 75 h.p., and in speed from 250 to 280 r.p.m., with unvarying success. Rolling can, of course, only be successfully done when the commutator is perfectly true, and should not be attempted after the commutator has been returned to service.

"Pixielite" Strip.

The coming Peace celebrations are creating a demand for coloured lamps, flexible illumination strip, and similar fittings, and the General Electric Co., Ltd., Queen Victoria Street, E.C. 4, has taken steps to meet the demand.

For the outline illumination of buildings, or for the formation of special illuminated devices, G.E.C. "Pixielite" strip is well suited. It is easy to erect, and can be fixed in a very short time, without trouble and at a minimum cost. It is a patented article, and is supplied in standard lengths, each comprising 60 bayonet-cap lampholders, wired 12 in. apart on twin 7/22 cable. The cable is secured to the lampholders independently of the terminals (fig. 2); the lampholders themselves are manufactured of glazed vitreous brown-ware, impervious to moisture and unaffected by heat. In addition to the foregoing, a miniature "Pixielite" strip is manufactured (fig. 3) which embodies the general features of the standard size, but the lampholders are arranged to accommodate small bayonet-cap Robertson or Osram lamps. It can be quickly made up and supplied with the lampholders at

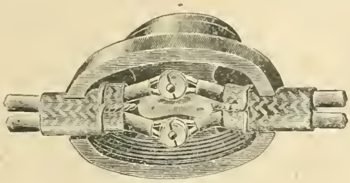

Fig. 2.—"Pixielite" Terminal.

any desired spacing from 6 in. to 18 in., wired either in series or parallel.

For general illumination work 5 to 8-c.p. carbon-filament lamps are recommended, but other lamps can, of course, be

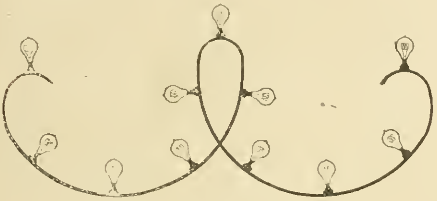

Fig. 3.—"Pixielite" Strip.

used if desired. The G.E.C. is also able to supply colouring and obscuring varnish in almost any colour and quantity, as well as frosting acid or varnish. Both varnish and fluid are very easily applied.

EXAMINATION OF MATERIALS BY X-RAYS.

Unknown to most engineers, considerable use has been made recently—mostly for war purposes—of the penetrating power of X-rays to give information regarding the internal soundness of materials like wood, steel, and concrete. A valuable collection of papers presented to the Faraday and Rontgen Societies, largely through the instrumentality of Sir Robert Hadfield, President of the former society, gave rise to a most instructive discussion on April 29th last, when the two societies met in joint session in the rooms of the Royal Society, Burlington House. Sir Robert Hadfield, supported by Dr. G. B. Batten, President of the Röntgen Society, presided over an audience which had difficulty in finding accommodation in the room available, and Professor W. H. Bragg, F.R.S., in an address setting forth the principles of the subject, set to the discussion a high level of interest and suggestiveness. The meeting opened at 5 p.m., and lasted, with an interval for dinner, until close upon 11 p.m.

Two causes have contributed to the extended use of X-rays from the examination of the comparatively light materials constituting the human body to the dense materials used by the engineer. The X-rays which long sufficed for the purposes of the surgeon had nothing like sufficient penetrating power to pierce even half an inch of steel, and it was not until the invention, in the laboratories of the General Electric Co. of America, of the now famous Coolidge tube, that the engineer possessed a tube that could produce for him the sort of rays he wanted. On the other hand, the "softer" X-rays that have long been utilised could very well have penetrated materials like wood, but it is only the advent of the aeroplane that has made a frail wooden structure to become really important from the standpoint of strength and soundness, for here bad workmanship or faulty material concealed from observation either by intention or accident, can easily cause the loss of valuable lives.

It is now known for certain that X-rays are nothing but ordinary light waves of very small wave length. This fact explains their extraordinary property of penetrating all substances, more or less, and it also follows that, generally speaking, the smaller the wave length, the greater the penetrating power. It is therefore the production of the so-called "hard" rays, those of exceedingly small wave length, that principally interests the engineer. But such rays require a very high tension discharge to produce them, and this, coupled with the limitation that the intense local production of heat places in the way of making tubes which can absorb a great deal of energy, is the principal difficulty in the way of practical progress. Up to the present it is hardly a workshop proposition to examine more than an inch or two of steel (although it is claimed that 4 in. have been penetrated)—and even so considerable exposure is necessary; some 250 seconds for 35 mm., but as much as 2,000 seconds for 40 mm., according to M. Pilon and Mr. Geoffrey Pearce.

The most powerful tubes at present used require a voltage of more than 100,000, and they absorb some 50 kw. It is therefore obvious that further progress will call for all the skill and knowledge at the disposal of the physicist and electrical engineer.

Mr. A. A. Campbell Swinton expressed the opinion that the whole matter of X-ray tubes needs to be envisaged from the engineering rather than from the laboratory standpoint, and he hazarded the suggestion that if we are ever to have really powerful tubes, they will have to be constructed of a material like steel rather than of glass, a development by no means impossible, for valves used in wireless work are already constructed of metal.

Even with the present limitations some very remarkable results have been achieved, and they were illustrated at the meeting by some striking photographs. A few examples culled from the many put forward in the numerous papers presented will suffice to give an idea as to the present state of the practical art of radiometallography. Examination of the carburetter of an aeroplane motor found to be defective in its action showed that the petrol feed canal was not free, due to defective workmanship. In such a case it is desirable to be able to diagnose the trouble without dislocating the apparatus, and only X-ray examination renders this possible. A similar example illustrated was the current distributor for an aeroplane magneto, which revealed an imperfect contact at a stud. For the examination of such objects as explosive shells, fuses, grenades, and torpedoes, the method has proved most useful, and in one instance the internal parts of an explosive body 35 cm. in diameter made of 12 mm. steel, were clearly radiographed.

At M. Schneider's works at Le Creusot X-rays have been successfully used in connection with researches into segregation and blow holes in steel castings, and the influence of aluminium in eliminating these troubles; in the examination of series of tungsten steels, and in the examination of compound metals. In this country the method has been employed at Messrs. Hadfield's works, at Woolwich Arsenal (as to which no information was vouchsafed by the representatives present, who came to take and not to give), and by the Aeronautical Inspection Department, although not at present as part of routine inspection work. The possibilities in the last direction were admirably set out in the paper contributed to the discussion by Capt. R. Knox, R.A.M.C., and Major G. W. C. Kaye, R.A.F. The matter here resolved itself largely into the examination of timber and details of wood construction, and therefore visual examination by means of a fluorescent screen was possible. No difficulty was experienced in detecting concealed knots, resin pockets, and grub-holes, and excess or deficiency of glue in glued joints was readily revealed. In the interior of completely laminated or box spars and struts every detail of construction could be clearly discerned, and some glaring examples of criminally-bad workmanship were thrown upon the screen. Let it be said at once that such cases were and are most exceptional, but the utility of the X-rays as a powerful supplementary instrument for the aircraft inspector is undoubted, and it must be anticipated that it will come into fairly general use.

A novel application of the radiographic method described by Sir Robert Hadfield and Mr. S. A. Main is the examination of carbon electrodes used in electric steel furnaces. The method was found to be of considerable service in throwing light on the behaviour of electrodes of different qualities, and it was suggested that it should be used systematically in experiments connected with electrode manufacture. Mr. S. A. Pollock, of the Post Office, stated that for the examination of soft materials like gutta percha, in which impurities were often introduced, and for discovering defects in the lead sheaths of underground cables, the method had been found extremely useful.

Several valuable papers on the technique of X-ray photography in connection with the special problems that have to be solved in the examination of materials were contributed to the discussion. We cannot do more here than briefly refer to them; the original papers should be consulted by those specially interested.

Mr. O. Block and Mr. F. F. Renwick spoke on "The Behaviour of Photographic Plates to X-rays," in which they dealt with such matters as the relation between the chemical action and the quantity of radiation, the influence of the developing agent, the influence of the wave length of the radiation on its penetrating power, and finally on the very important matter of fluorescent intensifying screens for aid in making the method more sensitive. In this direction much research work appears to be necessary, for at present, at any rate, the use of intensifying screens is essential for the effective penetration of thicknesses of steel. Messrs. Pilon and Pearce estimate that the degree of intensification obtained by the use of two reinforcing screens between which is placed the film sensitised on both sides, is 15 to 1.

Dr. R. E. Slade, the new Director of the British Photographic Research Association, in a well thought-out paper, discussed the efficiency of the photographic plate as a detector of X-radiation, and considered in particular the quality of rays which would give the maximum contrast in photographs through metals.

Mr. J. Brooksbank described his method of testing X-ray tubes for definition; this has been used by Major C. E. S. Phillips, who also contributed to the discussion, in the War Office X-ray laboratory.

We will end this brief account on the very suggestive note sounded by Prof. Bragg at the close of his address. As the wave length of the X-radiation increases, the absorption by any given substance increases also, but there is a critical wave length for every substance at which absorption suddenly drops back to a previous figure, after which it steadily mounts again. This was beautifully illustrated by some photographs shown by Prof. Bragg. The photographs showed a distinct "step," marking the critical wave length. So sharp is the line, and so definite its position for every element, that the phenomena might form the basis for a new method of examining spectroscopically the constitution of any body. In directions like this, as well as in the extension of the method worked out by Prof. Bragg for examining the nature of the crystallisation of substances, progress in our knowledge of the structure of solid substances may be anticipated which will prove of the utmost value to the engineer.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

12,265. "Operating and tripping mechanism of oil-break electrical switches." R. T. Norton. May 21st.

12,516. "Electrical thief-proof device for motor cars." F. Thomson & F. W. Woods. May 19th.

12,527. "Spark plugs for internal-combustion engines." R. Richardson. May 19th.

12,528. "Clip or fastener for connecting terminals, wires, &c." R. Richardson. May 19th

12,530. "Trolley wheel fittings for trolley poles or electrically-propelled vehicles." C. W. Mallins & J. P. Barker. May 19th.

12,537. "Sparking plugs." H. Longton. May 19th.

12,560. "Electric signal lamps." J. R. Craig. May 19th.

12,570. "System for supplying electricity to external circuit." A. Jenkins and W. J. Parfitt. May 19th.

12,587. "Means for securing ends for electric conductors." F. Jenkins and H. Lucas. May 19th.

12,589. "Electric welding tongs." H. F. Kuntzmann. May 19th.

12,594. "Ignition devices for internal-combustion engines." H. W. Carpenter. May 19th. (U.S.A., May 17th, 1918.)

12,610. "Wireless telegraphy." J. J. Aurynger. May 20th.

12,654. "Electric lighter." E. E. Greville & F. W. Read. May 20th.

12,656. "Electric driving gear for talking machines, &c." R. M. Lowne. May 20th.

12,664. "Electric light, &c., fittings." J. M. Landon. May 20th.

12,673. "Fittings for incandescent electric lamps." J. A. Manners-Smith. May 20th.

12,683. "Amplifying electrical variations." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 20th.

12,686. "Grouping and supporting electric lamps for decorative illumination." H. Bey & F. W. Bundy. May 20th.

12,695. "Electrolytic decomposition of chlorides." B. Cataldi. May 20th. (Italy, May 20th, 1918.)

12,700. "Means for temporarily generating an electric current." O. E. Jorgensen. May 20th.

12,713. "Method for producing electricity and mechanical power by permanent magnets." D. Suchostawer. May 20th.

12,714. "Electric dynamos." D. Suchostawer. May 20th.

12,727. "Electrical devices for transmitting signals and receiving same at a distance." J. W. Robinson. May 20th.

12,738. "Electric water-heater." H. S. Nadin. May 21st.

12,784. "Time-lag devices for electric automatic switches." F. C. Fuke and New Switchgear Construction Co. May 21st.

12,821. "Wireless telegraph and telephone transmission." H. J. Round. May 21st.

12,841. "Electrical switching means." E. A. Graham, W. J. Rickets and E. A. Sanftleben. May 21st.

12,862. "Mechanical coupling for electric conductors." S. J. Roderick and W. Thomas. May 22nd.

12,900. "Electric insulators." P. Venturini. May 22nd.

12,925. "Receiving radio signals." Marconi Wireless Telegraph Co. May 22nd. (U.S.A., February 7th.)

12,939. "Alternator for high-frequency currents." H. Antranikian. May 22nd.

12,952. "Accumulators." F. C. Stockel. May 23rd.

12,955. "Electrical condensers." E. A. Bayles, H. Higham & British Insulated & Helsby Cables, Ltd. May 23rd.

12,958. "Intercommunication telephone systems." J. W. Dunzey. May 23rd.

12,969. "Ignition devices for explosion engines." S. Davies & R. A. Morley. May 23rd.

12,970. "Means for measuring electric currents." M. B. Field. May 23rd.

12,985. "Ignition system for internal-combustion engines." M. S. Conner and C. C. Puckette. May 23rd.

13,004. "Magnetos." D. V. L. Fellows. May 23rd.

13,005. "Electric horns." D. V. L. Fellows. May 23rd.

13,007. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. & A. J. Ray. May 23rd.

13,014. "Electrical systems of power transmission." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 23rd.

13,015. "Electric welding electrodes." British Thomson-Houston Co. General Electric Co., U.S.A.) May 23rd.

13,017. "Electric batteries other than dry cells of the Leclanché type." G. N. Antonoff. May 23rd.

13,022. "Electric lampholders, &c." D. Assersohn. May 23rd.

13,023. "Manufacture of electric cables containing conductors conveying currents in parallel." Johnson & Phillips & D. A. S. Porteous. May 23rd.

13,024. "Whipping for telephone and telegraph cables." Johnson and Phillips & A. J. Tracey. May 23rd.

13,028. "Control means for electro-magnetic reciprocating devices." Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) May 23rd.

13,029. "Electrodes for primary cells and storage batteries and process of making such electrodes." Svenska Akumulator Aktiebolaget Jungner. May 23rd. (Sweden, June 13th, 1918.)

13,031. "Electric igniters." E. Humbert & C. A. Lefton. May 23rd.

13,036. "Signalling systems for telephone circuits." E. A. Graham, W. J. Rickets & E. A. Sanftleben. May 23rd.

13,059. "Terminal connections." H. S. Cooke. May 24th.

13,094. "Protective gear for alternating-current systems." British Westinghouse Electric & Manufacturing Co. & H. Pearce. May 24th.

13,105. "Method of springing overhead arm of tramcars, &c." H. L. Reilly. May 24th.

13,122. "Wireless telegraphy stations working on the duplex system." H. J. J. M. de Regnauld de Bellescize. May 24th. (France, January 22nd.)

13,132. "Electric arc lamps." A. K. Waistell & A. G. Watson. May 24th.

13,135. "Electro-magnetic wave signalling systems." N. Lea & J. Rees. May 24th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

15,120. Starting apparatus for internal-combustion engines. G. Green and F. May. October 24th, 1916. (126,015.)

15,274. Generation of sustained electric oscillations for use in wireless telegraphy and wireless telephony. J. Bethenod. November 5th, 1915. (126,019.)

15,547. Radio-telegraphy and radio-telephony. Soc. Française Radio-Electrique. December 8th, 1915. (126,030.)

16,668. Electric furnaces for the fixation of nitrogen. November 21st, 1916. E. K. Scott & F. Howles. (126,058.)

1918.

7,033. Automatic electric switches for furnace control and other purposes. H. Coates, H. J. Norballe and Waterford Electric & Manufacturing Co. April 26th, 1918. (126,113.)

7,138. Control and protection of compound-wound electrical machines. J. E. Goodwin. April 29th, 1918. (126,122.)

7,181. Dynamo-electric machines. Sir C. A. Parsons & J. Rosen. April 29th, 1918. (126,124.)

7,226. Electric ignition for internal-combustion engines. R. F. Bassi. June 30th, 1917. (117,604.)

7,387. Electric accumulator cells and methods of making the same. H. S. Hawkins. May 2nd, 1917. (115,635.)

7,443. Convertible electric fire. E. A. Welch. May 3rd, 1918. (126,142.)

7,596. High-frequency dynamo-electric generators. Marconi's Wireless Telegraph Co. & I. Shoenberg. May 6th, 1918. (126,146.)

7,665. Electrolytical production of zinc. G. H. Clevenger. May 7th, 1917. (115,846.)

7,881. Electric transformers for welding and like purposes. H. E. Steinbock. May 10th, 1918. (126,158.)

8,118. Brushes and the like for use in electrical machinery and appliances. C. A. Miller, F. J. Miller & E. A. Sanders. May 15th, 1918. (126,166.)

8,573. Protective devices for electric circuits. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 23rd, 1918. (126,179.)

8,846. Sparking plugs for use with internal-combustion engines. J. E. Barrows. May 29th, 1918. (125,803.)

8,953. Self-regulating continuous-current dynamos. A. H. Midgley and C. A. Vandervell & Co. May 30th, 1918. (126,188.)

9,495. Controlling means for electromagnetic feed reel brakes. H. V. James. June 10th, 1918. (125,813.)

9,915. Electric switches. A. H. Railing, C. C. Garrard & A. F. Searle. June 17th, 1918. (126,197.)

10,467. Electric ignition devices for internal-combustion engines. F. L. Hollister. June 25th, 1918. (125,828.)

10,640. Electric pencils for retouching photograph negatives. W. K. Franklin. June 28th, 1918. (125,832.)

10,256. Systems of electric power transmission. British Thomson-Houston Co. (General Electric Co., U.S.A.) June 21st, 1918. (126,199.)

11,486. Junction boxes and the like for electric wiring installations. G. S. Boothroyd and Callender's Cable & Construction Co. July 12th, 1918. (125,842.)

11,500. Electric burglar alarms. G. Kirk. July 13th, 1918. (126,213.)

12,219. Method for extracting zinc in electric furnaces. E. F. Berglund. October 22nd, 1917. (120,549.)

13,340. Electrically-operated fuel valves for internal-combustion engines. British Thomson-Houston Co. (General Electric Co., U.S.A.) August 16th, 1918. (125,860.)

12,554. Telephone exchange systems. Western Electric Co. (Western Electric Co., U.S.A.) August 1st, 1918. (126,216.)

13,756. Electrical instruments for signalling on railways. Tyer & Co. and F. W. Leake. August 23rd, 1918. (126,225.)

14,451. Electric lock-out switches. Igranic Electric Co. (Cutler-Hammer Manufacturing Co., U.S.A.) September 5th, 1918. (126,228.)

14,859. Electrodes for primary and secondary electric batteries. Fuller Accumulator Co. & T. Jones. September 12th, 1918. (125,871.)

14,932. Electrical current regulating apparatus. C. B. Waters. July 2nd, 1918. (125,873.)

18,339. Electrodes for arc welding and the like. J. H. Garbett. November 8th, 1918. (126,245.)

19,777. Automatic quick silver switches for electric flat irons. N. F. Neilson & Aktieselskabet Avanti Dansk Elektromekanisk Fabrik. November 29th, 1918. (125,900.)

20,266. Thermostatic electric circuit controlling devices. American Fire Prevention Bureau. February 8th, 1918. (123,058.)

20,556. Apparatus for use in imparting instruction in reading Morse code or the like as received by wireless. G. H. J. Horan & A. W. Gamage, Ltd. December 10th, 1918. (125,908.)

20,957. Lever-operated change-over switch for telephone exchanges and the like. M. B. Richter. December 17th, 1917. (121,608.)

212,900. Switces for electric-starting motors. H. Lucas & H. W. F. Ireland. December 19th, 1918. (126,253.)

21,631. Electric welding. T. E. Murray. October 4th, 1917. (121,956.)

1919.

674. Boro silicate glass for use as a filter to produce daylight effects. A. J. H. Haddan (Corning Glass Works, U.S.A.). January 9th, 1919. (125,920.)

675. Potash glass for use as a filter to produce daylight effects. A. J. H. Haddan (Corning Glass Works, U.S.A.) January 9th, 1919. (125,921.)

928. Sparking or ignition plugs. E. Leymarie. April 15th, 1918. (125,579.)

2,846. Devices for varying the point of ignition in electric ignition apparatus. Akt. Ges. Brown, Boveri et Cie. February 5th, 1918. (Addition to 9,959/18.) (123,090.)

3,251. "Device for varying the point of ignition in electric ignition apparatus." Akt. Ges. Brown, Boveri et Cie. February 9th, 1918. (Addition to 117,447.) (123,314.)

3,620. Apparatus for use in the manufacture of thermic telephones or microphones. Naamlooze Vennootschap de Nederlandsche Thermo-Telephoon Maatschappij. February 15th, 1918. (123,728.)

7,557. Electric signalling systems. H. Green. April 11th, 1918. (Divided application on 6,146/18.) (125,929.)

THE

ELECTRICAL REVIEW.

VOL. LXXXIV. JUNE 13, 1919. No. 2,168.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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OUR TRADE WITH BRAZIL.

THE reception given by the City of London last week to the President of Brazil, Dr. Pessoa, was a very happy event. Now that we are beginning to settle down to the cultivation of Peaceful international relations and interests, we hope that opportunity will arise for showing appropriate hospitality to many eminent guests from distant fields of commercial activity. For years before the war most of the manufacturing nations were casting fond and affectionate export glances across the seas to the vast undeveloped territories and resources of South America. Our own share of Brazilian business was large, but it was, comparatively speaking, a small fraction of what we desired it to be. The United States, busy as it was with its own internal requirements and developments, found time, money, and men, for investigating and cultivating the varied markets of Brazil, Argentina, Chile and Peru, and so on, but its geographical situation, involving shipping operations, was not greatly to its advantage in comparison with ourselves. The railway journey across the border to the north was a simple matter in exploiting American interests in Canada. In the South it was different. Furthermore, we always had more or less close and happy and intimate financial, railway and trading connections with South America, and our outlook up to a few years before the war was good, though the characteristic penetrative machinations of German organisations were not without an adverse effect. Brazil, with her expansive territories, always has possessed attractions for British financiers and traders, and it is unlikely that having sided with us in defeating the military ambitions of Central Europe, she will be unmindful of the past, or will fail to appreciate the difference of ideal that dominates the mind of the Briton and the Teuton. Ever since our early mariners and pioneers went down to the sea in ships in pursuit of trading ventures of exchange with almost unknown lands, we have had a natural instinct for assisting in the development of the resources of the world. That is how Britain became both a trading and a colonising power, and long years of experience in close friendship with other peoples have fitted us for aiding in the development of South American countries to-day, for their good and for our own—development which is in arrears by five years because Germany and her associates chose to hold up, by process of disorganisation, practically the entire peaceful operations of the civilised world. When the President of the Board of Trade remarked that Brazil was one of the countries of the world which was complementary to countries such as our own, he was saying nothing more than the simple truth. Brazil is complementary to this country to-day, as Sir Auckland Geddes said, because she possesses in abundance those things which we need and do not possess in abundance now, but also because, in an industrial manufacturing sense, we possess those things which Brazil earnestly wants as a means of securing her development. "We believe it is well for all things that all should be prosperous," and if we desire to see, not only a resumption of that great trading activity which existed between us in pre-war days, but a vast extension of it, so that Brazil may proceed without further hindrance upon that course of grand progressive development, it is not unreasonable to hope that those in responsible positions in Brazil will be impressed with the enormous increase that we have made in our manufacturing capacity equipping us for rendering suitable service. In due time no doubt this old country of ours will rise above its present difficulties; but it will obtain some assistance to that end if Allies such as Brazil, who know what we have been through, and have opportunities in the course of their own development for turning trade in this direction, will lend us Allied co-operation. The speech of Dr. Pessoa was couched in the happiest of terms. He was not unmindful that the pleasant relations that united the two countries were of no recent origin—indeed, they dated back "to the very first phase of Brazil's experience as a free people." In our British enterprises, searching out new fields for commerce, for industry, and for navigation there was "cordiality, mutual confidence and friendship." We would rather have this reputation than be remembered by schemes of conscienceless penetration and objectionable aggression, which even "married into the family" so as to make a good Teutonic business connection. Dr. Pessoa recognises that after the formidable struggle Britain is suffering from "fatigues," but he also recognises from the gathering at the Mansion House that we are preparing for a new campaign with our characteristic ardour and tenacity. He has a clear impression of our "abilities and our force," and he wishes to leave behind him an assurance that Brazil does not forget the great share that England had in her economic evolution "by supplying the means for founding of banks, for the construction of railways, for the improvement of our ports, and for every other sort of enterprise in our country." She will rejoice, he says, in seeing England taking her part again in the commercial competition, and in using her capital, her energy, and her intelligence, in the vast field that Brazil has to offer. He also assures us that during his period of Government he will make a point of furthering and protecting all initiative to this end. We believe that these assurances will be read with great acceptance by the leaders of our great electrical and engineering industries, and that in consequence they will go forward more heartily with whatever measures they may have on foot for securing a prosperous interchange with the Brazilian market in the coming years, when we shall depend so much upon exportation for recovering positions lost to us temporarily during the period of the war.

The I.M.E.A. Convention.

This year the Annual Convention of the Incorporated Municipal Electrical Association will be held at Felixstowe under pre-war conditions, so far as they can be realised. The members will meet on Wednesday next at Ipswich, under the presidency of Mr. F. Ayton, electrical engineer and tramway manager to the City, and now chairman of the Electric Vehicle Committee, which owes so much to his admirable work as hon. secretary; the Mayor will welcome the Association, and will entertain the members at afternoon tea, when the official programme of meetings and visits to works has been completed. On Thursday and Friday the meetings will be held at Felixstowe, and visits to war vessels and the Air Station are included in the programme—for the first time. A meeting of special interest is one restricted to "Committee" members of the Association, "to consider the question of the salaries of chief electrical engineers of municipal electric supply undertakings in the light of the applications that have lately been put forward by the Associated Municipal Electrical Engineers (Great Britain and Ireland)," a body which has grown out of the better known Association of Municipal Electrical Engineers of Greater London. We note that this meeting is to be held "After Dinner," and we hope that the mellowing influence of that repast will promote a benevolent disposition on the part of the Councillors, in order that the questions at issue may be solved amicably, and the Felixstowe Convention, which promises otherwise to be a most enjoyable function, may be marked by the cordial recognition on the part of the Committee members of the fact that the Engineer members are the brains of their respective undertakings, and as such are entitled to an adequate reward.

The I.E.E. Dinner and Conversazione.

After four years of war-time conditions, the Institution of Electrical Engineers this year resumes the annual dinner and conversazione, two functions which are looked forward to with keen anticipation by all who are fortunate enough to be able to attend them. On these occasions members foregather from all parts of the country, and renew old acquaintance under the happiest conditions. Many, alas! have passed on to another sphere; they will be sadly missed—but they leave behind the record of life's work accomplished, may we say with all reverence, with 100 per cent. efficiency—a record of which an engineer may well be proud. Such men are not to be mourned; they gave their lives, and it is for us, who bear their loss, to rejoice in their triumph over material things, and for ever to keep their memory green.

We are glad to see that the procedure which distinguishes the I.E.E. dinner from all other social functions of the kind, by restricting the speech-making to 50 minutes and providing opportunity for reunion, is again to be followed, and we anticipate an assembly even greater in numbers than the large gatherings of the past. The conversazione is very appropriately designed "to meet the Members of the Institution who have served in H.M. Forces during the War," who may count upon the heartiest of welcomes; but will those who have been demobilised or disembodied—a large proportion of the total—be permitted to wear their uniforms? We fear they will not, unless special steps are taken to obtain the sanction of the authorities, and we venture to press upon the Council the urgent necessity of taking immediate action to this end. Otherwise much of the interest of the occasion will be lost, and neither those who have served, nor those who are still serving, will be quite at ease, while others will fail to realise the extraordinary proportion of the membership which has taken part in the war—no fewer than 2,000 out of 7,000. In normal times the privilege of wearing uniform might not unreasonably be jealously guarded, but the times have changed; the Empire has raised 8 million soldiers and sailors, a citizen army of the highest quality, whose achievements have thrilled the world, and these men are justly entitled to wear their uniform at public functions—above all, at a function specifically devoted to their official reception by the professional Institution which is proud to claim them as her sons. Surely there could be no more appropriate occasion for the wearing of the uniform, and we trust that the authorities will recognise the fact.

[Whilst going to press we learn that officers will be permitted to wear uniform: but the privilege ought to apply equally to N.C.O.'s and men.]

Miners, the Community and Industry.

The proceedings of the Coal Commission are undoubtedly interesting, but they are not more interesting than they are important. The extreme element in Labour is having an opportunity to show openly the workings of its mind, but inasmuch as the inquiry cannot be fairly conducted without both sides being heard, the pros and cons of nationalisation are also being put forward by men of experience who recognise how easy it would be to endanger the whole industrial and economic system by the adoption of a reckless policy toward any one section of interests. What is happening in certain other countries at the present time ought to be an object lesson showing the lamentable consequences which upheaval may bring to whole nations, in which the working-class element naturally forms a considerable part. We are far from disapproving of efforts which strike at injustices to those engaged in industrial operations—whether in coal-mining, in chain-making, match-making, or in the clothing trades, but we are quite unconvinced that it is only through nationalisation that remedies can be introduced or enforced. We certainly are not convinced that the cost of coal to industry or to the millions of rationed coal consumers is likely to be reduced so long as Labour can secure whatever wage it pleases to ask, or can reduce its output as the mood inclines it. If experience of nationalisation in other departments had proved that the cost of a commodity or a service had been reduced, or that the efficiency of service given had been improved, because the hand of private control and enterprise had been removed, objections to national ownership and operation might be lessened, but without anticipating in any way the result of this inquiry, we may say that there is little hope of securing cheaper coal and higher efficiency of equipment and working of our collieries, by dispensing with the existing ownership and substituting State-ownership. As witness after witness has appeared, it has been obvious that the public have good reason to fear that both they as private consumers, and the fuel-using industries in which they gain their livelihood, will have to pay more even beyond the present prohibitive price per ton, if all sorts of burdens are to be added in the interests of already well-paid labour, and if the profits of coal-owners and middlemen are not fairly controlled. We should have supposed that few things were more important in the present critical industrial situation than that fuel should be plentiful and cheap for industry, and that the expenses of the householder—for whom the cost of living remains unconscionably high—should be reduced. Diatribes against any class of men, especially in these days, are not to our liking, but our own impression is that there are few better examples of the rank selfishness of organised labour than is this of the miners, who, unrationed, can burn as much coal as they like, while the private and industrial consumer, and the public power and lighting services, must be rationed, and must pay through the nose for the limited supplies which they are privileged to receive. What does it matter to the miner who shivers, as long as he and his can be warm through the winter months? Does he care how other industries are hampered and other industrial workers' interests are consequently jeopardised, so long as the coal-getter works less and receives more? Talk about the solidarity of the human race—the interests that are common to us all—do not the best interests of the whole nation during the coming critical days lie along the path of industrial prosperity? How can the machinery of economic life run smoothly if we deliberately put all this grit into its parts? In our opinion, little of the evidence given before the Commission has been of such immediate importance as that of Mr. Walter Leaf, chairman of the Committee of London Clearing Bankers, and chairman of electricity supply companies. He said that if nationalisation were to be carried out, the two essential conditions which must be fulfilled, if no great damage were to be done to industry in general, were (1) that there should be a reasonable prospect that it would result at least in not less efficient production than at present, ensuring a cost to other industries for coal at least as low as that at which it could be produced under private ownership; (2) that existing interests should be purchased by the State at a price which would appear equitable in the view of the average fair-minded man. Any confiscation of any interests without fair compensation would be a shock to public confidence, which would absolutely paralyse all industrial enterprise. Mr. Leaf expressed the views of the City when he said that the export of coal should as soon as possible be raised to the highest possible level. In order to resume our international trade it was absolutely essential that the exchanges should be put on a proper basis, and this could only be done by exporting. Coal, he said, was at once among the greatest of our exports and the one which could at once be exported without delays arising from the adaptation of war machinery. "It is to this article of commerce that we mainly look at the moment to restore the foreign exchange to parity. Until this is done, our manufacturers must be at a great disadvantage wherever they have to import their raw material." We wonder whether the miners or their spokesmen have ever given thought to the part that they may play in restoring the foreign exchanges, than which there are few more serious problems at the moment. From the statement made by Sir Auckland Geddes concerning the necessity for restricting our coal export by many millions of tons per annum owing to the miners' decreased output in the early months of this year, it is not possible to give Mr. Leaf and the City authorities much satisfaction. The possible further increase in the cost per ton of coal used by industry is also most disquieting. Industry, as time goes on, will depend more and more upon electricity, either under the Government Commissioners or the hydro-electric developments which are projected, and possibly the oil discovery may have a considerable influence. Further, the householder will with greater expedition adopt electricity for heating and other domestic purposes. These things are all to the good, or will be, in the long run. But *at this moment* the international position requires from the miner the best work that he can do, and general industry requires a bigger output from him at a reasonable figure to assist in the return of men and women to employment. Would that some voice from Heaven would make it plain that the interests of all of us are so delicately interwoven that at such a juncture as this, when foreign traders are so alert to profit by our disadvantages, no one section can selfishly press extravagant claims upon the rest, or unreasonably limit its own productivity, without the whole community suffering.

The Industrial League.

On Tuesday, last week, with our *confrères* of the Technical Press, we had the pleasure of hearing from the Right Hon. G. H. Roberts, M.P., president of the Industrial League, and Mr. H. E. Blain, vice-president, interesting particulars regarding the objects of the League and the methods by which it aims to promote harmonious co-operation between employers and employed. We were, of course, already familiar with the tenets of the League, which has been admirably described by the Right Hon. J. R. Clynes—himself, like Mr. Roberts, a Labour leader—as "an instrument for widening toleration, and for effecting a more complete understanding of recurring difference and rival interests"; and we wish to bring it more prominently before our readers, as an Institution which merits their whole-hearted approval and support. It was established in 1915 by a few men of imagination and foresight, to deal with some of the problems that were expected to arise out of the war; its unique advantage is that it embraces both parties in the industrial world, and brings them together in friendly discussion, striving at the same time to elevate the status of the worker and "make his life worth living," and to promote the public welfare by instilling the doctrine of increased production, without which nothing of permanent value can be accomplished. The League is out to educate both employers and employed, and to dispel the fog of distrust which in the past has kept them apart. It is about to initiate a vigorous campaign throughout the country, and is convening a three-day Conference in August for thorough discussion of the great questions with which it is concerned. The League has high ideals, and is led by men of action; its aims are wholly commendable from every point of view, and we earnestly exhort our readers to join it and support it in every possible way.

The Price of Electrical Energy.

On October 5th, 1917, and again on July 26th, 1918, we published lists showing the advances that had been made in the charges for electrical energy at a large number of towns in this country, to meet the increasing cost of production due to war conditions. The subject is one of considerable interest to central-station managers, who, with rare exceptions, have been compelled from time to time to revise their tariffs, and naturally desire to know what their *confrères* are doing in the matter.

This year, at the request of the Municipal Electrical Association, we have extended the investigation to cover the various tariffs more fully, giving both pre-war and present prices, and including the cost of coal; in consequence of this, the data have become too unwieldy to be conveniently handled in our columns, and therefore we are producing them in the form of a Table, issued separately from the journal. Complimentary copies of the Table are being forwarded to the engineers to whom we are indebted for the particulars, and to whom we tender our thanks for their kind assistance. Additional copies can be obtained from our Publishing Department, as advertised elsewhere in this issue.

METHODS OF PREVENTING THE TRANSMISSION OF VIBRATIONS IN BUILDINGS.

By A. B. EASON, M.A., A.M.I.E.E.

This article discusses various types of isolators which can be placed between vibrating machinery and the floors of buildings, and the effect of altering the intensity of pressure in the isolating supports, due to altering their dimensions.

(*A*) *Isolators for Reducing Vibrations: Anti-Vibrators.*—Consider the use of isolating devices from a theoretical point of view. It is well known that in laboratories, delicate instruments—such as very sensitive mirror galvanometers—are hung on rubber or spring suspensions, so that the vibrations of the walls of the building may not affect the instrument. In general, the more flexible and elastic the suspension—and as a result the slower the natural period of oscillation of the instrument—the less will be the effect of external vibrations on the instrument. The converse of this is true; if the source of vibration is the instrument, the effect produced on outside bodies will be reduced if the connecting links, suspensions, or supports are made more elastic.

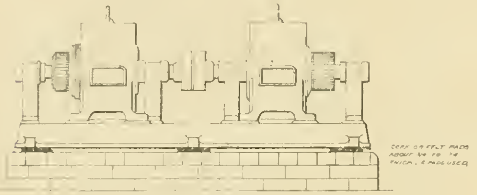
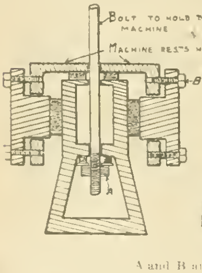
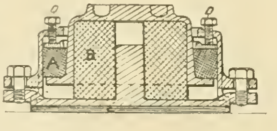


Fig. 1.

Notice how this principle is made use of in various forms of isolators. Fig. 1 shows a motor-generator resting on six pads of some composition such as rubber, cork, or mascolite. Such forms of support are relatively very inelastic. Fig. 2 shows Prache's isolator; four or six of these units would be required for a machine of moderate size. It will be seen that the holding-down bolt is not in direct contact with the iron support at any point. The elasticity of the support can be varied by screwing up the bolt A, and the side bolts B. Fig. 3 shows the type of support made to Fritz Gerb's Patent 11,892, of 1910, and 25,436, of 1912, by the Anti-Vibration and Noise Co. W. Christie & Grey, Ltd., now supply these with slightly different adjustments, though the principle is the same.





A and B are cork, felt or rubber.

Fig. 2.—Prache's Isolator. Fig. 3.—Gerb's Anti-Vibrator.

By tightening screws D the load per unit area on the elastic compounds A and B can be increased; the damping due to friction between A and B and the ironwork is then increased. Thus the elasticity and the damping factor are made independent of the load on the support due to the weight of the machine.

Fig. 4 shows an elastic support made of iron: the machine rests on the ends of bar A, which behaves partly as a cantilever: this bar rests on beams B, of flat iron. Both A and B are elastic, and the result of the combination is to prevent the vibration from reaching the brick pier. Fig. 5 shows a similar type of support, only more elaborate; the rubber pads A by themselves were not sufficient to prevent the relatively severe vibrations of the machine from reaching the bed. By placing them on the ends of the cantilevers B, and putting pads C as the fulcra under the cantilevers transmission was prevented. The girder cantilever B simply acts as a spring suspension. The transverse wood beams under pads A were placed on the I beam as a flat support for the rubber pad, which was larger than the I beam. The wood itself had practically no elasticity. The longitudinal wood beam was only used to distribute the pressure over the pier. The tests made on this form of support are reported in the *Post Office Electrical Engineers' Journal*, Vol. 12, page 35, April, 1919.

The use of sand, gravel, lead, and felt as isolators* is not satisfactory, though doubtless in one or two instances such types have cured troublesome vibrations; but the originating vibrations in such cases must have been of little magnitude.

Bousquet (*La Nature*, page 296, 1918) was able to prevent the vibrations due to street traffic from reaching large buildings by placing a layer of cork and resin, 1 metre deep, ½ metre wide, between the footpath and the building.

In Berlin the underground railway is separated from the ground by layers of gravel. (*Naturwissen.* Vol. 5, page 97, 1917). Hall (*Elec. World*, Vol. 60, page 200, 1912) agrees that sharp broken rock, or asbestos and leather, are valuable as isolators under heavy machinery, but suggests that sand is useless. Berger (*Gesundheits Ingr.*, Vol. 36, page 433, 1915) mentions that steel shavings form a useful isolator on account of their strength and elasticity; the vibrations are damped by friction and heat up the steel. Hoffmann states that placing spring beams under a 1,200-KW. A.C. transformer prevented the transmission of objectionable vibration, whereas placing layers of felt, cork, and rubber under the machine had been ineffective.

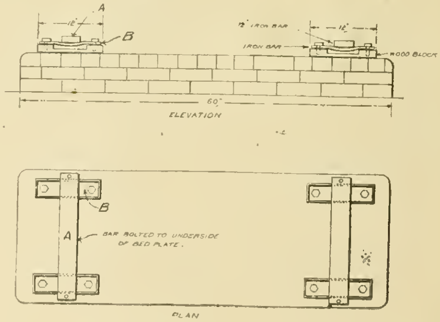


Fig. 4.

It is impossible to state which is the best isolator, but to get the best isolating result quickly one should have a form of support which is adjustable as to elasticity, and also, if possible, adjustable as to damping.

(*B*) *Effect of Elasticity of the Support.*—We shall now discuss the effect of the loading of the support, or of altering the intensity of pressure in the isolator. In the supports shown in figs. 2 and 3 the pressure is easily alterable by screw adjustments. In the I beam support, shown in fig. 5, the adjustment is made by altering the position of the fulcra B. Few writers say anything about the best size or thickness of isolator, or the best dimensions of the rubber, cork, or mascolite pads to use. For instance, let a machine weigh 2,304 lb., and be placed on four rubber pads; will it be best to have pads 2, 3, 4, 8 in. sq., with intensity of pressure, $p = 144, 64, 36$, or 9 lb./in.^{2}? Obviously,

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* Davies : Elec. Rev., Vol. 72, page 505, 1915.

p should be less than the crushing load of the material; but, apart from that, what load is suitable? The conditions of the problem are these:—A body of mass M is connected by an elastic support to the foundations W; the foundations have a natural period of oscillation (frequency, n', say); the mass M oscillating on the elastic support has a frequency, n. The frequency of vibration of the motor-generator which will cause resonant vibrations in the system is ordinarily neither n nor n'. The problem to be solved is to make a support of such characteristics that this resonant frequency is not near the frequency of vibration, f, in the machine, which depends on its speed. This assumes that the machine is a fixed-speed machine. To alter the frequency n of mass M on the support, one alters the elasticity of the support, which can be done simply by altering the dimensions of the support. Suppose that the vibration from a machine has been prevented from travelling to the floor by placing cork pads 6 in. square under it, both 4-in. and 8-in. square pads would probably be less-effective isolators. It is probable that a reduction in the size of pads will usually be more effective in stopping the transmission of vibration than an increase in their area. When one is experimenting with various types of support, one is really altering the frequency n of the machine on its support. The effect upon the amplitude of the floor vibrations is similar to that shown in fig. 6. This shows amplitude plotted against motor speed with a fixed type of support. Curve A was obtained with the motor direct on the floor; curve B was obtained with a pad of mascolite 11 mm. thick interposed between the floor and the motor. Exactly the same types of curve would be obtained if the motor speed was kept constant and different types of support were tested. But the different types of support cannot so easily be represented, as abscissæ, as they vary in material, size, and shape. The curves in fig. 6 are taken from Berger's report (*Gesundheits Ingr.*, Vol. 36, p. 433, 1913), from which the following conclusions may be drawn:—The maximum amplitude of vibration of the floor was reduced when isolators were used. (2) The amplitude at any particular motor speed might be less with no isolator than with one. (3) In these tests the smallest amplitude obtainable was 0·02 mm.; this occurred with the motor running at 2,000 R.P.M., and placed directly on the floor. (4) The minima obtainable with isolators was 0·03 mm., and was practically the same, no matter which form of isolator was in use. This minimum occurred at various motor speeds. The types of isolator used were:—Pressed felt, 9·3 and 21 mm. thick; 5 mm. rubber; 11 and 22 mm. mascolite; 9·3, 15, 20, and 40 mm. compressed cork.

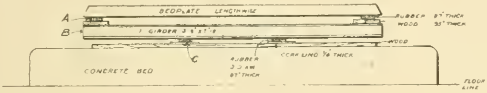

Fig. 5.

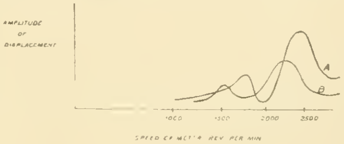

Fig. 6.

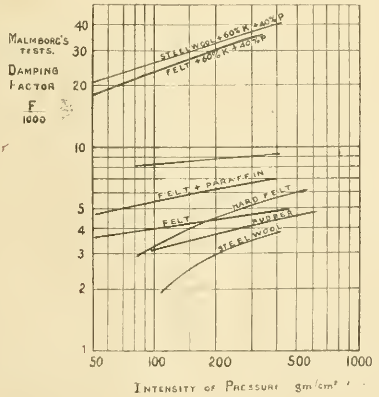

Fig. 7.

Ottenstein (*Elektrotech. Zeit.*, Vol. 32, page 410, 1917) made somewhat similar tests, and came to the same conclusions. He found light porous cork was a satisfactory isolator, but did not recommend its use generally, as it loses its elasticity readily.

In all these tests, the elasticity of the supports plays a decisive part. Malmborg (*Ann. der Phys.*, Vol. 44, p. 337, 1914) has investigated this property of elasticity, and the damping properties of the following isolating materials:—(1) Thick soft felt as used for packing saddles, known as "horse felt"; (2) hard felt used for the soles of shoes; (3) rubber; (4) natural cork; (5) "suberit"; (6) "Gewebebau platte," which probably is the same as mascolite; (7) steel shavings 0·1 mm. thick, of density 0·42 gm. cm.^{3}; (8) felt and lead; (9) felt impregnated with various viscous liquids, water, paraffin oil, resin. Fig. 7 shows how the damping factor is improved as the intensity of pressure in the isolating material is increased, confirming the advantage of reducing the area of the isolator. Malmborg concludes that the common isolators, cork, felt, &c., are relatively poor dampers; whereas the immersion of felt in a solution of paraffin and resin improved the damping immensely: the difficulty in practice lies in keeping the solution viscous; it tends to harden in the atmosphere.'

The general conclusions as to the best isolators are:

1. The supports should be made as elastic as possible.
2. When different materials are being used for the supports, the hard materials, such as iron, should be placed next the soft ones, such as felt and cork.
3. Layers of widely-different materials are useful.
4. A mere increase of area or thickness may be disadvantageous; the increase of intensity of pressure in the isolator is often advantageous.

Water-power in Sweden.—The three principal hydro-electric power stations belonging to the Government, Trollhätten, Älvkarleby, and Porjus, have been extended and now contain plant capable of an output of 153,500 KW. The energy supplied during the past year amounted to 692,000,000 KW.-hours. The Hemsjö Power Co., Ltd., has increased its power installation from 3,400 KW. in 1911, to 7,860 KW. in 1916, and equipped 68 miles of H.T. transmission lines complete with all necessary transformers and L.T. local lines. The output for the present year was 35,000,000 KW. The total income of the company during the year 1917-18 was £77,500, the average charge being 0.533d. per KW-hour. The actual charge depends upon the distance of transmission and the quantity taken. The present annual income per KW. is £9 17s. 6d. The power factor is 48.7. The Traffic Company Grängesberg-Oxelösund has supplied the power used on the Gällivare Railway, where the section Kiruna-Nathavaara has been electrified. The company's power station in Kiruna has distributed 9,700,000 KW.-hours to the railway line, but almost the whole of this power has been received from the Government power station at Porjus. The output from the company's own stations has been 65,300,000 KW.-hours, and auxiliary steam plant for 7,000 KW. is being erected. The Gällivara Ore mountain is supplied from the Porjus power station, 10,800,000 KW.-hours having been transmitted during the past year. The present high coal prices are favourable for the extension of hydroelectric power works, and the capital invested in such undertakings has during the last year increased from £2,200,000 to £11,100,000, in spite of the many difficulties caused by the war. Large areas of land are being cultivated by electric power and many new chemical and industrial factories are being erected, which, as the railways become electrified, will all require large quantities of electrical energy.—*Teknisk Tidskrift.*

THE ELECTRICITY SUPPLY BILL.

The Bill has now been long enough before the public to enable those more directly concerned in its provisions to form opinions as to its bearing upon their interests, and naturally very varied and conflicting pronouncements are appearing in the Press and in the minutes of Committees and company reports. Apart from the ebullitions of extremists on either side, which are usually based upon superficial impressions as to substance or obvious distortions of fact, the discussion centres mainly round the financial provisions of the Bill, and it appears to be certain that these will require considerable modification before the measure receives the Royal Assent, for the close examination to which they have been subjected has revealed a number of defects of material importance.

The companies' point of view has been ably expressed by Mr. P. D. Tuckett, chairman of the Urban Electric Supply Co., and of the Metropolitan Electric Supply Co., on behalf of the smaller undertakings, and by Mr. J. B. Braithwaite, chairman of three of the London supply companies, on behalf of the larger. Whilst approving of the objects of the Bill, Mr. Tuckett opposes public ownership and operation by District Boards: he welcomes the appointment of a Board of Commissioners, but would have them confine their activities to advisory functions and to those of an impartial expert tribunal. He deprecates the pursuit of vague ideals, which undoubtedly has wrought immense mischief in the past, and points out that the erection of super-stations under State control is not necessarily a short cut to cheap electricity supply. What he defines as the outstanding needs of the industry are freedom from harassing restrictions and political interference, and a fair field for enterprise, and he fears that the Bill whilst removing the existing restrictions will open the door to political interference in an aggravated form. But it is the question of compulsory purchase which chiefly alarms both these gentlemen, on the ground that the terms outlined in the Bill constitute a grave injustice to shareholders. Not only will their undertakings be deprived of the most valuable years of their concessions, and their property be severed in halves, without compensation, but also the purchase price of the plant will take account of depreciation and not of appreciation, contrary to the terms prescribed under the Electric Lighting Act of 1888, which provided for the payment of the "fair market value at the time of the purchase." Moreover, in the case of many small undertakings, the possibility of purchase by the local authority was very remote, whereas the District Boards will be in a much better position to purchase them, and the cost of management, thrown entirely upon the distributing side of the undertaking, will constitute a relatively heavier burden. Both objectors stigmatise the new proposals as a distinct breach of the Parliamentary bargain which was made in 1888, and under which most of the capital has been subscribed.

These, we agree, are not unreasonable arguments; but it seems to us that they take too little account of the safeguards provided in the Bill, and exhibit an unwarranted distrust of the discretion and fairness of the Commissioners. It is expressly stated in the Bill that in the event of disagreement as to the justice of the purchase price, the matter shall be referred to arbitration; the wording of this proviso and of the purchase clauses generally should be widened, so as to cover other points in addition to the cost and depreciation of the generating station alone, which cannot be regarded as separate and distinct from the rest of the undertaking. As regards goodwill, however, it is not so clear that the position of the companies is adversely affected, for goodwill is associated with distribution, and if, as is foreshadowed, the distributors remain in possession, they will retain the goodwill. In this connection, there is certainly justification for complaint if the District Boards, as Mr. Tuckett suggests, are able to come into the distributing area and supply electricity for lighting the streets, railway stations, &c., and this point ought to be satisfactorily settled by amendment of the Bill. As regards the powers of the Commissioners to amend or revoke existing Provisional Orders, we may point out that this can only be done by "Special Orders," which have to be reviewed by the Board of Trade, and, if opposed, to be made the subject of local inquiry: they have also to be laid before Parliament before they can be put in force. It should not, however, be within the power of the Board of Trade arbitrarily to curtail powers granted by Parliament without due compensation, and here also there is room for amendment.

On the municipal side of the debate, the Hammersmith Borough Council demands that public representation shall be assured predominance on the District Boards, and that the Boards shall be allowed to elect their own chairmen; objection is taken to the special representation of Labour as an invidious distinction. While the companies declaim against the injustice of the purchase terms, the Councils demand that their stations shall be purchased on the same basis as those in private ownership! The Hammersmith Council also objects to the lack of a right of appeal from the decisions of the Commissioners, and emphasises the "danger" that a company may be established to carry on a one-time municipal enterprise, with the advantage of starting with a very low capital—the outstanding debt. While we think that provision should be made for appeal or arbitration on any point which may involve a question of financial equity, we do not believe that there is the slightest risk of any company manipulation on the part of the Commissioners which would be detrimental to the public interest.

There is one point which frequently crops up, and which we think is regarded in a wrong light. It is alleged that plant and mains will cost at least twice as much as before the war, and that, therefore, the business of electricity supply will be heavily handicapped. In one sense this is strictly true; but actually it is of no importance. All other costs have gone up in a like ratio, and the situation of electrical undertakings is relatively unchanged; the fact is that the nominal value of the currency has fallen, but the relative values of commodities such as electricity and gas are much the same as before. As a matter of fact, the selling price of electrical energy has not increased so much as that of other commodities, owing to the larger proportion of the cost of electrical energy which is represented by capital charges; in effect, those capital charges have been *halved* by the change in the value of currency, and that is the main reason why the cost of electricity has not been doubled.

At a private gathering last week, Mr. Philip Dawson reviewed the position mainly from the technical point of view, severely criticising the idea which has found favour amongst the public that the Bill will enable the cost of electrical energy to be greatly reduced—a view which every electrical engineer knows to be entirely fallacious. He showed that with a load factor of 50 per cent. the minimum cost of the KW.-hour sent out from the super-station at high pressure would be slightly below ½d., and pointed out that before the war the cost of electrical energy in this country compared very favourably with foreign tariffs; he deprecated the suggestion that the super-station would be a remedy for all evils, though he admitted that there was room for an immense expansion of electricity supply. Stress was laid on the point which we have emphasised on previous occasions—that it was useless to erect big power stations without, at the same time, taking steps to secure adequate outlets for their product. In many respects, however, Mr. Dawson in the course of his speech modified his remarks materially, and, in fact, advocated many of the objects towards which the Bill is expressly directed, such as the co-ordination and amalgamation of existing undertakings, the supply of electricity to railways from stations carrying on general supply, State assistance on commercial lines, the removal of hampering restrictions, &c.; and his address, whilst admirably summarising the position and correcting erroneous ideas that the general public may have formed, contains little to edify the technical man.

In our issue of May 23rd we abstracted at considerable length Mr. Highfield's paper before the Royal Society of Arts; the author dealt with the subject in detail, and, like

Mr. Dawson, pointed out the pressing necessity of the removal of the present uncertainty, in order to enable urgently needed extensions to be carried out. For this purpose he pressed for the immediate appointment of the Electricity Commissioners, leaving the creation of District Boards and the purchase of stations and mains to follow in due course when the more urgent considerations had been disposed of.

(*To be continued.*)

MR. BRAITHWAITE'S VIEWS.

In a letter to the *Financial Times*, Mr. J. B. Braithwaite said that as chairman of three of the electricity companies supplying London, he thought it well that the public should realise that the Electricity Bill as at present drafted involved a serious breach of faith with the investor. When electricity supply was in its infancy and Parliament was anxious to encourage private capital to undertake the risky work of pioneering the new industry, the Electric Lighting Act of 1888 was passed, giving the companies who received provisional orders under it a 42 years' tenure. This extended tenure was given because, under the Electric Lighting Act of 1882, clause 27, power was taken to purchase the undertaking within six months after the expiration of a period of 21 years, and it was found impossible to raise the necessary capital on these conditions. The purchase of the undertaking by the local authority of the district served was provided for, the terms of purchase being such, first, that where a part only of the undertaking was purchased, as proposed under the Electricity Bill now before Parliament, loss occasioned by severance was to be paid; secondly, that the purchase price was to be the fair market value at the time of the purchase.

The Act as drafted constituted a three-fold breach of the Parliamentary bargain under which the capital of electrical supply undertakings throughout the country had been subscribed: (1) In providing for the purchase of the generating station apart from the distribution system without any compensation for severance. (2) In providing that the actual cost of the generating stations less depreciation should be the purchase price instead of their fair market value at the time of the purchase. (3) By anticipating the date of purchase provided for in the 1888 Act by 12 years without any compensation for the same.

He could not believe that any Government would allow such a gross breach of faith to go through. Now that electric supply was well understood and that the various companies were receiving some return for their early outlay, it would be grossly unjust to deprive them without compensation of the last 12 years of their tenure, which, in the ordinary course of events, would be the most profitable. There was another point so far as the London electricity supply companies were concerned. Under the Act of 1908, which substituted the London County Council for the individual borough councils as the purchasing authority, it was provided that if the London County Council exercised its right of purchase in 1931 it must not buy one company and leave another, but, if it purchased at all, it must purchase the undertakings of all the companies.

Under the present Electricity (Supply) Bill the District Electricity Board was not even bound to buy all the generating stations and transmission lines within its area; a company which had only been granted by Parliament a small area in which to supply electricity, and consequently had a small and relatively uneconomical generating station, might have its district invaded and its business taken away from it without receiving any compensation whatever even on the partial and inequitable terms provided in the Bill.

MR. TUCKETT'S CRITICISM.

At the meeting of the Urban Electric Supply Co., Ltd., on May 21st, the chairman, Mr. P. D. Tuckett, after a general review of the situation, outlined the proposals embodied in the Electricity Supply Bill, and said that so far as it was an attempt to handle the problem on a broad and comprehensive basis, they would all agree that it proceeded on the right lines, for no one questioned the importance of taking all possible steps to encourage the development of a cheap and ample supply of electricity, for which there was still an immense field open; but in providing for public ownership, and still more for operation by District Boards, he feared a grave mistake was being made.

He found it difficult to believe that five supermen, under the control of a Government department, and acting through District Boards constituted on the lines proposed, were likely to handle the complexities of so technical and rapidly growing a business half as successfully as those who had built it up and were already familiar with its many needs and difficulties. The whole industry was prepared to welcome the appointment of an expert Board of Commissioners for co-ordinating and controlling its development, advising Parliament of its needs, and generally promoting its welfare by acting as an informed and impartial tribunal and in other ways, and it had so formally expressed itself. That he conceived to be the proper function of such a board, rather than to undertake the dangerously ambitious experiment of attempting to run the business.

As stated in an admirable pamphlet of Electrical Development issued by the Ministry of Reconstruction, "In the past ill-considered legislation based on vague ideals rather than sure knowledge, has done much to hamper electrical development in this country."

In view of the immensely enlarged importance of electricity at the present time, it would be deplorable if they were again to be condemned to suffer from hasty and ill-considered legislation based on vague ideals rather than sure knowledge; yet that was the danger.

The outstanding needs of the industry were:—

Freedom from the artificial and hampering restrictions from which it had so long suffered, and

A fair field for its enterprise free from the paralysing uncertainties arising from political interference and liability to purchase on uncertain terms.

Whilst going a long way to meet the first of these requirements, the Bill seemed likely to rivet the shackles of political interference tighter than ever.

With extensions of plant called for in every direction, there was urgent need for a settled policy and renewed confidence if the industry was to go forward whole-heartedly with the difficult task which lay before it, for, until its future status was determined and it was assured of fair treatment, it could not be expected to incur the abnormally heavy expenditure which current prices involved.

With regard to the purchase of their stations, he considered the terms suggested as open to the gravest objection. The standard price was to be the cost price, less depreciation. They were to stand to lose where there had been depreciation in value without being given any credit for appreciation in value. Moreover, the expenditure which was to be taken into account in determining the cost price, and the amount of depreciation, were to be settled by the Commissioners, who were in no sense an impartial tribunal, since they had a direct interest in acquiring the stations as cheaply as possible. It seemed altogether opposed to the most elementary principles of justice that the Commissioners should act as judges in their own cause, and yet this objectionable feature recurred all through the Bill.

Then, again, some of their undertakings were not purchaseable for many years. Unless they were to receive compensation therefor, why should they be deprived of their stations now, and so lose the right to the benefit of the increased economies which they expected to derive from the improved plant which they would have erected therein during the remainder of the term?

Again, many of their undertakings were purchaseable by the local authority on the basis of capital expenditure plus a percentage. Why should they have their stations taken away on any less favourable basis?

To have the District Boards substituted for the local authorities as purchasers of their undertakings was a serious variation of the bargain on which they undertook the risk of embarking on the business, since with many of their small undertakings the chance of the local authority exercising its power of purchase was comparatively remote, a factor which constituted a material element in computing the risk.

They would still require competent technical staffs, even if deprived of the stations; in their small undertakings how were they to afford them for distribution alone? And how was it supposed that cheap electricity was going to result from a duplication of staff, the distribution being run by them and the stations by the District Boards? and was not the divided responsibility bound to lead to endless confusion and difficulty?

The District Boards, having deprived them of their stations, were to be allowed to supply lighting authorities, railways, tramways, &c. In some of their towns the public lighting represented a large proportion of the load, and without it they could never have undertaken the obligations of the concession. They derived a substantial revenue from supplying the light and power in railway stations, yards, workshops, &c. In other towns they supplied the tramway load. On no equitable basis was it possible to deprive them of these loads without adequate compensation.

Seeing that their Provisional Orders constituted the Charters under which they worked, it seemed a strong measure to suggest that they might be revoked at the will and pleasure of the Commissioners backed by the Minister of Ways and Communications.

Probably the Bill would receive considerable modification during its passage through Parliament, and he imagined it was more than likely that most of their stations would fall within the category of those which the District Boards might be exempted from acquiring.

EXPENDITURE UNDER THE BILL.

A memorandum has been issued as a White Paper showing the expenditure likely to be incurred under the financial clauses of the Electricity (Supply) Bill. Dealing with revenue expenditure, it is stated that the whole of the expenses in connection with the administration of the Bill would ultimately be borne by the District Electricity Boards proposed to be set up, among which the expenses will be apportioned. During the first five years after the passing of the Act the expenses will be paid out of moneys provided by Parliament, but such moneys are to be treated as advances from the Treasury and are to be repaid with interest. It is difficult accurately to forecast this annual expenditure, but the salaries, office and travelling expenses of the Electricity Commissioners, their inspectors, assistants, and staff should not exceed £35,000 per annum. Under clause 3 the Commissioners, with the approval of the Board of Trade (or the Ministry of Ways and Communications), may cause necessary experiments for the improvement of the methods of electricity supply to be made, and it is thought that the expenditure on this account will not exceed £10,000 a year. This money will be recovered from the industry in the same way, and there will be no permanent charge upon the State.

As to capital expenditure, it is stated that under clause 19 powers are sought for the Board of Trade (or Ministry of Ways and Communications) to expend on urgent works a sum not exceeding £20,000,000. This money is also an advance from the Treasury, and will be repaid, with interest and such charges as the Treasury may require, by the Electricity Boards for the districts concerned when established. It is anticipated that this expenditure will be spread over a period of five years from the passing of the Act, as under:—

Financial year ending April 1st.		Capital expended.
1920	... ...	£1,000,000
1921	... ...	3,000,000
1922	... ...	7,500,000
1923	... ...	5,000,000
1924	... ...	3,500,000
		£20,000,000

This estimate is based on the known urgent requirements for new generating stations and plant, and is spread over the time necessary to cover the constructional period. It also covers the necessary transmission and inter-connecting cables and lines, having regard to the annual output from and capacity of British cable makers' works.

In clause 33 the Treasury is empowered to guarantee the interest, on such terms as it thinks fit, on stock not exceeding £25,000,000, to be issued by the Electricity Commissioners for the purpose of loans to District Electricity Boards or authorised undertakers where it appears that money necessary for the purposes of the undertakings cannot be otherwise raised on reasonable terms. It is impossible to say in what cases (if any) it will be necessary to call upon this guarantee. The whole scheme is based upon the anticipation that the industry shall be self-supporting, and it is not expected that the guarantee will, in fact, involve the Treasury in any payment, but the provision is regarded as necessary, if only for the purpose of facilitating the issue of such stock as may be found to be required.—*Financial Times.*

INCENTIVES TO EFFICIENCY.

By MAJOR E. A. PELLS, R.E.

The first question any worker will ask as soon as the idea of efficiency methods is brought to his notice is: "What are we going to get out of it?" After all, this is but human nature, and the natural feeling of any living being, that if extra effort is made an extra reward should result. Therefore it is obvious to the dullest student of psychology that it would be useless to set standards and arrange routing to obtain a maximum output without providing the necessary encouragement in the shape of increased pay or bonus. There is one thing that must always be kept before one when fixing the amount and method of making the reward, and that is not to arouse the suspicion of the worker that he is being "done," by introducing a too complicated system of arithmetic.

There are many ways by which the superior and more industrious worker can be given the benefit of his extra ability and energy. Many employers still pin their faith to time payment, but this is usually very unfair to the good, honest worker unless carefully collated, authentic records are kept of all workers' ability and work, and rises given for individual efficiency. If this is done it is much more satisfactory and may spell for efficiency in output, but where we have the worker going his own pace, as it were, and trusting to the goodness or honesty of purpose of his employer to give him his just reward, his rises in pay therefore cannot be viewed as incentives to efficiency, because they are problematical, and if his master thinks he will go on at the same pace without a rise in pay, he will in all probability never receive any. They also come *after* the effort, and are paid for work which may not be nearly so well done as that which actually earned the rise. For this very reason many workers prefer a plain piece rate, and employers prefer it, too, as it is something very definite, and the wage calculations become a very simple matter indeed. Piece rates constitute a problem, to obtain the ideal, as the abilities of workers very often vary to such an extent that a rate upon which one worker can just earn a fair week's wage enables another to take away more money from the pay table than the shop foreman. To get over this difficulty, Emerson, the eminent American efficiency engineer, suggests that when the man has finished the task which gives him a fair wage, he should be allowed to leave his work, thus getting the benefit of his prowess in more leisure hours. This may be all right in a small works, and where most of the work is of an individual character, but when machinery is running and in large works, it introduces a difficulty concerning the waste of power on one hand, and the question of discipline on the other. The fixing of piece rates is a question for experts, and should only be done after due investigation, and not by guesswork. Haphazard methods of fixing piece rates have been the cause of more industrial unrest and strife than anything else. The most equitable method of applying incentive is undoubtedly by one of the several task bonus systems which provide a definite incentive to the worker to attain and exceed bonus standard. The various bonus systems all have minor points to recommend them individually, but collectively they are based upon the same principle; this is, that when the worker completes his standard task he earns a bonus and receives a piece rate for all work over the task. The introduction of such a system should be carefully explained to the workers, and a clear exposition posted up showing how their wages are calculated under it, when it will be found that an equitable wage system, carefully explained and thoroughly understood, by which the efficient operatives receive their just reward, undoubtedly encourages the co-operation of the workers in the efforts put forth to gain efficiency. Considered psychologically, the mere fact of providing a definite ideal which all workers are encouraged to make an effort to attain by the reward offered, is very sound, as it is human nature to require something to aim at, with a reward when one gets there. The task idea can be amplified and even introduced into clerical work where the diversity of work factor is not too great, so that throughout a works all are working to a schedule. It is usual to fix the bonus between 30 per cent. and 50 per cent. of the day rate. So it is possible for a man to earn that per cent. increase in his pay by his own efforts, assisted, of course, by the instruction cards, which are the outcome of the efforts of the efficiency engineer. It can truly be said of bonus systems that they include all the points in favour of time and piece rates, with none of the drawbacks of either. The bonus system also gives one a rough indication of the general value of the efficiency in the shop, and all cases of unattained or lost bonus should be carefully investigated. I have not yet said anything of profit sharing or proportional bonuses on the result of the firm's working. These are not always successful for several reasons. First, it is a bargain between two parties, employer and employé, one of which has every opportunity to cheat the other, and the other has no means of checking. Secondly, every worker benefits according to the amount of his present position and pay, and not *pro rata* to his industry and ability. Thirdly, from the employer's point it is anything but equitable, for out of 18 factors which affect efficiency, the worker only affects one, so therefore his share should be an eighteenth part. There are many instances where the profit-sharing system is in vogue, and working quite satisfactorily, but the majority of the workers appear to regard it as a lucky windfall, or gift from the gods rather than a portion of their just reward for their efforts on behalf of the firm.

There is no doubt that the task bonus system is the best method of providing an unmistakable incentive to the achievement of standard, and by turning the daily labours of the worker into a kind of competitive game with a definite reward for the winners, we go far towards solving the problem of industrial efficiency.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The Origin of Electricity Supply.

In your leader on electricity supply in your issue of May 30th, I notice you say that "If there had been no company undertakings to blaze a track through the forest of obstruction and disappointment in the early days, there certainly never would have been any municipal electrical undertakings or any I.M.E.A. to-day, and we cannot help feeling that the Association takes a narrow view of this subject, unworthy of its past."

Confirmation of your statement can be obtained by referring to the evidence given before a Select Committee of the House of Lords in 1886, when three amendment Bills were under consideration to extend the 21 years' purchase contained in the Act of 1882. On that occasion Mr. Edward Orford Smith, who gave evidence as town clerk of Birmingham, and also on behalf of the Association of Municipal Corporations of England, pleaded that electrical science was not then sufficiently advanced to ensure the practicability of an electric supply from a central station; but, in answer to further questions, he admitted that he had not read an account (published the day before) of the successful working of the plant at Paddington, and would not admit that the real obstacle had been the legislation of 1882.

He objected to a company coming to supply electric light, as it would demand power to break up the streets, and the Corporation of Birmingham had no intention of starting anything in the nature of electric lighting for itself, but he wished to extend its veto to Provisional Orders.

It is unnecessary to mention the indebtedness of the industry to the enterprise of public companies since that time, for all progress has been initiated and carried out by them, including the introduction of the steam turbine.

In 1893, when fighting numerous actions for vibration, I ordered the largest Parsons' steam turbines that could be made at that time, and although they were only 350 KW. each, all the troubles and defects which a turbine could possibly develop seemed to concentrate in these early efforts, and as a result Sir Charles commenced a triumphal progress, out of which municipal electrical undertakings have derived full benefit.

Frank Bailey, *Joint Managing Director*,
The City of London Electric Lighting Co., Ltd.

London, S.E., *June 3rd*, 1919.

The E.P.E.A. Award.

Your correspondent "Wessex," in last week's issue, asks: "How can the E.P.E.A. award apply to Mr. Harding or any of his colleagues who consider it *infra dig.* to join a trade union, and therefore, one naturally concludes, are not members of the E.P.E.A.?" Now, I will give your correspondent a few "crumbs" from other trade unions accepted by the E.P.E.A. at the London Electric Railways power station, Lots Road, Chelsea:—

National Union of Railwaymen's award of 48 hours per week: National Union of Railwaymen and Electrical Trades Unions' award of bonuses and 12½ per cent., totalling £2 6s. 4d. They also get a free holiday pass to almost anywhere in the United Kingdom, privilege tickets at half single fare return for self and wife, and quarter single fare return for children. On the top of all this they are trying to create "holy war" for 20 per cent. plus £90.

Now I ask: If the N.U.R. and E.T.U. awards extend to non-members why should not the E.P.E.A.'s award? Perhaps this ought to be brought to the notice of the Minister of Labour or the arbitrators when dealing with "hard cases." I see the E.P.E.A. are using the "strike" or "handing in notice" weapon they made such a song about a little while back.

Ulster McReavie.

June 9th, 1919.

"Shift Engineer's" statement that "A very considerable percentage of our members have received the full award" is, according to the latest E.P.E.A. report, incorrect. That report distinctly states that out of 636 undertakings, over 500 have not paid the claim or the award. However, I have now received the information I was seeking, and understand that about 80 per cent. of us are still in the cold. No doubt the knowledge that there are so many of us will console us; but alas, that knowledge satisfies no tradesman's bill, neither does it provide a summer holiday.

Still, one has other sources of consolation. "Shift Engineer's" curious use of metaphor for example, wherein he belauds moral suasion and speaks of steam hammers being used to crack nuts. The E.P.E.A. tells us most distinctly what moral suasion brings—patronising contempt—whilst even elementary commonsense demonstrates that moral suasion never yet charmed kernel out of nut shell. One has to use force. Consequently, as we wish for a particular kernel, so must we first crack the shell which surrounds that kernel; and the shell which surrounds our kernel is so hard, so thick, that we may have to use a steam hammer. So here we come to a full stop. Happily, we can once again smile, for does not our friend "Shift Engineer" inform us that in such a case the E.P.E.A. will not fail to "Draw the sword strongly"!!! This, indeed, is real Adelphi unadulterated; but then, what exactly is the effect of "drawing the sword strongly"? It may fly from one's hand with the vehemence of the "strong withdrawal," and go over to the enemy; whereat the insolent foe laughs, picks it up, and prods us with our own weapon. Or, perchance, the "strong withdrawal" may end in the unfortunate striking of one of our friends and comrades who stand around us. No doubt the fact that it *was* accidental, will console our comrade for the breaking of his jaw with the flat of our strongly drawn weapon; but, on the other hand, it may not—and one cannot deny that one has injured a friend and given the wicked cause for glee. It may perhaps fall out, that the "strong withdrawal," with a flourish, may affright the foe; on the other hand, he may be scornful and—use his weapon whilst "Shift Engineer" flourishes and "strongly withdraws."

No, my friend, no; we don't howl for blood, we don't howl for anything—it's abominably bad form. What we desire is peace; and if not peace, than to USE the sword skilfully. If in the using we are damaged, or go under, well—Kismet. At least, we have not been trodden under like worms, and that is something.

Now that our Association has officially informed us that about 80 per cent. of the total number of undertakings have not paid the claim or the award, one desires no longer to occupy valuable space in your columns. It, then, only remains to thank yon and withdraw, not strongly, but graciously.

Connaught T. Smith.

June 9th, 1919.

Carbon Brushes.

In the paper on carbon brushes by Mr. P. Hunter-Brown, reference was made to the decreasing coefficient of friction with increased speeds.

I have been in the carbon-brush trade for ten years, and found this to be a rather general rule which, however, did not always hold true. I had attributed this characteristic to the probable fact that at high speeds the brush was not in such intimate contact with the commutator, or in other words, that more of an air cushion was present under the brush face.

Recent experiments, however, have indicated that there is a critical pressure for each grade of brush at which the coefficient of friction is constant at any speed. With lower pressure the coefficient of friction decreases with increased speed, whereas, with high pressure the coefficient increases with increased speed. This critical pressure is different for each grade, and is lower for low-friction brushes than it is for high-friction brushes.

National Carbon Co., Ltd. (Inc.),
E. H. MARTINDALE,
Sales Engineer.

Cleveland, O.,
May 21st, 1919.

German Accumulators in the War.—At the outbreak of war the German industry was faced with a tremendous call for batteries for submarines. The larger types required batteries of 220 cells of 4.500 amp. hrs. capacity, weighing 80 tons, and costing about Mk.¾ million. In 1917 86 submarines were placed in service, and in 1918 the monthly addition was from 10 to 14 submarines. In this connection the success of F. Bayer & Co. in producing synthetic rubber was of the greatest value for the manufacture of battery boxes. The output of synthetic rubber reached 150 tons per month in 1918 at a price of Mk.37 per kg. The army used large quantities of accumulators for lighting automobiles, signalling by arcs and wireless, lighting dugouts for gun crews and reserves, and lighting aircraft. The transport of cells for charging necessitated the substitution of celluloid for glass boxes to save weight. At first the celluloid was defective, particularly in its cementing, but the quality improved later The prevention of spilling the acid was achieved by a number of devices, generally consisting of chambers connected with the interior of the boxes by small tubes in such a manner that the acid could not flow out of the ventilating openings. The need of small stationary batteries rose greatly owing to the ever-increasing dearth of petroleum and other illuminating substances, and produced a great scarcity of lead, which rose to Mk.90 per 100 kg. The prospects of the accumulator industry in Germany are very bad.—*E.T.Z.*

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The Callender-Frampton Service System.

Some years ago we briefly noticed this system, which is intended to facilitate the localisation of faults in cable networks by the simple method of looping-in the distributing cable into the consumer's premises. As the war conditions restricted extensions there has been little activity in laying new services; now that freedom is restored, it may be worth while to draw attention to this system, which has been improved in the interval.

Fig. 1 shows a three-wire distributor fed at both ends from the network boxes A and B, and having two-wire services taken alternately off either side of the system. One of the outers is cut at each service, and a loop is taken into the consumer's premises, this loop being completed through a removable copper link C in the house fuse set. It will be seen that by removing any one of these copper links the circuit may be broken at that point, and that by removing any two links on one conductor the intervening portion of that conductor may be disconnected for testing.

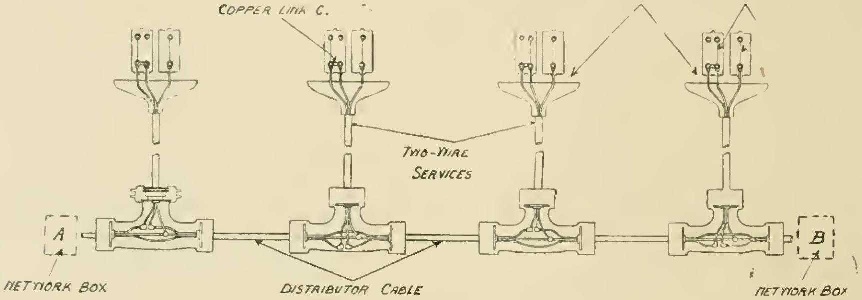

Fig. 1.—Diagram of Callender-Frampton System.

By disconnecting only the shortest possible section of cable at one time (that is to say, the portion from one service to the next service from the same side of the system), the whole length of cable can be tested in successive sections without interrupting the supply to any installation supplied from that cable. Further, when a fault occurs, after it has been located by the method described below, the faulty portion of the cable may be isolated in the same way, and the supply reconnected to every service on the cable, leaving the fault to be repaired at leisure.

It will be seen that on the pole connected to the loop in the distributing cable the fuse contacts are in duplicate, but only one fuse is used, so that when a conductor of the distributing cable is broken by withdrawing the copper link the installation may be connected by the interchangeable fuse to whichever side of the loop remains connected to the supply. When a section of the cable is to be isolated, either for testing purposes or because a fault has been traced to that section, the first copper link at each end of the section of cable to be isolated is removed, and the fuse at each end is placed on that side of the break which remains alive.

When a fault has occurred to earth on one of the outers of a three-wire distributing cable, and the main fuse in the feeding network box has blown, the following method is adopted to locate the fault :—

Commencing from the end at which the cable is fed (if it is fed from both ends, the test may be commenced from either), the copper link is removed from the fuse box on the affected service nearest the network box, thus leaving connected to the network box only that portion of the cable on that side of the system between it and the first service, and disconnecting the remainder. A trial fuse is then inserted in the network box, and if the fault is in that section of cable this fuse will blow. If this does not happen, and if, when the house fuse is put in the side of the box nearest the network box, the lamps light up, then the fault is not in that section of cable.

The copper link at the next service on the same side of the system is then removed, and the one previously removed is replaced, thus connecting another section of the cable to the portion already alive; this process may be repeated, adding section by section and trying the lamps at each service, until the faulty section is reached, which will be indicated by the reconnected portion being found dead, owing to the trial fuse in the network box having blown.

Having now found the fault to be between two adjacent services, this section is isolated, and new main fuses are inserted in both network boxes, when every service on the cable may be furnished with a supply. In the case of a distributor fed at one end only, of course only those services between the network box and the fault can be given a supply while the fault remains.

Messrs. Callender's Cable & Construction Co., Ltd., of Hamilton House, Victoria Embankment, E.C., control the patent.

Tandem Resistance for Bioscope Arcs.

Our illustration (fig. 2) shows a tandem resistance, designed to obviate the possibility of overloading a bioscope generator, which is manufactured by Messrs. Austin Walters & Son, Gaythorn Electric Works, Little Peter Street, Manchester. When ordinary resistances are used the operator either switches off his first projector and then strikes the arc of the second, or, as is more often done, strikes the second arc before switching off the first, thereby seriously overloading the generator. By using a tandem resistance it is claimed to be impossible to overload the generator, and a three- or four-part film can be run through without any break whatever. When near the end of the first spool, the operator moves the resistance regulator on to the first contact of the second arc, which allows a small current to pass when the carbons are adjusted. The small arc created is not strong enough to project a light through the film or to interfere in any way with the first arc. The circuit having been made as described, the regulator is moved over the corresponding contacts as desired, which increases the current in No. 2 arc and decreases the current in No. 1 arc. It will therefore be appreciated that both projectors can be controlled without overloading the generator, as it is impossible to increase the current on either projector without decreasing it on the other. These resistances are not an experiment, and we are informed that numbers are in daily use, and giving entire satisfaction.

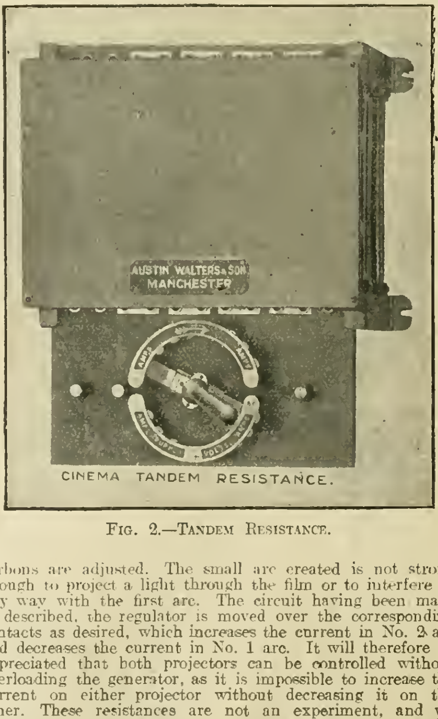

Fig. 2.—Tandem Resistance.

LEGAL.

Marconi's Wireless Telegraph Co. v. The Crown.

(Continued from p. 660.)

Mr. Justice A. T. Lawrence sat again in the King's Bench Division on Wednesday, June 4th, to assess the damages due to the Marconi Wireless Telegraph Co. from the Crown for breach of contract in regard to the construction by the company of an Imperial chain of wireless stations round the Empire.

Sir Edward Carson, K.C., M.P., continuing his opening address on behalf of the company, said there was no hostility on the part of the company towards the Government, and they would be prepared to do everything they could to meet the views of the Government with a view to future friendly relations. He put in a summary of the cable traffic showing the number of words transmitted from 1909 to 1916, with the percentage of increase worked out. With the exception of 1911 the increases were all over 10 per cent. (This figure being the basis of the company's claim, amounting roughly to £7,000,000.)

Evidence was then called. The first witness was Mr. Godfrey Isaacs, managing director of the Marconi Co. He said that when the company was founded in 1897 it had a capital of £100,000, and owned only one English and four foreign patents. In 1913 the capital had been increased to £1,500,000. The Marconi International Marine Communication Co., with a capital of £1,500,000, operated wireless installations on about 90 per cent. of the 2.587 ships equipped. In the earlier years of its existence the commercial development of the company was not so efficient or extended as the technical. That was mainly due to lack of energetic management, the company allowing anyone to use their patents. As a result the Germans usurped all the Marconi patents, and were using them in competition with the Marconi Co. The company had expended £450,000 on research work. They had an expert technical research staff of about 90, and were spending between £50,000 and £60,000 a year on research.

Mr. Leslie Scott: What is the longest distance you have got messages through?

Witness: Between 12,000 and 13,000 miles—from Carnarvon to Sydney, N.S.W. The messages were received in Sydney by the managing director in Australia by means of an installation on the roof of his house. Commercial wireless communication direct with Australia would be possible if they constructed stations.

Mr. Isaacs spoke of the company's war work. They constructed stations abroad, beginning in 1915, for which they had to send every particle of the material, including bricks and mortar. These stations were constructed in a few months. They received, translated, and dispatched to the Government practically every word sent out by wireless from all over the world. Showing how wireless beat the cables, witness said when wireless was started between Vancouver and Honolulu in 1914 the cable traffic was approximately 250 dollars a day. Wireless began at the reduced rate of 25 cents a word, compared with the cable rate of 35 cents, and within two months the cable rate came down to 25 cents. In 1917 the cable traffic was still 250 dollars a day; the wireless traffic was 500 dollars a day. The wireless traffic increased more than threefold: the cable traffic remained stationary. The long-distance wireless installation between Clifden and Glace Bay, Nova Scotia, had, said witness, many disadvantages compared with what the projected Imperial wireless chain of stations would have provided. If erected to-day the masts would be 600 ft. high. Witness said that the figures of 80,000,000 words picked up and 8,000,000 words transmitted during the war were entirely Government work. In addition commercial work was done till nearly the end of 1917. Wireless had made great progress in recent years, and the traffic had grown beyond the company's capacity to handle. They had had to advise customers that they could not accept traffic, and had also had to cable thousands of words which could not be handled by wireless. He thought the traffic for many years, if the chain of stations had been established, would have shown a far greater increase than 10 per cent. per annum, which was the amount of royalty the company was to have under the contract. As for the probability of the company continuing to receive those royalties for either 18 or 28 years, as provided for in the contract, that was, he was confident, assured by the increasing experience and efficient working of the company and its officials, and the fact that the company and its associated companies adapted fresh inventions every year. Even were no fresh inventions forthcoming, in his opinion commercial wireless would be better carried out by a private company than by a Government department. The first reason for that was that a private company would reduce rates at a greater speed than a Government service, and reduced rates would lead to increased traffic. The whole policy of private enterprise was to reduce rates to the lowest possible figure and increase traffic to the highest possible maximum. In the second place, a private company like Marconi was able to open stations in foreign countries, and thus arrange through traffics, in that way increasing traffics.

Mr. Scott: Would the probability of new inventions by the Marconi and associated companies be of assistance?

Witness: They would be a necessity, for the traffic must necessarily grow with the development of trade, and apart from the normal growth and great growth which would have followed the substantial reduction of traffic which was contemplated, to be able to conduct the service efficiently would require to be introduced year by year every improvement that came along. It would have been essential to have the experience and inventions of the Marconi Co. if the British system was not to fall far behind foreign systems which were run by the Marconi service.

Cross-examined by Sir Ernest Pollock (Solicitor-General) for the Crown, witness said the contract between the company and the Post Office was not a burdensome contract, but it involved risk and doing work which prevented them doing other work.

The Solicitor-General: Your claim is for £7,182,000. Was that the value you contemplated the contract would be worth to you?

Witness: I always regarded the contract as a very valuable one, but I have never put a figure to it, because I never went into that.

You never realised it was worth £7,000,600?

No. I did not realise it was for £7,000,000. I realised it was a very big scheme, but with complicated figures of this sort it is difficult to estimate what the amount is, unless you work it out as my auditors have done.

The hearing was adjourned.

On Thursday, Mr. Godfrey Isaacs was further cross-examined by the Solicitor-General. The witness was questioned in great detail about technical charges to Egypt and India, and expressed dissent from several suggestions put to him by the Solicitor-General. In further cross-examination, witness agreed with the Solicitor-General that though it was possible to wireless to Singapore, it was not possible to wireless on from Singapore to Australia. Had the Imperial chain of wireless stations been built when they were proposed to be built it would have been possible. If the station at Devizes had been completed it would have been possible to wireless to Australia, and an enormous amount of money would have been saved by the Post Office, who would thus have avoided sending through two or three stations.

The Solicitor-General remarked that the contract did not contemplate the erection of a station in Australia.

Sir Edward Carson: The contract provides that the Singapore station should be able to communicate with Australia.

The Solicitor-General: I think Mr. Isaacs agrees with me that the erection of a station in Australia was a matter for the Australian Government.

Sir Edward Carson: It was plainly contemplated that the Singapore station was to be one of the stations to communicate with Australia.

Mr. Isaacs: The Commonwealth Government were most anxious to put up their station.

Mr. Justice Lawrence: You would not put up the whole six stations simultaneously?

Mr. Isaacs: Certainly, we should, every one, just as we put up 13 stations simultaneously for the Admiralty in all parts of the world. We had undertaken in the contract to do so. They had all to be completed in 18 months.

The Solicitor-General put to witness figures relating to cable traffic in recent years with a view of showing how this traffic was affected by war.

Mr. Isaacs said: I think the trade of the world and the telegraphic traffic of the world will be phenomenal after this war, in consequence of the extraordinary conditions which have arisen, and in consequence of the entirely new competitive conditions which are going to obtain directly we have the restrictions on trade removed.

The Solicitor-General suggested that wireless was not so reliable as cable traffic.

Mr. Isaacs: I don't agree. The Germans found wireless more reliable than cables, because all their cables were cut.

The Solicitor-General inquired if there was a single instance of long-distance wireless traffic having shown a cumulative increase of 10 per cent. per annum over a series of years.

Mr. Isaacs replied in the affirmative, and instanced the San Francisco-Honolulu service.

The Solicitor-General: Is it true that the wireless traffic between Clifden and Glace Bay in 1913 was only 3 per cent. of the cable traffic and only 4 per cent. in 1917?

Mr. Isaacs: Probably, that may be so, but that service suffers from many disadvantages. Glace Bay is 600 miles from Montreal and 900 miles from New York, and depends upon the cable. At a subsequent stage, Mr. Isaacs said his contention all along had been that the wireless did not take away from the cable traffic, but created additional traffic by offering lower rates.

The hearing was adjourned to June 24th.

British Thomson-Houston Co., Ltd. v. Duram, Ltd.

The Court of Appeal, on June 5th, delivered judgment upon the appeal of the British Thomson-Houston Co., Ltd., from a judgment of Mr. Justice Sargant refusing their application for liberty to amend the specification of Letters Patent No. 21,513* of 1906 for an alleged invention relating to a process for the treatment of metallic tungsten, and for the manufacture of electric filament lamps therefrom.

Lord Justice Warrington read a judgment in which he said the Master of the Rolls agreed. He said that at the date of the application for liberty to amend there were proceedings pending for revocation of the patent. The section of the Act of 1907 under which the application to amend was made allowed a patentee to amend the specification by way of disclaimer on such terms as to costs and otherwise as the Court might think fit, but it provided that the amendment should not be allowed if it had the effect of enlarging the claim which was described at the date of the original application. Mr. Justice Sargant had refused to allow the proposed amendment as in his opinion the proposed amendment was substantially different from what was said at the date of the specification, and then he said that in his discretion he did not think fit to allow the proposed amendment. Having referred to the action which the appellant company brought against Duram, Ltd., the Lord Justice said that the section of the Act of 1907 under which the appellants applied for leave to amend never intended that anybody could change a bad specification into a good one. He thought that Mr. Justice Sargant was right in refusing to allow the amendment. It was impossible to say that Mr. Justice Sargant had not exercised his discretion on proper grounds.

Lord Justice Duke concurred, and the appeal was accordingly dismissed, with costs.

THE ATOM OF ELECTRICITY.

At the Manchester College of Technology on Tuesday, March 25th, before a crowded and very appreciative audience, a lecture was delivered by Sir **Ernest Rutherford** upon "The Atom of Electricity." Mr. A. P. M. **Fleming**, Chairman of the North-Western Centre of the Institution of Electrical Engineers, presided. In opening the proceedings, he explained that the lecture had been organised by the Institution to enable those who had little occasion or little opportunity to study the fundamental principles of science underlying electrical phenomena to remedy their deficiencies in that respect, and to enable those who had received a scientific training to renew their knowledge.

Sir **Ernest Rutherford** said the problem of the nature of electricity and its connection with matter had excited profound interest in the minds of scientific men since the experiments of Franklin in 1750. He was the first to formulate the theory, generally known as the "one fluid" theory, which supposed that electricity was an intangible, unweighable fluid permeating all bodies which were regarded as positively electrified when they contained an excess of it, and negatively electrified when they were deficient in it. Later, the "two fluid" theory was put forward, which supposed that there were two electrical fluids. While the controversy between the adherents of those two theories was proceeding, Faraday, in 1833, made his famous experiments in electrolysis, *i.e.*, in the effects produced by the passage of electricity through certain conducting or chemical solutions. The theory was that the solution in some way was broken up into a number of positively- or negatively-charged particles, and the passage of electricity through it really consisted in the movement of the positively-charged bodies in one direction and of the negatively-charged bodies in another direction. Faraday observed a remarkable relation between the amount of material deposited and the atomic weight of the element. Indeed, his experiments clearly showed that electricity was of an atomic nature, but it was not until many years later that this fact was tentatively recognised. Dr. Johnson Stoney, in 1874, was the first to point out clearly that the results of electrolysis were only explicable on the assumption of the atomic nature of electricity, and he made an approximate calculation of the actual quantity of electricity carried by the unit which he suggested should be called the electron.

The discovery of the X-rays in 1895 gave a great impetus to the study of the passage of electricity through gases. It was shown that a number of positively- or negatively-charged particles or ions were produced in the gas, and it was possible to study in much greater detail the way the charges moved, and to examine their effects. The neutral gas, or a certain number of molecules of it, was ionised by radiation. The question arose whether the charges carried by these ions in the gas were really of the same nature as the charges in electrolysis. One method adopted in the investigation involved magnifying ten thousand times the particles emitted by radium, which were rendered visible and counted at the rate of 5,000 a minute. The actual charge carried by the whole group of particles was determined, and, dividing one quantity by the other, they were able to arrive at the charge carried by each particle. There was another experiment made with cathode rays, in which the bright particles emitted by radium were observed shooting upwards at a velocity of the order of 50,000 to 100,000 miles per second. They looked like blue rays of light, but could be deflected to the right or the left by a magnet. These particles were negative electrons, consisting of negative charges of very minute mass. It was really the disembodied atom of electricity quite apart from any atoms of matter. The evidence was reasonably complete that the negative electron was the unit or atom of electricity, and that its mass was purely explainable by its electrical effect; in other words, there was no matter associated with it; it was just a flying atom of electricity. So far they had got the negative atom of electricity separated. Now came the question: What about the positive atom of electricity? Was there a counterpart of the negative electron? Many had searched for it during many years, but nobody had found a positive charge which was the counterpart of the negative. The lightest mass they could find of a positive charge was actually the hydrogen atom; in other words, an atom of matter. Why was this? Many people thought that they must get the positive electron of the same small mass as the negative electron. Personally, he believed they would never do so, that there was at this stage a real distinction between the positive and the negative atoms of electricity, and the positive would never be found of less mass than the hydrogen atom. His opinion was—and there was no evidence to contradict it at the moment—that the positive electron was the hydrogen atom positively charged.

A hundred million ordinary atoms put side by side would about cover the width of a finger, and the negative electron was about a hundred-thousandth the diameter of an ordinary atom of matter. This much could be said—with a certain hesitation, because it was not verified—that they seemed at this stage to have got the idea that there were two kinds of electricity which really differed from one another—probably not in charge, because the charge was the same, but in dimensions; and probably the properties of matter, the structure of the atoms of matter, were due to the fact that there was a real distinction between positive and negative electricity. So the "two fluid" people, though they did not know it, and deserved no credit for it, were really right.

The lecturer proceeded to show by experiments the effects produced by the negative electrons in motion, and also by the positive bodies, when passing through gas. Other experiments, he said, threw light on the structure of the atom. It could be shown that in a multitude of ways that the negative electron was a constituent of the atom of matter, a mobile constituent that could be easily removed. How was the atom built up? Assuming it to be an electrical structure containing electrons or negative charges, it must have a corresponding magnitude of positive charge to make it electrically neutral. Some interesting suggestions had been put forward, and one in which he and others believed was the nucleus theory. It was arrived at experimentally. If they watched some alpha particles passing through gold they would see that some were deflected and turned aside at right angles. This indicated that when the negative electron, flying along at 10,000 miles a second, got inside an atom it came into collision with something which gave it a violent deflection. Experimental investigation led to this conclusion. The atom was built up in a rather surprising way. At the centre was a very minute nucleus which carried a positive charge; surrounding it on the outside were a number of electrons arranged at distances which, proportionately to the actual dimensions, might be called vast. If they imagined the nucleus in the centre to be about the size of a football in the middle of that room, the nearest electron would be out in the street and the furthest electron 400 yd. away. The electrons occupied the space, but did not fill it, and in the centre was this nucleus. Obviously the arrangement of the electrons was defined, and the properties of the atom were defined, by the magnitude of that charge in the centre which contained practically the whole mass of the atom. No doubt it was complex in itself, although of such minute dimensions.

Now by measuring the scattered particles one could form an idea of what was the actual charge on the nucleus. In an atom of gold one might say it had about 80 of the atoms of electricity. It could not be done very accurately by that method, but it was possible to get an estimate, and the general result seemed to show that the actual nucleus charge in the centre of the atom was about one-half of its atomic weight. Obviously, if the atomic theory of matter held they could not have one atom 20 and the next one 20¼; they could only have 20, 21, 22, and so on. Probably, therefore, the nucleus charge would vary by definite units or atoms of electricity. That view received a very remarkable verification by the work of Moseley in studying the wave length or frequency of the X-rays produced by the cathode rays. Moseley, who lost his life in the Dardanelles, was one of the ablest of the University's younger physicists. He took a whole system of elements, put them in a tube, and fired the cathode rays upon them. That gave rise to the X-rays which were characteristic of those elements, and by observation of the vibration of the lines in the spectrum he was able to show that the frequencies were proportionate to the square of certain numbers which were now called the atomic numbers. Starting with hydrogen as 1, helium was 2, lithium 3, and so on. The general evidence showed that the charge on the nucleus of the atom was 1 for hydrogen, 2 for helium, and so on. Moseley was not able to verify the whole series of elements, but since his death the investigation had been carried as far as the highest element, uranium, which had an atomic weight of 92. With four exceptions, the atomic number of every element from 1 up to 92 had been verified

He had said the nucleus was a very small thing. What must its composition be? There was reason to believe that the nucleus was built up of simpler units. It was a complicated thing consisting of positive atoms of hydrogen and helium with negative electrons mixed with them, but on the whole the positive charges were greater than the negative.

Although so minute, it was composed of a large number of bodies, and presumably was a system in itself, a system, so to speak, guarded on all sides by the electrons round it.

It might be asked, how were they to penetrate into the nucleus to find out what it was made of? There was some evidence which threw light upon that point. The general evidence was that the mass of the nucleus must be of the same order as the electron itself. If they could get particles swift enough to penetrate into the interior of the nucleus of any atom a large amount of information could be got by studying the deviation of swift particles that were flying through matter, the reason being that they penetrated right into the inner centre of the atom, and the forces involved in those collisions that he had spoken about were exactly the same as the forces involved when two atoms, say of helium and hydrogen, were in collision. Although these bodies were infinitesimal the forces at work were measured in pounds. The great problem was whether they would break down under the impact of these enormously swift particles. That was the problem of the future.

They had now arrived at this stage, that the atom of matter was nothing more than electricity. In fact, the whole of matter was really a manifestation of electricity, and they sought to explain the properties of matter by the combination of negative and positive charges. His audience would understand that although a great advance had been made in the knowledge of these things, when they reached the point of being able to discuss the possibilities of the structure of the atom they had still a long way to go. The great problem of the relation between electricity and matter was of fascinating interest to scientists, and he thought it would be the great problem lying at the base of science for years to come.

A vote of thanks to the lecturer was carried unanimously.

BUSINESS NOTES.

Another German Retreat.—The *Frankfurter Zeitung*, refers with regret and anxiety to the increasing number of retirements of leaders in banking, industry, and commerce, as it regards it as essential that they should remain at the service of German economic life, their work being more indispensable in the future even than in the past. The tendency among leaders to forsake their posts has also been present in Hungary under the new régime, and it led in April to the issue of a decree by the Hungarian Revolutionary Council providing (says the *Neue Freie Presse*) that the present directors, managers, and officials of the industries to be socialised are bound to remain in their positions and to continue to carry on their undertakings to the best of their ability, so far as they were at their posts at March 22nd of the current year, or were prevented from carrying out their duties by no fault of their own. Their salaries must not be more than before, but in no case are they to exceed Kr.3,000 monthly. Anyone contravening these regulations is to be brought before the revolutionary tribunal.

Electrical Appliances for China.—We have received a copy of the February issue of the *Far Eastern Review*, published in Shanghai, and having London offices at 97, Gresham Street, E.C. 2. It is a special and very bulky number (10s. 6d., post free), devoted specially to the subject "Ports of the Orient." It contains a large volume of information which should be of service to firms and others interested in trading operations with the Far East. Attention is specially devoted to China. In the course of an article on "The Chinese Market for Machinery," it is stated that the use of electrical appliances is naturally limited to those cities and districts where electric power is obtainable, and the constant growth of this trade under these circumstances is promising. "A great many electric power plants have been unable to get machinery during the past year to take care of natural increase in consumption, and new contracts for current have been subsequently refused. With an increased import of appliances under such circumstances we can only infer to what size the business would have grown under normal conditions."

Industrial Relations.—In the course of his speech at the annual meeting of Richardsons, Westgarth & Co., Ltd., at Hartlepool, to which reference is made in our "City Notes" to-day, Mr. D. B. Morison, the chairman, said:—"With regard to the industrial outlook, provided that labour, in striving for the immediate realisation of high ideals, is not forgetful of the frightful financial obligations that this country has to face, and provided also that we—and I refer to both capital and labour—work together with a determination to win out in the coming industrial world struggle, then we can say, 'All's well.' If, on the other hand, we refuse freely to recognise that the highest productivity possible, in association with correspondingly high pay, is a governing factor in the attainment of success, then the realisation of this economic fact will be forced upon us by the dire experiences of an industrial cataclysm of the first magnitude. As between these two alternatives and their inevitable consequences a decision must be made by capital and labour; together, and together only, capital and labour will stand or fall, and on the choice of these alternatives depends the future of manufacture in this country."

The Industrial League.—On June 3rd the Executive of the Industrial League explained the aims and policy of the League to the technical Press. In an introductory speech, the chairman, Mr. G. H. Roberts, M.P., President, said that it was established by a few people of imagination, to do something for their country in the trying times that would follow the war, and that the country was emerging from that ordeal more successfully than might have been hoped was in some measure due to the influence of the League. In the war all classes had learnt their value to the nation; every worker should have good wages, security, a decent home, and the amenities that made life worth living, but the League did not take a one-sided view of the question—there must also be increased production. Men could not be guided by things that they did not understand; the great mass of the people was ignorant of the principles of production, and the League was out to educate both employers and employed. The nation had to choose between harmony and conflict; the latter meant irreparable disaster to all parties, while harmony guaranteed efficiency and success. Unless harmony were very soon established, our country would be handicapped for ever in the markets of the world; unless our home and foreign trade constantly expanded, the nation must suffer. The Industrial League supported the demand of the workers for a fuller and richer life, but taught them that they must exert themselves to gain it.

Mr. H. E. Blain, vice-president, said that suspicion and distrust between man and man, and between class and class, were infinitely mischievous; the welfare of all depended upon the strength and rapidity with which those feelings could be stamped out. Few had thought that the first six months after the war would pass so peacefully as they had passed; firmness on the part of the Government, fairness on the part of the employer, and understanding on the part of the employé, were indispensable to industrial peace, and the whole future of the race depended on the success with which the tenets of the League were carried into practice. Co-operation between capital and labour was absolutely essential. They were organising branches of the League, embracing men of all parties, religions, grades, and classes; they believed in their fellowmen, and desired to benefit their race and to develop the spirit of co-operation. In August a three-day conference would be held, at which the subject would be discussed, and he asked for the hearty support of the Press.

Mr. E. J. P. Benn drew attention to the practice of the daily Press of distorting the facts in reporting speeches, and pointed out that Mr. Roberts had not spoken of the Whitley Report.

Mr. Roberts agreed that the trade and technical Press had maintained a free and independent attitude, and said that the discussion of the facts regarding British and foreign trade was of great influence in counteracting the anarchistic tendencies of the day; they must plan very carefully lest they should upset that very complex machine. The prosperity of the working classes was only possible when trade and industry were established on a safe and stable foundation. The Whitley Report contained a great idea, and would be the salvation of our country. They should bring the workers down from the clouds and confront them with actualities, in their own interest. Workers were entitled to a brighter life, but must work to win it; to teach them was the work of the Industrial League.

The German Bosch Business.—The Robert Bosch Co., Stuttgart, reports for the year ending September 30th, 1918, a net profit of Mk.3,799,252, against Mk.4,290,423 in the previous year. In 1916-17 a dividend of 10 per cent. on the Mk.12 mill. capital was paid, but this time it is proposed to make no distribution, but to place Mk.2,632,000 to reserve against war taxes, Mk.100,000 to the legal reserve, and Mk.200,000 to special reserve, carrying forward Mk.867,252. The book value of the works has risen from Mk.5.97 to Mk.7.36 mill. raw materials, part finished and completed products Mk.21.99 mill., securities Mk.12.35 mill., and debtors Mk.14.96 mill. On the other side the loan debts were Mk.15.24 mill., bank debts Mk.1.95 mill., and current debts Mk.20.77 mill. The special reserve fund for conversion to peace production is Mk.1 mill. The directors regard the greatly increased stocks as a source of danger of loss, as they are chiefly products which are either useless after the war, or would require conversion for peace purposes. A further important danger is the large amounts outstanding in Austro-Hungary. The bank balances, which amounted to over Mk.10 mill. in the previous year, are completely exhausted, and future prospects are poor. The company is taking up the sale of its former peace production, but it is doubtful how far it will be able to regain its former foreign customers for same.—*Frankfurter Zeitung.*

It is indeed "doubtful."

Opening Credits on Behalf of Enemies.—The Board of Trade have issued a General Licence under the Trading with the Enemy Proclamations authorising persons in the United Kingdom to open credits on behalf of persons or bodies of persons in enemy countries for the purpose of financing transactions that have been authorised under Trading with the Enemy legislation in the United Kingdom or any other part of his Majesty's Dominions. and transactions between persons residing or carrying on business outside his Majesty's Dominions which have been authorised by the Allied and Associated Governments, or any of them.

Catalogues Wanted Abroad.—British trade catalogues of industrial machinery, electrical machinery, appliances and equipment, electric railway equipment, and scientific instruments, may be sent to Mr. Field, H.M. Trade Commissioner at Toronto, 257-260, Confederation Life Buildings, Toronto, by August 15th for display for inspection by Canadian buyers at the Bureau of Information which will be open at the Canadian National Exhibition during the last week in August and the first week in September.

Catalogues of British firms desiring to do export trade with Czecho-Slovakia, should be sent to H.M. Chargé d'Affaires, British Legation, Prague.

British catalogues intended for the interior towns of Turkey should be sent to Mr. A. Waugh, British High Commissioner, Constantinople.

German Wage Demands Retard Business. — The Herrman Löhnert Co., in Bromberg, has numerous pressing inquiries for special articles, but buyers are generally postponing their orders, as they cannot make up their minds to pay the high prices asked in consequence of the wage demands of the workmen.—*Koln. Ztg.*

According to the *Weltwirtschaftszeitung* of May 2nd, the Leipzig Fair at the end of April was a record as regards the number of exhibitors and the number of would-be purchasers. Of buyers from foreign countries, about 700 were from German-Austria; between 600 and 700, Czecho-Slovakia; about 200, Moravia and Austrian Silesia; between 250 and 300, Sweden; about 600, Holland; about 350, Switzerland; about 250, Denmark; between 30 and 40, Norway. There were also a few visitors from enemy countries and about 300 exhibitors from foreign countries. The large share taken in the Fair by German industries might be claimed as a proof that Germany had already surmounted to a very considerable extent the economic difficulties resulting from the Revolution; but that is not the fact, for the very high prices of the exhibits caused by the high wages prevalent throughout the country considerably affected the business done. But, says the paper mentioned, the first Peace Fair certainly did show that German manufacturers are turning their backs on "substitutes."

The well-known contractors, the Philipp Holzmann Co., in Frankfurt a.-M., who formerly had developed an active business in constructional work in foreign and overseas countries, state in their report for 1918 that since the outbreak of the Revolution there bas been a serious reduction in the output of workmen and a lack of desire to work, while at the same time there have been continual unreasonable wage and salary troubles and exaggerated demands for reduction in hours of work. The direct effects were disproportionately high working expenses, wasteful use of expensive machinery and tools, and a far longer time employed in construction. Indirectly these conditions, along with the lack of raw material and the growing traffic difficulties, must hinder the expected revival of building activity and not only reduce profits, but also affect most seriously the general national economy.

The *D.A.Z* (April 5th) says that complaints such as the above are not new, but are common to-day to every industry employing heavy labour, and, well known as are the causes, equally difficult is the remedy. But they must be brought to notice, in order to draw attention to the aims towards which the efforts for reconstruction of the national economy must be directed.

Space Still Available at the Athens Exhibition.—As we have already informed our readers, the Federation of British Industries is organising a British Manufacturers' Exhibition in Athens. It will be held in October and November next. At the present moment there is a great demand in Greece for practically every description of manufactured article produced in this country. We need hardly point out, therefore, that the Exhibition affords our firms an excellent opportunity of introducing their goods to Greek buyers. There is still some space available in the Exhibition, but manufacturers should not delay sending in their applications. Among the articles mentioned by the B.F.I. Special Commissioner in Athens as being greatly in demand, are the following :—

Machinery of every description, particularly agricultural machinery.
Railway rolling stock, &c.
Electric dynamos, &c.
Automatic telephones.
Fertilisers and chemicals generally.

Italian Electrical Companies.—There has been formed at Milan a company styled Fabbrica Italiana Lampadine Elettriche. S.A., with a capital of 2,500,000 lire, for the manufacture of electric lamps.

A company has been formed at Mondovi Carassone with the title of Industria Ceramiche Elettro-refra Harie La Vittoria, to take over the business of the firm Ceramiche Georgis ed Industrie Ceramiche Nicolone Sard e Ca.

The following companies have increased their capital :—Società Idroelettrica Piemonte, Turin, 15,000,000 to 40,000,000 lire ; Società Elettrica di Benevento, Milan, 375,000 to 1,500,000 lire, increasing eventually to 3,000,000 lire ; Società Elettrica Milanese, Milan, 3,000,000 to 5,000,000 lire ; Società Elettrica Sarda, 1,200,000 to 10,000,000 lire : Forze Idrauliche dele Appennino Centrale, Florence, 2,000,000 to 4,000 000 lire : Società Elettrica Bergamasca, Bergamo, 6,360,000 to 10,000,000 lire : and Elettrica Commense A. Volta, Como, 6,000,000 to 8,000,000 lire.

The Società Italiana di Utilizzazione Forze Idrauliche, Milan, capital 80,000 lire : and the Società Anonima Gaz ed Elettricità Palermo, have gone into liquidation.

Import Restrictions.—The President of the Board of Trade, after duly considering the recommendations of the Consultative Council on Imports, has given the following further directions in regard to the Prohibition of Import :—

The restrictions on the importation of the following articles are to be removed, and general licences have been issued :—

297. Celluloid in sheets, rolls and rods.
307. Aluminium sheets, foil, circles, rods, bars, ingots, angles, wire, tubes and strip.

The importation of the following articles is to be licensed only exceptionally as and when required :—

334. Manufactures of celluloid except sheets, rolls and rods.
335. Manufactures of aluminium except sheets, foil circles, rods, bars, ingots, angles, wire, tubes and strip, also powder and hollow ware.
339. Door bells other than electric bells.
343. Electrical toys.

The importation of the following articles is to be restricted as shown :—

350. Manufactures of bone, horn, and ivory, are to be admitted at the rate of 100 per cent. of 1913 imports.
352. Gas mantles are to be admitted at the rate of 100 per cent. of 1916 imports in quarterly amounts.
355. Insulating cloths and tapes (including varnished cambrics and oiled silks) are to be admitted at the rate of 25 per cent. of 1913 imports.
356. Carbons for arc lamps, cinemas and searchlights, are to be admitted at the rate of 20 per cent. of 1916 imports.

Applications for special licences should be made as usual to the Department of Import Restrictions, 22, Carlisle Place, S.W. 1.

Import Relaxations and Restrictions.—The concluding meeting of the Consultative Council on Imports was held at the Board of Trade on June 2nd. In view of the completion of the Council's work, the *Board of Trade Journal* of June 5th contained a consolidated up-to-date list of the import relaxations and existing restrictions. The list is divided into two parts :—(1) The articles which may, and (2) those which may not, be imported without licence from the Department of Import Restrictions.

New Swedish Company.—A new electrical engineering concern has lately been organised at Trelleborg under the title of the Svenska Elektriska Verkstad Aktiebolag.

Royal Visit to Braby's. — Prince Albert visited the Ida and Victoria works of Messrs. Braby & Co., Ltd., at Deptford, last Friday, in connection with the Industrial Welfare Society.

Chemical Works Fire Loss in Germany.—The Electro-Saltpetre Works Co. in Berlin, formed in 1915 by the A.E.G. and the Grieshiem Electron Chemical Factory with Mk. 3 mill. capital, suffered severe loss in 1917 by a great fire and explosion, and closed the year 1918 by carrying forward the loss, increased from Mk. 1,211,958 to Mk. 1,417,209.

Co-partnership in German Steel Trade.—The North-West Group of the German Iron and Steel Manufacturers' Association has joined with the Workmen's Organisation in a working partnership. A Chief (District) Committee of the Association of Free Employers' Unions is to look after affairs for the Unions combined in this working partnership for the Rhenish-Westphalia District. The business is to be conducted by the German Overseers' Union.—*Köln. Ztg.*, April 27th.

Trade Announcements.—Messrs. T. J. Grainger & Co. have changed their address to Street's Building, 87, Westgate Road, Newcastle-on-Tyne (Telephone, Central 2998). The stores department is at 17, Dean Street, Newcastle-on-Tyne (Telephone, Central 3474).

The British Thomson-Houston Co., Ltd., of Rugby, in order to deal with increasing business in the Liverpool district, have opened an office and stores at 33, James Street, Liverpool (Telephone number, 358 Central ; Telegrams, "Asteroidal," Liverpool). The new stores will carry a stock of wiring supplies, electric light fittings, and "Mazda" lamps for ship lighting and general purposes, and will deal with inquiries for all classes of B.T.H. electrical apparatus, such as turbines, generators, motors, switchgear, control gear, &c.

Mr. G. C. Gowan, who has been demobilised, has recommenced business as an electrical engineer and contractor, at 58, High Street, Aylesbury.

Mr. J. Haley, discharged from the Army as unfit for further service, has commenced business as an electrical engineer and contractor, at 5, Hanover Street, Halifax.

Messrs. Pooley & Austin are moving on June 16th to temporary offices at 69, Victoria Street, London, S.W. 1.

Mr. Andrew Chalmers has resigned his position of assistant manager, electrical department, William McGeoch & Co., Ltd., 28, West Campbell Street, Glasgow, and has started business under the firm name of Andrew Chalmers & Mitchell, electrical and mechanical engineers, brassfounders, and general merchants, at 49-51 William Street, Anderston, Glasgow.

Electric Lamp Manufacturers' Association of Great Britain.—The new telegraphic address of this Association is : "Britelma, Cannon, London."

Auction Sale.—By direction of the U.S. Government Engineering Department, Mr. R. H. Ruddock, instructed by Messrs. J. G. White & Co., will sell by auction on June 17th, at the American Government Engineering Department, Didcot, a quantity of new engineering equipment and stores, comprising Parsons oil engines, dynamos motors, &c. See our advertisement pages to-day.

Assets Auction Co., Ltd., will sell by auction on June 18th, at 119-121, Newington Causeway, London, S.E., the stock of an electtrical goods factor. Full particulars, &c., appear in our advertisement pages to-day.

For Sale.—Maidstone Corporation invites offers for one balancer (2 × 230 v.); the Disposal Board, Ministry of Munitions, has for sale one new 500 H.P. Mirrlees, Bickerton & Day Diesel engine, with spare parts, &c. Full particulars are given in our advertisement pages to-day.

Battery Manufacture in Australia.—In the *Industrial Australian and Mining Standard* for April 24th, just to hand, there appears an article announcing the building of a factory situated at Blackwattle Bay, Glebe Point, Sydney, for the manufacture of storage batteries. There is works accommodation for 200 or more hands, but at present only 15 are employed. The company—Accumulators, Ltd.—only began operations at the works at the beginning of the present year. The present capacity is for turning out £50,000 worth of batteries per annum, but it is stated that this output could be increased five-fold with adequate protection. Batteries for train-lighting sets have already been provided to the Commonwealth and State Railways, and others have been supplied for house lighting. Beginning with a capital of £5,000, authority has since been received from the Government to increase this to £15,000. Among other things stated in the article are the following:—Storage batteries are quite 95 per cent. lead. This the company purchases from the Broken Hill Pty. Co. The wood lead-lined boxes are made of Australian pine, and later on it is intended to manufacture, or have manufactured, in Australia the glass jars which are often preferred to the wood lead-lined boxes. With the exception of these glass jars, not one part of the storage battery is imported from abroad. At present British storage batteries are allowed into the Commonwealth free of duty, and there is only an *ad valorem* duty of 10 per cent. on foreign batteries. This the company considers is entirely inadequate. It asks for an *ad valorem* duty of at least 25 per cent. upon batteries of British manufacture and 35 per cent. on batteries of foreign manufacture.

Book Notices.—*The Decimal Educator.* Vol. I. No. 4. June, 1919. London: The Association. Price 6d.—In the present issue of this publication we note several articles and notes on lecturing, which will be found useful by those organising public lectures for the dissemination of the principles of decimal counting. Other matters of interest that are dealt with are the annual report of the Decimal Association and the progress of the Royal Commission on Decimal Coinage, whilst the metric system in the gas industry and the London County Council's views are dealt with in instructive articles.

"Income-Tax up to Date, including an Explanation of the Excess Profits Duty as Revised." By H. J. Gully, F.C.A. Revised Edition. London: *Financial News*. 9d.; post free 10d.

The June issue of *Mayfair* (2s.) is a special aircraft number. It is charmingly produced, and contains numerous excellent half-tones of men who are prominent to-day in the aircraft world, also of aircraft factories and machines. A full-page cartoon in beautiful colouring is included of the Hon. Mr. Justice Sankey, chairman of the Coal Commission; another, equally effective, shows Major-General Sir W. Sefton Brancker, K.C.B., who did fine work under the Air Ministry.

Dissolutions and Liquidations.—Falk, Stadelmann and Co., Ltd. (Australia).—It is announced in the Australian papers just to hand that the Minister for Trade and Customs has appointed Mr. R. H. Shackell, of 59, William Street, Melbourne, controller of the business in Australia of the above company.

Welsbach Light Co. of Australasia, Ltd.—A similar announcement appears regarding the appointment of Mr. Thomas Brentnall, of 360, Collins Street, Melbourne, as controller in the case of this company. Particulars of debts, &c., had to be sent to these gentlemen by April 14th in the case of the former, and by May 2nd in the case of the latter, company.

Gill & Cook, consulting electrical and telephone engineers, Winchester House, London, E.C.—Messrs. F. Gill & W. W. Cook have dissolved partnership. Debts will be attended to by Mr. W. W. Cook.

Brown Bayley's Steel Works.—Meeting, July 8th, at 5, Gray's Inn Square, W.C., to hear an account of the winding up from the liquidator, Mr. H. Ashford.

Vulcanized Fibre, Ltd.—Particulars of claims, &c., to be sent by June 30th to the liquidator, Mr. C. Cooper, 60 and 62, Spring Gardens, Manchester.

Consolidated Diesel Engine Manufacturers, Ltd.—Sir W. B. Peat, the liquidator, stated at a meeting of shareholders, held on June 3rd, that when the order for liquidation was made the assets showed a total of £283,714. During the war the works of Carel Fréres were taken possession of by the Germans, and they were in the possession of the Germans when he was appointed liquidator in November, 1914. As soon as it was possible after the Armistice the chairman of the committee, together with other members, went over to Belgium and interviewed the people there with regard to the position of the works as the Germans had left them. Colonel Bridges, a member of the committee, made a valuation of the works as they stood at that date. They met Messrs. Carels and another gentleman, who was an intending purchaser, and they thoroughly examined the position of affairs and the prospect of selling the company's 10,001 shares in that company. They were faced with the position that the company had no funds, and that they were urgently in need of funds, and they were discussing a reconstruction of the concern. They received for these 10,001 shares over £150,000 in cash. Messrs. Carels had had a claim against the Consolidated Diesel Co., and the company also had a claim against Messrs. Carels, but a compromise had been arrived at. Their total realisations had been £280,636. So far one distribution had been made to the shareholders—namely, 10d. in the £—and the committee now recommended the declaration of another 5s. in the £. The proposed dividend was approved by the meeting.

Catalogues and Lists.—Messrs. Adam Knox & Sons, Ltd., 47, Crownpoint Road, Glasgow.—Leaflet describing the "Reliable" visual indicator for winding-engine signals, non-cumulative and mechanically operated.

Messrs. H. Dunod & E. Pinat, quai des Grands-Augustins, 47 and 49, Paris, VIe.—Catalogue of publications on science and industry.

Bankruptcy Proceedings.—Frederick James Earle, 3, St. Nicholas Street, Truro, Cornwall, late Lemon Quay, Truro, electrician.—The adjourned public examination of the above debtor took place at the Town Hall, Truro, on May 13th. Defendant was apprenticed to a chemist, but in 1906 joined the Army. In 1916 he was invalided out of the service with a pension. In 1918 he became a cinema operator at 35s. a week. While at the cinema he started business as an electrician. He secured some goods on credit. He went to London to obtain some money (£50), became ill, and was sent to hospital. During his absence his goods were sold by order of the Sheriff. He attributed his present position to the sale of his stock for the low sum of £90; he considered it worth £300. His deficiency was £411. He hoped all along to be able to pay his creditors in full, although he did not remember making profit on any contracts. The examination was closed.

Tanks for Sale.—Thirty fighting tanks are included in the immense variety of goods which are being sold by direction of the Disposal Board of the Ministry of Munitions. It is thought that some public bodies or Associations may favour the idea of using these attractive objects for raising funds for local charities, &c. The tanks are at present lying at the Training Centre, Wool, Dorset, and will be disposed of by tender.

LIGHTING AND POWER NOTES.

Accrington.—At the Council meeting, last week, reference was made to a resolution that the existing water turbine at the sewerage works be so arranged, and necessary plant installed, as to transmit to the Corporation mains electricity not required by the Sewerage Board. This arrangement would pay 20 per cent. upon the outlay. The decision to increase existing charges for energy by a further 10 per cent. applied to all customers. A L.G.B. inquiry would be held on the application to borrow £85,000 for extensions to the electricity works.

Barrow.—Conference on Electricity Supply.—With a view to bringing together all the local Council representatives and power users in the Furness and South Cumberland area, to consider the electrical supply for the whole district, the Mayor of Barrow has, with the approval of the B. of T., convened a meeting, to be held at Barrow Town Hall on July 1st, the object being to prepare a scheme which can be handed over to the District Board, so soon as it is constituted, and be submitted by the latter to the Electricity Commissioners. The Ulverston U.D.C. has appointed representatives to attend the conference.

Battle.—The U.D.C. has decided to support the Hastings T.C. scheme to supply electricity to the district.

Bedford.—New Services.—The L.G.B. having withdrawn restrictions on the borrowing of money for making house connections, all such connections applied for are to be made subject to the consumer paying the cost of all cable laid on private property. Meter rents of all newly-installed meters are to be increased to 12s. per meter, per annum; charges in respect of existing meters to remain as at present. Particulars in support of a loan of £1,000 for these works are to be prepared, and a power supply is to be given to the Bedford Ice Factory subject to the necessary guarantees being given.

Extensions.—It was reported that there was not sufficient plant in hand to put existing plant out of commission long enough for thorough overhauling, and that even when the 1,000-kw. turbine was replaced there would still be risk. It was agreed that the scheme authorised on March 26th last be now proceeded with, and that tenders be invited for plant and buildings. As originally intended, it was proposed to install one 1,500-kw. set, the same size as the existing one, but generating at 6,600 volts, instead of 2,100 volts. The existing transformers would be used as occasion required for stepping down for general supply instead of up as at present. It was proposed to install two boiler-plant units, each with a capacity of 30,000 lb. of steam per hour. The induced draught plant would be converted from steam to electrical drive: the four coal bunkers would be duplicates of the existing ones, and it would be necessary to provide for the mechanical handling of ashes and clinker.

Blackburn.—L.G.B. Inquiry.—On June 3rd, Col. T. C. Ekin, of the L.G.B., held an inquiry respecting an application for sanction to borrow £250,000 for the erection of a new electricity generating station at Whitebirk. The site comprised 64 acres, at a rent of £480 per annum, with a 10 years' option to purchase. There was an excellent supply of water from the canal, and transport facilities would be provided by the canal and railway. The new station was designed so as to form part of a complete scheme for the district. That clause was framed after conference with the B. of T.

Birkenhead.—Mains Extensions.—The L.G.B. has informed the T.C. that it can now borrow £1,925 for mains and cable extensions under an old sanction.

Bradford.—Mains Extensions.—The engineer has been instructed to proceed with the extension of E.H.T. feeders at High Street, Great Horton, and the provision of transformer-chamber equipment, at an estimated cost of £1,600.

Bray (Co. Wicklow).—Loan Sanction.—The Irish L.G.B. has sanctioned the Council's application for a loan of £5,000 for extension of the electricity works, repayments to spread over 15 years.

Bury.—Year's Working.—There was a loss on the year's working of the electricity undertaking of £1,983, to be taken from the reserve fund. Coal cost £20,200 during 1918-19, against £14,600 in 1915-16, and wages have gone up from £5,132 to £10,706 during the same period.

Ceylon.—Water Power.—According to *Indian Engineering*, compared with India and some other countries, the possibilities of hydro-electric power production in Ceylon at moderate cost are far superior. The Ceylon Industries Commission urges on the Government the desirability, without loss of time, of completing a thorough investigation of the possibility of using the power available. The Public Works Department has investigations in hand on several streams. Only one scheme, that in connection with a supply for Colombo, is being gone into in detail.

Clayton (Yorks.).—Prov. Order.—The Bradford electricity department states that it has been in communication with the B. of T. respecting the proposal to apply for a prov. order to supply and distribute electricity to Clayton, and the Corporation gave formal notice of its intention to apply for the order. The Clayton Council approved the action.

Continental.—Switzerland.—A movement tending to concentrate the generation and distribution of electricity into one large undertaking is making itself apparent in Switzerland. In 1916 the company styled Forces Motrices du Canton de Berne Soc. Anon. bought up the Forces Motrices du Wangen S.A. for 10.000,000 fr., formerly the business of the German firm of Lahmeyer & Co., of Frankfort. At the end of last year the first-named company also bought out the whole of the shares of the Forces Motrices de Laufenthal Soc. Anon., at Laufon, and undertook the working of the installations of the last-named company with the two stations at Dittengen and Zroingen. The Berne company has now absorbed all the smaller or secondary companies in the Canton, solely from the impossibility of the smaller concerns to cope with the increasing demands which the growth of the electrical industry is making upon companies. A like movement of concentration is apparent in French Switzerland. At Lansenne, a company has been formed styled Ouest Electrique Soc. Anon., with the object of uniting all the electrical concerns of French Switzerland. The capital is 5.000.000 fr., and the Government of Geneva has taken shares to the value of 600,000 fr. The Canton of Basle has also joined this combination.

France.—The Société Hydroelectrique de l'Isère has been authorised to start the erection of a hydro-electric station on the Isère, at St. Nazaire-en-Royans. The estimated cost of the undertaking is 20.000.000 fr., and the power expected to be obtained 20.000 H.P. Authorisation has also been given to the Société des Forges de Franche-Comté to build a dam at Bourg-de-Sirod, on the Ain, the power expected to be realised from a 44-metre fall totalling 1,812 KW. A station is also to be erected on account of the State on the Corrèze, near the village of that name. The dam, 100 metres long, will provide a fall of 166 metres, yielding 8,000 H.P.

Denney.—Proposed Mains Extensions.—An estimate is to be prepared of the cost of extending the mains to Anchor Burn, Dunipace, where energy is needed for lighting and power.

Dewsbury. — Restricted Supply. — The capacity of the generating station is such that the Corporation has decided that for the present no further applications for supplies of energy can be entertained.

Douglas (Isle of Man).—The Committee of the Isle of Man Legislature held an inquiry on Monday last week into the application of the Douglas Electric Light and Power Co. for powers to supply electrical energy in Douglas. The application was opposed by the Douglas Corporation.

Dungannon (Co. Tyrone).—Proposed E.L. Scheme.—It is suggested that electric lighting and power should be installed for the town and district, and is pointed out that the Portna Falls on the Lower River Bann would be a good source of supply for Mid-Ulster. A Committee has been appointed to deal with the question.

Elland.—Mr. W. H. Eastwood, in a general report, states that the position of the electricity undertaking is going to be eased a little by the Bill now before Parliament, and, seeing that Bill proposed reasonable safeguards in the matter of capital outlay, nothing would be gained at this stage by "rushing into the hands of the Yorkshire Electrical Distribution Co."

Ellesmere Port.—Electricity Supply.—The Mersey Power Co. has informed the U.D.C. that it will request the B. of T. to proceed with its application to supply electricity in the district as if the Council's consent had been given, owing to delay on the part of the Council in arriving at a decision in the matter.

Folkestone.—Electricity Charges.—With reference to the Electricity Co.'s proposal to increase the charge for energy from 7d. per unit to 8d., the T.C. has advised consumers to pay 8d only under protest. Under their order the company's maximum price is 8d., but under a deed of transfer with the Corporation, the charge is limited to 7d., and the T.C. agreed to 7½d. being allowed. The company has threatened to cut off the supply to consumers refusing to pay 8d.

Formosa.—Hydro-Electric Scheme.—According to a report by the United States Consul at Taiwan, the Formosan Government, in co-operation with private capital, is contemplating establishing what, it is said, will be one of the largest hydro-electric plants in the Far East, at Jitsugetsu-tan (Lake Candidius), in Nanto Prefecture, Taiwan. It is planned to start the plant during the present fiscal year, probably in August, or as soon as the Bill for the necessary appropriation for the undertaking has passed through the Diet, the Cabinet having already signified its approval of the scheme. A limited company will be organised, the Government to hand over to this company, as its share of the investment, all of the electrical industries (both immovable property and equipment) at present in its hands, the balance of the capital required to be subscribed privately. As this is not a purely Governmental undertaking, there will be no discussions in the Diet regarding expenditures, but certain matters will require the Diet's approval, and it is expected that particulars regarding the establishment and maintenance of the company will soon be made public in that body. Plans have been adopted for putting up plant, capable of developing a maximum of 130,000 H.P., and serving the whole island. Power is to be supplied for industrial purposes at about ¼d. per unit. The work of construction will take five years, and will cost £4,800,000. Capital for the undertaking will be largely subscribed by Japanese firms, having branch offices in Taihoku, and also in New York City. The engineers in charge will be Mr. Yamagata for construction, and Mr. Okoshi for electrical equipment, both of the Public Works Department of the Formosan Government. The American Consulate at Taihoku has supplied the Public Works Department with American catalogues, describing excavating, electrical, and other machinery.

Glasgow.—Year's Working.—Although there has been no increase in the units sold by the electricity department, the revenue has increased by £60,000 over last year's total of £850.000, due to the increased charges.

Halifax.—Mains Extensions.—It has been decided to extend the E.H.T. main at Club Lane, Ovenden Road, up Ovenden Road to Cousin Lane, and then with an overhead line to Muxenden and Muxenden Mill, at an estimated cost of £1,746, subject to Messrs. E. Armitage & Son agreeing to pay half the cost of the main.

The Committee has agreed to pay Messrs. E. Green & Son, Ltd., of Wakefield, £51. to cover the increased cost since the date of the tender, for the supply of one of the patent fuel economisers.

Sanction has been given for the supply of electrical power to the mills of Messrs. Sykes & Morley, Corporation Street.

Ireland.—The Irish Local Taxation Returns for 1917-18, show municipal indebtedness for lighting at £2,132,842. The net expenditure from revenue amounted to £8,847,366, or excluding municipal electric lighting, gas, and tramway undertakings, it was £7.618,479.

London.— Fulham.—In factories and other similar premises where there is a consumption of not less than 12,000 units per quarter for power purposes, the charge for electrical energy supplied for lighting purposes on the same premises is to be subject to a special rebate of 50 per cent., without any further discounts.

Manchester.—Year's Working.—In 1918 there was a surplus of £23.665 on the Corporation electricity department; this year there is a deficit of £37,602. To meet this the whole reserve fund (£28,797) has been transferred to revenue account, and £13,604 carried forward as a charge against future profits. On capital account the total outlay totals £3,495,218. The mortgage debt stands at £1,851.701. The volume of business has fallen by 5 per cent., the annual sales totalling just over 184½ million units. The average price paid for coal has risen 3s. 5d. per ton during the year.

Barton Scheme.—The proposal to erect a new generating station at Barton was approved by the Council in December, 1914, and borrowing powers amounting to £424,220 were then sanctioned. As a war measure, those powers were diverted for the purpose of extensions at the Stuart Street and Bloom Street stations. It is now proposed to carry out the Barton scheme, and the increased cost, which makes it necessary to borrow over a million pounds, is due not only to the present-day cost of labour and materials, but also to alterations in the design and size of plant. The Electricity Committee suggests that during the years of construction the interest on loans should be capitalised, and the sinking fund suspended. This suggestion has been accepted with some hesitation by the Finance Committee. In order that the scheme may be considered by the Government Departments at an early date, the Finance Committee raises no objection to the application for borrowing powers, but points out that if the borrowing powers are granted, another opportunity ought to be afforded so that the need for the station may be again examined before any commitments are entered into. In a report recommending the re-creation of the Barton borrowing powers, Mr. S. C. Pearce states that the provision of 50,000 KW. of new plant, which is the amount proposed, will probably suffice for the department's requirements over a period of not less than seven, or more than ten, years. If the proposal to capitalise the interest and suspend the sinking fund is adopted, the total annual payments will amount to £134,550, but within the next six years recurring capital charges to the extent of £176,537 will expire, and very considerable economies are expected from the modern character of the new plant. The over-all efficiency (coal to electrical energy) of the existing Stuart Street station is 11·55 per cent., but it is confidently anticipated that the new Barton station will show an over-all efficiency of 18 or 20 per cent.

Navan (Co. Meath).—The Town Tenants' and Vigilance Committee has asked the Irish L.G.B. to withhold sanction of a proposal to expend £1 250 on new electrical plant for the town on the ground that the existing plant is satisfactory.

Portrush (Co. Antrim).—Extension of Time.—The B. of T. has extended till August 15th, 1920, the time for laying the mains, &c., in connection with the electric lighting scheme, a loan of £10,500 for which it is proposed to obtain from the Belfast Banking Co.

Rotherham.—Year's Working.—The annual report on the working of the Corporation electricity undertaking for the year ending March 31st last, shows that the units sold have increased 14·6 per cent. during the year; the average price obtained per unit sold was 1·03d. The total receipts were £108,873, against £78,013; gross profit, £20,514, against £19,701; and capital charges. £17,999, against £14,139, and £2,514 carried to appropriation account. The Electricity Committee has recommended that the basic rate for the supply of electricity be reduced from 1¼d. to 1d. per unit.

South Africa.—At the last meeting of the Cape Town T.C., the city electrical engineer reported that the damaged stator which had been sent to England for repairs, was due to arrive in about a week's time. Portions of the 11,000-volt cable (ordered two years ago) for augmenting the supply to the Government railway workshops at Salt River and Southern Suburbs, had arrived, and, assuming that the transformers were received during the next three months, the department should be in a position to meet the demands for lighting, very shortly.

Stockport.—Price Revision.—The charges for electricity are to be increased by 10 per cent. to all consumers, with the exception of those having special agreements.

West Hartlepool.—E.S. Bill.—The T.C. has decided to support the recommendations of the I.M.E.A. and the Conference of North-East Coast Municipal Authorities possessing electrical undertakings in respect to the Electricity Supply Bill.

Wigan.—L.G.B. Inquiry.—A L.G.B. inquiry was held by Col. Ekin at Wigan on Wednesday, last week, into the application of the Corporation to borrow £101,250 for extension of plant at the electricity works.

Worcester.—Year's Working.—The report on the working of the electricity department for the year ending March 31st last, shows a total income of £32.235, compared with £31,394 for 1917-18. The cost of generation and distribution amounted to £19,138, leaving a gross profit of £12,951, equivalent to 6·3 per cent. of capital expended and 17·7 per cent. on capital outstanding, which amounts to £73,320. After payment of interest, £4,423, redemption of capital, £6,281, and income-tax, £439, there remained a profit of £1,808. During the year interest and sinking fund charges were reduced by £1,152. The net profit was carried forward to the appropriation account, of which the balance available was £3,182, and it was recommended that this sum be retained as a reserve against the anticipated loss on the current year's trading; £27,095 was expended on new plant and cables since 1914, and, in spite of this, the outstanding debt has been reduced from £91,271 to £73,319. With the exception of minor re-arrangements, no new works were undertaken at the Hylton Road works. During the year 615,703 units, against 1,000,718, were generated at the Powick water-power works, the output of which depends entirely upon the water flow of the river Teme. The total increase of demand equals the equivalent of 6,209 30-watt lamps, against 15,708 30-watt lamps in 1917-18; 21 new consumers were connected and extensions made to 59 installations. The total output for the year was 4,294,168 units, against 4,637,269: the total works cost being 1·04d. per unit sold, against 0·77d. last year.

TRAMWAY AND RAILWAY NOTES.

Blackburn. — Year's Working. — The annual report showed a profit of £6,650, against £6,970 the previous year. Out of this profit came £3,000 for arrears in permanent-way improvements. The receipts for the year were £94,992, against £80,361, and the expenses increased from £53,231 to £69,020. Wages increased by £5,715, and since the close of the financial year further increases have been granted involving £7,000.

Blackpool.—Contract System.—The tramway contract ticket-holders are to pay more, and 3,000 people are affected. At present a contractor can, for £3, travel on almost all routes. The new adult "all routes" price is £8. Mr. Furness (tramway manager) submitted that so far back as 1915 there was a loss of £2,000 on the contract system. During the last seven years the amount of subsidy to contractors in meeting working expenses has been £17,843. Last year the amount was £5,588.

Bradford.—Track Repairs.—Work on the renewal of the Manchester Road tramway track will be commenced on June 28th. Owing to delay arising between the Post Office and the B. of T. in connection with the removal of underground telergraph cables, it is not yet practicable to commence work on the renewal of the Thornton Road section.

Continental.—Spain.—There has been formed at Madrid a company styled Ferrocarril Electrico del Gnadarrama, with the object of building and working an electric railway from Cercedilla to the port of Navacerrada. The capital is said to be subscribed by Madrid and Argentine capitalists, and the building of the line is to be begun forthwith.

Belgium.—A Commission was appointed in 1916 to investigate the advisability of electrifying the Belgian State Railways, and an interim report was issued advocating the electrification of a considerable portion of the lines. When the Belgian Government was reinstated in its capital, a new Commission was appointed to go over the work of the previous Commission, and to investigate. not only the electrification of the railways, but also unifying the supply of electricity for all purposes all over the country. This Commission has recommended the immediate preparation of a scheme for the electrification of the Brussels-Antwerp line and of the railways in the immediate neighbourhood of Brussels, and its next task is to inquire into the question of co-ordinating existing electric supply undertakings and the erection of new super-power stations.—*Times Engineering Supplement.*

Italy.—On June 4th, a tramway accident at Rome resulted in two deaths and a number of injuries. The accident was caused by a failure of the brakes. The tramwaymen immediately went on strike as a protest. The municipal tramwaymen resumed work in the afternoon, but the employés of the Società Romana, to which the vehicle belonged, remained on strike. The men assert that this is the only way left to them of protesting against the condition of the tramways, regarding which they have complained many times. The company contends that it is the inevitable result of the war. The men, on the other hand, assert that the company could quite well maintain all the necessary material in good order, but will not go to the expense which that would entail in view of the fact that the whole tramway system of Rome will eventually come under the municipality.

Doncaster.—Extensions.—Plans and specifications are to be prepared for doubling the tramway track on the Balby route and at St. Sepulchre Gate. The plans will be subject to B. of T. approval.

Fleetwood.—Car Licences.—A case raising an interesting issue, and concerning the licensing of cars, drivers, and conductors of the Blackpool and Fleetwood Tramroad Co., was adjourned at Fleetwood Police Court last week. The company takes the attitude that there is no obligation on its part to take out licences in the Fleetwood district. Fleetwood Council claims the right to licence cars, &c., and to draw the fees.

Glasgow.—Year's Working.—The approximate figures of the year's working to May 31st, of the Corporation tramways are:—Income, £1,527,056, as against £1,404,110, an increase of nearly £123,000; passengers carried, 464,000,000, as against 430,946,566.

Depreciation.—Reporting on depreciation, the general manager of the tramways states that at the end of the last financial year the amount in hand for renewal of track was £206,887. If the Committee continued to set aside £400 per mile of single track, which was equal to £78,511 per annum, it would have at its disposal by the end of the year 1922-23 the sum of £599.442. The expenditure in renewals this year would be £25.000, but for the next four years it was hoped to spend about £200,000, so that by May 31st, 1923, £825,000 would have been expended. This would leave a shortage of £225,000, which must be made up during this and the next four years. Meantime, he suggests that the Committee shall set aside £700 per mile instead of £400. This means an increase in the annual sum to meet renewals of £58,879. The sums to be set aside for this year would be as under:—Permanent way, £137,390; power plant, £14.164; cars, £18,030; electrical equipment of cars, £9,878; other rolling stock, £2,760; Clydebank bridges, £500—a total of £182,722.

Halifax.—Wages.—Upon the request of the Amalgamated Association of Tramway and Vehicle Workers, that, in accordance with the Engineers' Award, time and-a-quarter should be paid for night work and double time for Sunday work, to the shed staff at the tramway depôt, the Tramways Committee has recommended that skilled and semi-skilled men in the tramway engineer's department be paid the same rate for Sunday work, in accordance with the agreement between the representatives of the Municipal Tramways Conference, Tramways and Light Railways Association, and the National Transport Workers' Federation, on March 21st last.

Messrs. Courtaulds, Ltd., have withdrawn their offer to purchase the Highroad Well tramway shed, and an offer by Messrs. Wm. Acquith, Ltd., to purchase the land and buildings, comprising the old tramway depôt, for £6,500, has been accepted.

Lancaster.—The T.C. has agreed to the closing of a part of the tramway track from the centre of the town to the railway station. This portion was constructed 16 years ago, at a cost of £9,000, and never had paid, and would cost £6,000 to put in order.

Liverpool.—Proposed Improvements.—The Special Reconstruction Committee recommends extensive improvements in the tramway facilities at the Pier Head. It is proposed to offer premiums of 1,000, 500, and 250 guineas for the best schemes.

London.—L.C.C.—The Highways Committee reports, with reference to the increases in fares on the Council's tramways; that one of the principal reasons for the increases was the institution of the 48-hours' week and other concessions involving an increased annual expenditure estimated at £360.000, or nearly £1.000 a day. In 1914 the total wages bill for the tramways undertaking was £1.102.220 for operating 59.209.289 car-miles. For 1919-20 this sum, it is estimated, will be increased to £2.421.250 for a car-mileage of 53,000,000. In order that the Council's tramways may pay during 1919-20, it will be necessary to raise over £1,000,000 more than the revenue for last year, which was approximately £3,680,000. The Highways Committee considers that a revision of the fares is necessary to balance expenditure and revenue.

Children's Fares.—Commencing on July 1st, children's fares are to be reinstated on the L.C.C. tramway system. They will be approximately half the existing adult fares.

L.C.C. Extensions.—The Standing Orders Committee of the House of Commons having decided against the suspension of the Standing Orders in the case of the L.C.C. Tramways and Improvements Bill, which cannot therefore be proceeded with, it is proposed to urge its necessity by deputation to the B. of T. and L.G.B. Steps are being taken to proceed with the delayed construction of the authorised tramways in High Street and East Hill, Wandsworth, and from Lee Green to Eltham; the supplemental estimates put forward are, respectively, £20.370 and £53.675.

Tube Trains.—The B. of T. states that the additional carriages recently placed in service by the tube railways during the mid-day hours number 119. Since May 30th, 70 extra coaches have been running on the District Railway on the mid-day service and three additional six-coach trains have been in operation on the Central London Railway. The Bakerloo has increased its three-car trains, running at 2½ minutes' intervals, to five-car trains; the City and South London has accelerated its service from one train every 4¾ minutes to one every 3½ minutes, and the 5 and 2½ minutes' intervals on the Hampstead Tube have been shortened to 4 and 2 minutes respectively. On the Piccadilly Railway a three-car train, each 2½ minutes against each 3½ minutes, will be run. These arrangements involve an additional 243 cars during the mid-day hours.

Lourenco Marques.—Threatened Strike.—The tramwaymen gave notice to strike at the end of May. They demanded an increase equivalent to 54½ per cent., which the company refused to consider. The demand was for an increase from 11s. to 17s. daily, which meant an increased expenditure of over £4.000 a year on the tramway service, which, the company declared, had never paid working expenses.

Malvern.—Mr. C. C. Broad has applied to the Light Railway Commissioners for an Order reviving the powers granted by the Malvern (Funicular) Light Railway Order, 1911.

Rotherham.—Year's Working.—The annual report on the working of the Corporation tramways shows total receipts of £104.207, compared with £82.959 last year; gross profit, £20,702, and total surplus, £2.797. Receipts per car-mile had advanced from 18·43 per cent. to 25·09 per cent. Power expenses had increased 31·97 per cent., traffic expenses 46·37 per cent., and repairs and maintenance 51·56 per cent. The total operating costs had increased 34·68 per cent. Passengers carried in 1917-18 numbered 18.095.654, against 17,833.753 this year. There was a deficit of £91 on the Maltby trolley system and of £2.621 on the petrol routes.

Wharfedale.—Inadequate Service.—Strong protests have been made against the alleged inadequate service of railless cars provided in Wharfedale by the Leeds Tramways Department. Burley, it is said, is sometimes left without service altogether, owing to divergence of vehicles to the Otley route.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Telephones.—Sir William Slingo, late Engineer-in-Chief to the Post Office, is reported to have said that the British telegraph system was the best in the world, and he considered that in the matter of automatic telephones this country was ahead of America. He was shortly going to America in a consultative capacity to the American Government in connection with the future development of the telephone in that country.

A trial of automatic telephone apparatus is being made at several Parisian post offices—notably in the Boulevard des Italiens and in the Place de la République.

Cable Interruptions.—Mr. Illingworth stated in the House last week that the cables to Gibraltar had been restored, but there were faults in two of them which prevented their being used to their full extent. The American Pacific cable was still interrupted, but cable ships were engaged on its repair and it was hoped that the work would be completed in a few days. The restoration of this cable would to some extent relieve the congestion to the Far East.

The Direct Spanish Telegraph Co gives notice that cable communication with Spain "via Spanish" has now been restored.

German Cables.—A correspondent of the *Frankfurter Zeitung* writes in reference to the German cables to Spain and North America from Emden, that these were cut at the beginning of the war, and later were reconnected with France and England, and utilised by the Allies. If the Allies actually retain them after Peace, it will mean a severe blow to German overseas trade, as the American cables forwarded over 3,000 cables daily, 90 per cent. of which were of a commercial nature, and even five minutes' delay in these telegrams would prejudice German traders seriously in competition with other nations. The political disadvantages of exclusion from direct communication with America, and the danger of commercial spying at the foreign transmitting place, need hardly be alluded to. Even if the Allies allowed new German cables to be laid, it would hardly be possible to arrange this, as fresh concessions would be difficult to acquire, new cables would cost 150 per cent. more than before the war, the capital required could hardly be found on the German market, and, finally, the raw materials are not available. This demand of the Allies must, therefore, be resisted to the utmost.

Monte Video.—The threatened strike of telephone operators has been averted by the granting of increases in salaries, the minimum monthly salary of operators being raised from $23 to $30 Uruguayan gold.

Red Cross Free Cables.—The British Red Cross Society and the Order of St. John have gratefully accepted the proposal of Sir John Denison Pender, that the Eastern and Associated Telegraph Co.'s concession with regard to free cable service shall continue to the end of the year.

United States.—The Western Union Telegraph Co. state that arrangements are under way with the Western Telegraph Co. of Great Britain for a direct cable between the United States and Brazil, thence down the eastern coast of South America. The new scheme involves the laying of 3.200 miles of new cable. The connection between North and South America will be from Miami (Florida) to Belem (Brazil), *via* Barbados. The work is expected to be completed in six months.

Strikes of Western Union Telegraph employés in 10 Southern States have been called, but all the operators are not responding to the call. The telegraphists and electrical workers "out" in Atlanta (Georgia) are demanding the sanction of a general strike.

A national strike of telephone workers, involving operators, maintenance constructors and repairmen, is to begin at Cleveland, Ohio, on June 16th. The order is due to the strike of commercial telegraphists, which was to begin on June 12th. The telephone employés are making similar demands, viz., recognition of the Union and the right of collective bargaining, and the abandonment of discrimination in discharging Union men. In the event of a big national strike of telegraph and cable operators, the Government will use military forces if necessary to keep the wires and cables open for Government business.

Wireless Telegraphy.—According to the daily Press, the Handley-Page aeroplane now being assembled at St. John's, Newfoundland, for the trans-Atlantic flight, on June 2nd picked up wireless calls from English, German and Italian land stations 4,000 miles distant, whilst its wireless apparatus was being tested.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Sydney.—June 23rd. Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.*

Bethnal Green.—June 19th. Electricity Committee. L.T. cables and pipes, section pillars, house services, and roadwork. (June 6th.)

Birkenhead.—July 28th. B. of G. Installation of internal telephones. (See this issue.)

Eccles.—June 23rd. Electricity Committee. Supply and laying of three-way underground ducts; supply and drawing-in 2,733 yd. of ·20 sq. in., E.H.T., three-core cable. (May 30th.)

Paris.—July 10th. Administration des Postes et Télégraphes. Supply of multiple commutator switchboards. Particulars from Direction de l'Exploitation Téléphonique, 4, Bureau, 103, Rue de Grenelle, Paris.

Tasmania.—Launceston.—July 28th. City Council. Sub-station equipment, battery, reversible booster, switchgear, &c. City Electrical Engineer.

Manchester.—June 17th. Electricity Committee. 10-ton overhead travelling crane. Secretary, Electricity Department.

June 20th. Electricity Committee. Coke or coke breeze during 12 months. Secretary, Electricity Department.

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*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

West Hartlepool.—June 17th. Corporation. H.T. switchgear; two 1,500-KW. transformers; two 500-KW. rotary converters; one cooling tower. (May 30th.)

Woolwich.—June 18th. Electricity Department. One 5,000-KW. steam turbine, with condensing plant and accessories. (June 6th.)

CLOSED.

Bolton.—The Tramways Committee.

Bromilow & Edwards.—Two chassis made by the Associated Equipment Co., to be used for the tower wagons.

Bradford. — Electricity Committee. Two additional 300-K.V.A. transformers, Ferranti, Ltd.

Tramways Committee.
14 point tongues, Hadfields, Ltd., £98.
15 tons ½-in. round mild steel rod, Crossley & Davenport, at £21 per ton

Hammersmith.—B.C. :—

350 yd. ·2 sq. in. L.T. cable :—

Pirelli General Cable Works, Ltd.	(recommended)	**£170**
Western Electric Co., Ltd.		182
Callender's Cable & Construction Co., Ltd.		184
B. I. & Helsby Cables, Ltd.		18[illegible]
W. T. Henley's Telegraph Works Co., Ltd.		189
Macintosh Cable Co., Ltd.		203

Maintenance of storage battery : —

Premier Accumulator Co., Ltd.—£88 per annum for a period of five years (the previous contract just expired was for £45 per annum).

FORTHCOMING EVENTS.

Physical Society of London.—Friday, June 13th. At 5 p.m. Special general meeting. Papers on "A Comparison of the Wave Form of the Telephone Current Produced by a Thermal Detector and a Rectifier in Heterodyne Reception," by Mr. B. van der Pol, and "The Magnetic Properties of Varieties of Magnetite," by Messrs. E. Wilson and E. F. Herroun.

National Foremen's Association, Engineering, Shipbuilding and Allied Trades (West London Branch).—Saturday, June 14th. At the Norfolk Arms Hotel, Burwood Place, Edgware Road. Ordinary meeting.

Incorporated Municipal Electrical Association.—Annual convention :—

Wednesday, June 18th. At 10 a.m. At the Town Hall, Ipswich. Reception by the Mayor of Ipswich. Presidential address by Mr. F. Ayton, Engineer and Manager, Ipswich Corporation E.S. and Tramways Department. Paper on "The Whitley Report: the Application of its Recommendations to the Electric Supply Industry," by Ald. W. Walker.

Thursday, June 19th. At 10 a.m. At the Spa Pavilion, Felixstowe. Discussion on "Electric Transmission," to be opened by Mr. S. L. Pearce. Paper on "The Rating of Electric Supply Undertakings," by Bailie W. Smith.

7.15 p.m. At the Felix Hotel, Felixstowe. Annual dinner.

Friday, June 20th. At the Spa Pavilion. Annual general meeting.

Industrial Reconstruction Council.—Tuesday, June 17th. At 6 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Some Methods of Regulating Wages," to be opened by Mr. J. Baker, Iron and Steel Trades Confederation.

Society of Technical Engineers (Woolwich Branch).—Friday, June 20th. At 6 p.m. At the Shakespeare Hotel, Powis Street, Woolwich. Discussion on "The Third Party Policy."

NOTES.

British Scientific Products Exhibition.—On account of the very large number of applications that have been received by the Organising Committee of the forthcoming Exhibition of British Scientific Products, all the space available at the Central Hall, Westminster, has now been allotted, and no further applications can be considered. The Exhibition will be open to the public from July 3rd to August 5th. Its scope will be more extensive than was possible at last year's display, when war conditions made it necessary to withhold from public view much of the scientific and technical work carried on in Great Britain. Striking testimony will be furnished of the enterprise of British manufacturers, and the uses they have made of science and invention in new industries and the development of old.

The Electric Vehicle Committee of Great Britain.—Mr. R. A. Chattock, who has been chairman of the Committee since its formation in 1913, and who in that capacity has done much valuable pioneer work in promoting the use of electric vehicles, has been compelled, owing to the pressure of other work, to resign the position, although he will continue to serve as a member of the Committee.

At the last meeting of the Committee, held on May 9th, Mr. Chattock's resignation was received with regret, and a resolution was passed thanking him for his services. By a unanimous vote of the Committee, the hon. secretary (Mr. F. Ayton) was elected chairman for the year ending March 31st, 1920. Mr. Shrapnell-Smith was re-elected vice-chairman, and Mr. J. Christie was re-elected hon. treasurer. Mr. Ayton will continue to hold the position of hon. secretary, to which he was re-elected.

A Special Committee to investigate the question of the most suitable quality of rubber to employ for solid tires for electric vehicles has been appointed jointly by the Electric Vehicle Committee and the British Association of Rubber Tire Manufacturers.

The Committee's publication, "The Electric Vehicle," will appear monthly, commencing with the June issue.

Strikes.—The building trades of Melbourne have struck and the seamen's ballot is proceeding, but the majority of men are absenting themselves. Adelaide is imposing drastic light and power restrictions, as the city only possesses three weeks' supply of coal. Melbourne coal lumpers have struck, and restrictions have had to be imposed on the use of gas and electricity. It is feared that there will be a repetition of the great strike of 1917. As a result of the coal shortage factories are closing down wholesale. Some manufacturers have installed oil engines, and are thus enabled to continue work. Mr. Watt, acting Premier, is to submit to Parliament a Bill to amend the existing arbitration legislation.

At Toronto the general strike has come to an end, leaving the metal trades to continue their fight alone. At Winnipeg there are also signs of some workers returning, although the deadlock continues. At Vancouver a general sympathetic strike is in progress, while demonstrations have been held at Manitoba. At Montreal employés of Canadian Vickers, Ltd., have gone on strike for a 44-hour week.

At Paris there are some signs of improvement in the labour position, although the strikes continue. Traffic workers declare they will not return to work until they have obtained full satisfaction. Employers are equally firm. Large numbers of workers are idle in other parts of France.

At Rome workers, including tramway employés, are idle through strikes. The Italian Press lays the blame upon the delays of the Peace Conference.

A general strike has commenced among the Danube and Hungarian steamship companies' workmen. All passenger and freight traffic on the Danube is stopped.

In Norway the Minister of Defence has threatened to use military means for the maintenance of social order.

Radium Bombardment.—Lecturing last Friday at the Royal Institution on "Atomic Projectiles and their Collisions with Light Atoms," Sir Ernest Rutherford said he thought he had obtained some evidence of the disruption of atoms by the impact of the swift alpha-particles shot out by radium C. His grounds for this view are roughly as follows: When one of these alpha-particles hits the nucleus of a light atom like that of hydrogen in a head-on collision, the atom is pushed on a certain distance more or less in the line of motion of the particle. A heavier atom, like that of nitrogen, is not pushed so far; yet when the experiment is tried on nitrogen a few atoms are found that go as far as hydrogen atoms, and in fact appear to be hydrogen atoms. The possibility that the hydrogen comes from external sources seems to be disproved by the precautions taken, and in that case it must come from the nitrogen. The lecturer was, therefore, led to the speculation that the nucleus of the nitrogen atom was made up of three atoms of helium and two of hydrogen, and that the hydrogen which made its appearance in his experiments was sent off the nucleus of the nitrogen atom by the impact of the alpha-particle.—*The Times.*

Chief Technical Assistants' Association.—The annual dinner of the Association was held on May 31st, Mr. J. M. Parker (Croydon), the chairman of the Association, presiding. After the loyal toasts had been duly honoured, the chairman, in proposing the toast of the C.T.A.A., stated that during the past year they had discussed some very useful and practical papers, relating to the plant under their charge, which were of undoubted benefit to all, and they had an excellent programme for the ensuing year. He recollected that the past chairman, Mr. H. F. J. Thompson (Battersea), expressed the hope at their last annual dinner that the various protective associations would ultimately combine; it was a pleasure to recall that during the past year they had joined forces with the E:P.E.A., and he hoped there would be further amalgamations. He emphasised the fact that any good work which was accomplished by an association was achieved by the energy and public spirit of its members, and he hoped that all of them would, to the utmost of their abilities, further the interests of the C.T.A.A. and those with whom they were associated. The position was very critical, perhaps more so than most of them were aware, and attempts had already been made to discredit and break up their protective organisation. While it was true that there were not many bad employers, still there were always plenty who were prepared to shelter behind the bad ones, and seize any advantage that could be gained by their activities. The policy of their protective association was sound, and its record would bear investigation. It was up to every one of them as the chief technical assistants of their various undertakings to see to it that as far as lay in their power, right decisions were taken in all matters pertaining to the welfare of the staffs, for only thus would the interests of the industry to which they had devoted the best years of their life be safeguarded. An excellent musical programme was provided by Mr. Bradshaw (Islington), ably assisted by several members of the Association, and a most enjoyable evening was spent.

Imperial Communications. — At a meeting of the Industrial Group in the House of Commons, Colonel Archer Shee submitted a statement on the post-war importance of Imperial communications, with special references to cables and wireless. He also emphasised the necessity for shipping subsidies, with a view especially to facilitating cheap third-class passages abroad. The British Commonwealth Union has decided to set up immediately a special Parliamentary Committee to inquire into these two matters and to prepare a report.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The Secretary of the Institution is informed that demobilised officers attending the Conversazione on the 25th inst are permitted by the authorities to wear uniform on that occasion.

The annual dinner is to be held on Thursday, June 26th. Early application for tickets should be made, in order that the necessary arrangements may be effected.

Mr. J. F. Neilson occupied the chair at the summer meeting of the SCOTTISH CENTRE of the Institution, held at Aberdeen on Friday last. There were 64 visitors, and a total attendance of about 130. The members were accorded a civic welcome by the Lord Provost, Sir James Taggart. Mr. C. H. Wordingham, C.B.E., President, in the course of an address, said the electrical industry had an extraordinary fascination for the legislator, and that it was a dangerous experiment to put any industry largely under the Government. Prof. Magnus Maclean (Glasgow) delivered a lecture on "Water Power," in which he emphasised the important part it could play in developing the Highlands, where the power was less used than it was a century ago. Mr. A. Newlands, chief engineer, Highland Railway Co., said there was a strong determination on his part to secure such an amount of power as existed for his own particular need. The members were entertained at luncheon by the Electricity Committee of the Town Council, and spent the afternoon sight-seeing, visiting Rubislaw granite quarries, Donside paper mills, and the Corporation electricity works.

Society of Engineers.—At a recent meeting of the Status Committee of this Society, it was agreed that members should increase their fees (other than those charged as a commission) by 33⅓ per cent., and that the fees mentioned in "Professional Practice in Engineering (Part I), Consulting Engineers," should be altered accordingly.

At the NEWCASTLE ROTARY CLUB, on May 30th, Mr. W. F. T. Pinkney, of the Newcastle Electric Supply Co., gave an address on "Electricity and Public Service." It was curious, he said, that there still were people who regarded electricity as something of a luxury. He believed the universal use of electricity would come, but it might be a long time before electricity would be available in every part of the country. No form of energy was so well adapted to labour-saving as electricity. The introduction of electricity more largely into the housing schemes would, he thought, lead to cleaner homes.

Industrial Meetings on Tower Hill.—The Industrial Reconstruction Council is holding dinner-hour open-air non-party meetings at Tower Hill, every Monday (commencing 16th inst.), at 1 o'clock. At these meetings the policy of adopting Whitley Councils—or Trade Parliaments—in each industry, will be advocated as one of the best constructive methods of increasing productivity, solving Labour problems, and bettering the lives and conditions of wage-earners.

Sales of Government Property.—The progress made in the sale of surplus Government property under the direction of the Disposal Board, Ministry of Munitions, is indicated by the fact that the value of the stores sold up to date amounts to upwards of £107,000,000. We note that the Controller of Telephones, Telegraphs and Electrical Instruments has visited Belgium, with the result that sales will be considerably accelerated. Of the several sales authorised by him, one includes that of 150,000 lamps, and he has also arranged for a quantity of samples of captured or surplus material to be on view at the Agricultural Hall, Islington.

British Oil.—The Minister of Munitions has issued a licence to the Oilfields of England, Ltd., to search and bore for, and get, petroleum, near Newark. The licence, which is the subject of a White Paper, is to continue in force for two years. The payment of any royalty is distinctly forbidden without the consent in writing of the Minister, and all information of boring is to be placed at the disposal of the Minister. It is also provided that if the Government desires to acquire the boreholes, workings, or plant, these shall be transferred at a price to be determined, the Lord Chief Justice of England to be arbitrator in disagreement.

Mine Explosion.—It is feared that 100 men lost their lives in an accident which occurred last week, near Wilkesbarre, Pennsylvania, to a train carrying men into the workings of a mine tunnel under construction. The train was drawn by an electric locomotive. The overhead-trolley wire broke, and the sparks exploded a car-load of blasting powder at the end of the train. Hardly a man in the train escaped, and as fire broke out at once, filling the tunnel with sulphur fumes, rescue work was rendered very difficult.

Educational.—The *Times* states that 10 new £200 scholarships enabling American scientific students to study in Swedish Universities have been founded. Funds are being raised in Sweden to send 10 Swedish students to the United States.

Inquiries.—Agents of the Hawkins-Everett lightning arrester are asked for.

French Water Power.—According to Mr. Eugène Schneider, President of the Iron and Steel Institute, the hydraulic power available in France in 1914 was 750,000 H.P., and in 1918, 1,500,000 H.P.; installations in course of realisation or under consideration amounted to 4,500,000 H.P. The total power of known waterfalls was 9,000,000 H.P. If it were reckoned that 1,000 H.P. hydro-electric saved 10,000 tons of coal per annum, the falls which were to be worked represented the equivalent of 30,000,000 tons of coal, and the future total power about 60,000,000 tons per annum.

The Decimal Association.—The annual report of the Decimal Association for the year 1918-19 reviews the progress of the decimal coinage movement, which is being investigated by a Royal Commission; Mr. H. Allcock gave evidence before the Commission on behalf of the Association. Many public bodies have passed resolutions advocating this reform, as well as the adoption of metric weights and measures. A canvass of members of Parliament, Trade Unions, and Chambers of Commerce showed an almost complete absence of opposition to these reforms. A lecture campaign is being prepared by Mr. E. C. Barton, who reports that in every town visited he finds enthusiastic decimalists. Educational authorities are taking steps to improve the methods of teaching the metric system and decimals. A notable departure has been the establishment of a quarterly journal, the *Decimal Educator*, as the organ of the Association, which achieved a marked success. Provincial branches are being founded. In Canada and Australia the movement is making progress, and in France and Italy the early adoption of the metric system and decimal coinage by Britain is urged as essential to the development of trade. The Russian Government is reported to have resolved upon the adoption of metric weights and measures, and the United States Section of the International High Commission declares that the general use of the metric system in trade, especially with Latin-America, is of the first importance. The principal engineering institutions of the United States, with the exception of the Society of Mechanical Engineers, have decided in favour of the metric system. In Germany, after this year, the metric system will be obligatory in the textile trades, and in Japan the compulsory adoption of the system is contemplated, while the Chinese Ministry of Communications recognises the necessity of the reform, which is to become operative at the end of next year. The Decimal Association has gained largely in strength and financial resources during the year, and is about to embark on a more vigorous propaganda. The address of the Association is 44, Finsbury Pavement, E.C. 2.

Coal, Gas, and Electricity Rations.—The Controller of Coal Mines announces that it is necessary to continue the rationing of coal, gas, and electricity for household fuel and lighting, for a further period. It is, however, proposed to modify the present order to the extent that consumers of less than 5 tons of coal in the year, and 12,500 cb. ft. of gas in any quarter, or 400 B.T.U. of electricity in any quarter, will not be subject to assessment. They must, however, be registered with their coal merchants for the supply of coal. A revised Order which will take effect from July 1st next, will be issued during the present month. In the meantime the following memorandum is issued for the information of the public :—

Anthracite, coke and patent fuel will be exempted from the Order for the time being.

All consumers of coal must register with coal merchants for their supplies. Present registrations will be valid unless notice to the contrary is given by either consumer or merchant.

The present assessments are current for a year from various dates commencing with October 1st, 1918. In the case of consumers over the quantities named above, the assessments will be renewed for the same annual quantity for 12 months from July 1st, 1919, and the balance of the old assessments cancelled.

New certificates will be issued to all present holders of certificates for 12 months' supply, and it will not be necessary to make application for the certificates, except in the case of new consumers or of those who, owing to a change in the basis upon which the original assessment was made, desire a modified assessment.

The new assessments and certificates will date from July 1st, in order to enable private consumers, so far as coal may be available, to stock on account of the coming year's allowances. Immediately on the issue of the new Order arrangements will be made to enable this to be done during the months of July, August and September.

The supply of fuel already made under any existing certificates in respect of the period subsequent to June 30th will be treated as a supply on account of the New Year's allowances.

The conversion equivalents of gas and electricity in terms of coal will be fixed at :—18,750 cb. ft. of gas to the ton of coal; 1,000 B.T.U.'s of electricity to the ton of coal.

The control of maximum prices for the sale of coal will be rigidly enforced.

In order to simplify some of the machinery and provisions of the present Order, the special Local Fuel and Lighting Committees will be discontinued, and, in the ordinary course, the control of the Local Fuel Overseer will, subject to the directions of the Controller be left to the local authority—except in the Metropolitan Division, which will continue under the immediate supervision of the Household Fuel and Lighting Branch of the Coal Mines Department.

Economy in the consumption of coal still remains vital to the national interests. If the output of coal in the near future will allow a relaxation of these restrictions the Local Fuel Overseer will be authorised from time to time to receive applications for such increased allowances as any increase in the supplies of coal may justify.

A German "Technical Supplement."—An announcement recently circulated in the German technical Press, relates to the publication in Germany of a technical review of the foreign Press. The German Review was originally published as a confidential war service under the authority of the Ministries of War and Education, and presumably with the co-operation of the Society of German Engineers. The undertaking is significant of the importance attached to the organised provision of technical information in Germany.

Appointments Vacant.—Lecturer in engineering drawing (£350 + bonus), for the Manchester College of Technology; assistant in the Government Railway and Electricity Department, Zanzibar (£300); electrical testing superintendent (£300), for the Bradford Corporation Electricity Department; cable jointer (70s.), for the Corporation of Ayr Electricity Works; lecturer in electrical engineering (£150 to £195 + 15s a week war bonus), for the L.C.C. Technical Institute, Paddington; junior shift engineer (73s.), for the Burnley B.C. Electric Lighting Department; electrical engineer (£600) for the South Shields Corporation. See our advertisement pages to-day.

Fatalities.—An inquest was held at Stourton, last week, respecting the death of Fredk. Arnison (16), general labourer, of Leeds, who was killed at the Yorks. Copper Works. The evidence showed that two brass tubes which the youth was carrying over his shoulder came into contact with the switchboard of the electric plant, and he immediately fell to the floor dead. A representative of the firm said that bogies were provided on which tubes might be carried, but there was no rule that the tubes should be carried on them. The switch was placed at the top of a short column, and was out of the way in the ordinary course. Normally, it could be touched and no shock received, but when the tube the lad was carrying touched the switch he formed one earth. To complete the circuit another earth was needed. This was found in an accidental earth that occurred in the press-house on that particular day. It was explained that these earths occurred in the best systems from time to time, and to avoid them a search was made once a fortnight. It was stated that previous to this there had only been one fatal accident at the Yorkshire Copper Works in 30 years, and arrangements had been made to prevent a recurrence. Verdict, "Accidental death."

The B.A. Meeting in 1921.—It is proposed to invite the British Association to hold its meeting at Edinburgh in 1921.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—At the Barrow Town Council meeting on June 2nd, the Electricity Committee minutes contained a copy of a letter from Mr. H. R. Burnett, borough electrical engineer, to the Mayor respecting "grossly inaccurate and misleading statements" made at the Council meeting on April 7th, when the question of his salary was under consideration. The statements referred to mis-stated the amount of Mr. Burnett's advances in salary. Mr. Burnett had previously supplied the Committee with information showing that the *average* salary, with bonus, paid in 22 undertakings comparable with Barrow was about £900 per annum, and in nearly one half of these, and a number of smaller undertakings, the salary now being paid or promised was £1,000 per annum, or over. At the end of his letter to the Committee, Mr. Burnett stated:—

> Whilst the Association of Municipal Electrical Engineers, which has applied to you on my behalf, is most anxious to avoid taking any extreme measures to enforce their demands, I think it right that the Council should realise that it intends to insist upon Corporations paying its members reasonable salaries for the positions which they occupy, or agreeing to refer the question to arbitration. In any action which the Association may decide to take, it will, I have no doubt, not only have the support of all its members, but also of the Electrical Power Engineers' Association, to which every member of the technical staff of your electricity department, and a very large proportion of the assistant engineers throughout the country, belong. If, therefore, the Council persists in its refusal to grant the reasonable request which has been made by the Association, the responsibility for any difficulty which may arise in the administration of your electricity department must rest with the Council.

When the matter was before the Council, the Councillor who made the remarks mentioned above admitted that some of his figures were wrong. Respecting the threats in Mr. Burnett's letter, he (Coun. Whinnera) believed that the works could be carried on if the technical staff came out.—Coun. Barrie thought the position was a very unhappy one, and Coun. Basterfield contended that in dealing with officials' salaries the Council should remember the arguments used when the question of wages was being discussed, namely, that Corporation workers had a week's holiday with wages and a continuous employment for life. That applied also to officials.—Coun. J. H. Brown asked if provision was being made to staff the electricity works in the event of the technical staff and borough engineer going on strike.—Coun. Barrie replied that the Committee understood that the matter was not yet finished. Mr. Burnett was going to appeal to some other authority. It was a position which was simmering, and it would find an outlet by and by. The Committee had made no preparations; they were hoping for a change for the better.

By a large majority—the opposition being chiefly Labour—the Leeds City Council, on Wednesday last week, agreed to the advance of the salary of Mr. J. B. Hamilton, tramways manager, from £1,000 to £1,500 per year, irrespective of his salary of £500 per year as the Corporation's commercial manager.

Maidstone T.C. has increased the salary of the electrical engineer, Mr. Hoadley, from £618 per annum to £769 as from April 1st, and from that date £1 for every extra 35 kw. on maximum demand, £1 for every additional 35 consumers, and £1 for every additional 100,000 units sold.

Mr. J. A. Cressey, who was recently demobilised, has been appointed shift engineer at the Peterborough municipal electricity works, and has taken up his duties. He was formerly charge engineer at St. Albans electricity works, from which he enlisted with the R.E. in June,, 1915, serving in France during the winter of 1916.

Mr. Annetts, late electrical engineer to the Morecambe T.C., who is proceeding to Oxford, has been presented with a cup by the electricity works staff.

Exeter T.C. is recommended to increase the salary of the electrical engineer to £750 a year.

Mr. E. S. Tayner, borough electrical and tramways engineer, Doncaster, has been granted an increase of salary from £550 to £700 for one year, and after that to £750. Mr. Rayner has had an increase of £100 since his return from temporary Government war service.

At last week's meeting of the Swansea Corporation Electricity Committee, the Town Clerk read a communication from the Ministry of Labour asking consideration of an application by the Associated Municipal Electrical Engineers to grant chief electrical engineers and managers of electrical undertakings the awards made to the engineering and foundry trades by the Committee on Production, and also to adopt a formula based on the size of the stations, number of units generated, &c., which, the Town Clerk explained, meant in the case of the borough electrical engineer, Mr. J. W. Burr, a total increase in salary from £700 to £1,050 per annum, the increase, according to the Society's application, to be retrospective to March, 1918. The Ministry of Labour, who had been approached in the matter, suggested that, failing an amicable arrangement, the matter be referred to arbitration. —The Chairman referred to a resolution of the Council to defer all increases in salary to the chief officials of the Corporation for 12 months, and asked what was the Committee's position.—The Town Clerk said that that resolution could be rescinded at any time.—Several members admitted they would have to "face the music," and Mr. Morgan Rees thought it the better plan to reconsider the question of the whole of the chief officials' salaries.—Mr. Daniel Jones moved that the salary of the electrical engineer be increased to £1,050. It was better to make a clean cut of it.—The Town Clerk said that several municipalities had given the increases asked for.—Mr. Dd. Richards proposed an amendment that the matter be referred to arbitration.—The amendment was lost and the resolution adopted.

The Stafford Town Council has increased the salary of the electrical engineer, Mr. Robins, from £388 per annum to £550, the present emolument of house, light, fuel, &c., to be continued.

Mr. C. A. Hopkins, of the Chatham & District Light Railways Co., and formerly of the Swindon Corporation electricity and tramway department, has been appointed chief clerk to the Wigan Corporation tramways.

General.—Last week the Duke of Connaught, as President of the Royal Society of Arts, presented to Sir Oliver Lodge the Albert Medal of the Society in recognition of his work as the pioneer of wireless telegraphy.

Mr. Lionel Robinson and Mr. Jas. Devonshire have been elected directors of the Underground Electric Railways Co. of London.

Captain J. E. Bannen, R.A.M.C., has been appointed specialist in electrical science, Poona Division, with effect from April 15th, vice Captain Goss, R.A.M.C., vacated.—*Indian Engineering.*

Mr. John Newlands, who has retired, is, according to the *Daily Chronicle*, to be succeeded in the controllership of the Central Telegraph Office by Mr. John Lee, postmaster of Belfast; and the deputy-controller, Mr. John Bailey, who has also retired, is succeeded by Mr. A. W. Edwards.

Mr. J. Digby, who was connected with the Marconi Co. for 10 years, and for five years held the speed record for long-distance wireless, and has been an instructor in Marconi Schools in London, Glasgow, and Manchester, will be principal in the Northern Wireless College, which is to be opened shortly in Belfast.

The King has conferred the Territorial Decoration on Capt. and Temp. Lieut.-Col. H. E. Webb-Bowen, D.S.O., Major A. Levin, and Capt. G. W. C. Kaye, London Electrical Engineers, and on Major G. A. Bruce, Tyne Electrical Engineers.

Lieut. E. W. Young, Kent Fortress Engineers (Electric Lights Companies), has been restored to the establishment to which he was a supernumerary. He was commissioned in 1915, and served for a considerable period with a regular unit of the Royal Engineers.

Lieut. W. A. Gladwin, Tyne Electrical Engineers, has been restored to the establishment of the Corps. He was commissioned in October, 1916, was at the School of Instruction for some time, and seconded in his Corps whilst there.

Quartermaster and Lieut. A. Kennedy, Royal Engineers (Electrical), Territorial Force, has been promoted captain. Capt. Kennedy received his commission in the London Electrical Engineers as Quartermaster and Lieutenant in May, 1916.

Mr. Frederick M. West has relinquished his commission as second-lieutenant, R.G.A., on account of ill-health, retaining his rank, after being invalided home from France. Mr. West is anxious to resume touch, after four years' service with the Forces, with his many electrical friends. Mr. West will be remembered by our readers as the contributor of a series of articles on "The Selling Side of Electricity." He has resigned his position with the St. Marylebone electricity supply undertaking in order to join the A. & A. Electrical Co., Ltd., of 13, Farringdon Road, E.C., as manager of their factoring department.

Birthday Honours.—The honour of Knight Grand Cross is conferred upon Sir H. LLEWELLYN SMITH, K.C.B., Secretary to the Board of Trade. G. E. P. MURRAY, Esq., C.B., Secretary to the G.P.O., is made a Knight Commander.

Capt. B. F. MCMURTRIE, manager of the export department of the British Thomson-Houston Co., Ltd., who saw two years' active service in France and 15 months in Italy, has been included in the King's Birthday Honours for the O.B.E. (Military Division).

Lieut. A. MCDOUGALL, R.E., whose name appeared in the Birthday Honours List as receiving the M.B.E. (Mil. Div.), was before the war employed in the electrical department of the N.E. Rly. at the C.M.E.'s Office, Darlington. He is an Associate of both the Electrical and Mechanical Institutions. Lieut. McDougall joined the Forces in January, 1915, and for the first one and a half years was engaged in mine laying. He was commissioned in the R.E., and has been responsible for the erection and maintenance of several small generating stations for the searchlights in connection with anti-aircraft work. He is at present retained as Technical Adviser for that work in the Dundee area.

Among those who received honours in connection with the King's birthday is Major HARRY RICHARDSON, the general manager and engineer of the Dundee Corporation electricity department, who has been awarded the O.B.E.

Obituary.—MR. P. S. BEASLEY.—The staff and employés of Messrs. Willans & Robinson, Ltd., of Rugby, have placed in the cemetery an Aberdeen granite cross over the grave of the late Mr. P. S. Beasley, assistant works manager, who died on October 16th last.

NEW COMPANIES REGISTERED.

F. Smith & Son (Southampton), Ltd. (155,622).—Public company. Registered May 30th. Capital £25,000 in £1 shares. To take over the business of a marine optician and compass adjuster carried on by J. Crombie Smith & Son, at 23, Oxford Street, Southampton, and also the business of electricians, electrical engineers and fittings makers carried on by E. M. F. (1914), Ltd., at London and Walsall. The first directors are: John Crombie Smith, 23, Oxford Street, Southampton, marine optician; Joseph Max Bein, 56, Belmont Road, Portswood, Southampton, electrical engineer; and William Steel, 37, Cromwell Road, Southampton, marine optician. Solicitor: J. D. Bassitt, 154, Above Bar, Southampton. Registered office: 23, Oxford Street, Southampton.

Ratherham & Co., Ltd. (155,711).—Private company. Registered June 3rd. Capital £1,000 in £1 shares. Manufacturing, mechanical, and electrical engineers, toolmakers, and manufacturers of clipping machines, particularly horse clippers and toilet clippers, &c. The subscribers are: J. Ratherham, 27, Church Road, Hanwell, engineer (300); A. Cutts, 325, Franklin Road, King's Norton, Worcs., engineer (100); E. Carwardine, 34, Drayton Road, Edgbaston, Birmingham, secretary (100). First directors: J. Ratherham, A. Cutts, and E. Carwardine. Registered office: St. Dunstan's Works, St. Dunstan's Road, Hanwell.

Rapid Accumulator Co., Ltd. (155,710).—Private company. Registered June 2nd. Capital £25,000 in £1 shares. To acquire patents relating to the production, treatment, storage, application, distribution, and use of electricity. The subscribers (each with one share) are: F. C. Hilbery, 4, South Square, Gray's Inn, W.C. 1, solicitor; F. Smith, 4, South Square, Gray's Inn, W.C. 1, clerk. Permanent directors: J. W. Johnstone, 46, Leadenhall Street, E.C.; J. Cartier, 110, Cannon Street, E.C.; A. Andries, 1, West Terrace, Folkestone. Registered office: 110, Cannon Street, E.C.

Indicators, Ltd. (155,585).—Private company. Registered May 29th. Capital £24,000 in 22,500 7 per cent. participating preferred shares of £1 each and 30,000 ordinary shares of 1s. each. To acquire patents relating to advertising by electricity, and to any apparatus therefor, from P. H. Waller and B. E. Nordman. The subscribers (each with one preference share) are: P. H. Waller, 41, Wilson Road, Camberwell, S.E. 5, engineer; B. E. Nordman, 25, Ashford Avenue, Hornsey, N. 8, merchant; T. J. Garstang, 36, Priory Avenue, Hornsey, N. 8, poor law official. Directors: P. H. Waller, B. E. Nordman and T. J. Garstang. Solicitors: Russell and Arnholz, 3 and 4, Great Winchester Street, E.C. 2.

Webster, Mitchell, Ltd. (155,647).—Private company. Registered May 30th. Capital £5,000 in £1 shares. Merchants, manufacturers' agents, general agents, &c. The subscribers (each with one share) are: F. E. Hayward, 45, Finsbury Pavement, E.C., incorporated accountant; E. Clough, 22, Brigstock Road, Thornton Heath, engineer. First directors: H. J. Mitchell, managing director of Hedley Mitchell, Ltd., drapers, Erith; A. V. Downton, director of Enfield Electrical Cable Co., Ltd., Brimsdown, Middlesex; and A. W. Webster, 46, Hafton Road, Catford, S.E. Registered office: 52, Cheapside, E.C.

Moulson & Anderson, Ltd. (155,701).—Private company. Registered June 2nd. Capital £5,000 in £1 shares. To enter into agreements with A. E. Moulson and G. E. Anderson and to carry on the business of general electrical and mechanical engineers. The subscribers (each with one share) are: W. Holroyd, 3, Silverhill Drive, Bradford, sheet metal engineer; A. E. Moulson, 70, Cumberland Road, Bradford, engineer; G. E. Anderson, 45, Woodhall Road, Bradford, engineer. The first directors are: W. Holroyd, A. E. Moulson, and G. E. Anderson. Registered office: Ross Works, Birksland Street, Bradford.

Manchester Armature Repair Co., Ltd. (155,702).—Private company. Registered June 2nd. Capital £15,000 in £1 shares (5,000 preferred). To acquire the business carried on at Ford Lane, Pendleton, as the Manchester Armature Repair Co., to enter into an agreement with C. H. Wilson and others, and to carry on the business of electricians, engineers, manufacturers and repairers of electrical apparatus and appliances, &c. The subscribers (each with one share) are: C. H. Wilson, Glen View, Saltburn-by-the-Sea, chemical manufacturer; A. B. Hutton Wilson, Egglescliffe, County Durham, chemical manufacturer; R. Ainsworth, 15, Half Edge Lane, Eccles, Manchester, electrical engineer. The first directors are: C. H. Wilson, A. B. Hutton Davies, and R. Ainsworth. Solicitor: P. H. Monk, 13, Queen's Terrace, Middlesbrough.

Ernest Wainwright (London), Ltd. (155,661).—Private company. Registered May 31st. Capital £5,000 in £1 shares. To acquire the business of an electrical engineer, manufacturer, and merchant of engineering appliances, electrical fittings and gramophone motor parts, carried on by E. Wainwright at 159, Victoria Street, Westminster. The subscribers (each with one share) are: E. Wainwright, 44, Montalt Road, Woodford Green, merchant; S. W. J. Vaisey, 15, Rowan Road, Hammersmith. Directors: E. Wainwright and S. W. J. Vaisey. Registered office: 159, Victoria Street, S.W. 1.

Signal Electric Co., Ltd. (155,685).—Private company. Registered May 31st. Capital £12,500 in 10,000 7 per cent. preference shares of £1 each and 5,000 ordinary shares of 10s. each. To manufacture electrical accessories and appliances of all kinds, &c. The subscribers (each with one preference share) are: E. Baker, 22, Tottenham Court Road, S.W., cinema proprietor; E. St. John, 48, Batoum Gardens, Hammersmith, W. First directors to be appointed by the subscribers. Solicitor: P. Holt, 4, Bank Buildings, Purley.

CITY NOTES.

Altrincham Electric Supply, Ltd. During 1918 24 new installations were connected. Actual consumers number 1,785. After meeting debenture interest premium on debenture redemption policy, &c., the profit is £7,130, plus £431 brought forward. After meeting preference dividend to September, 1918, amounting to £2,555, putting £600 to reserve for income tax, and £500 to reserve for depreciation of plant, &c., 9s. per share is to be paid on the deferred shares, absorbing £3,150 out of the balance of £3,906. The results fall short of the anticipated figures owing to increased cost of fuel and restricted consumption, also reduction of power consumption for industry after the signing of the armistice. The Broadheath district is coming largely into favour as a manufacturing centre, and fresh applications for power are being received; still further works are to be erected. At the generating station two water-tube boilers and a 2,000-KW. turbo-generator are to be added, which, together with additional mains, &c., will cost £40,000. In order to provide this the capital of the company is to be increased to £100,000 by the issue of 50,000 shares of £1 each. The new plant will enable the present Lancashire boilers to be dispensed with; fuel economy and increased efficiency will result.

Richardsons, Westgarth and Co., Ltd. At the annual meeting, held at Hartlepool, on June 3rd, Mr. D. B. Morison, the chairman, stated that during the war period the total H.P. of the engines manufactured by the company was 603,000, 503,000 being for ships and 100,000 for the generation by steam turbo plants of electric power on land. In addition, a 25,000-H.P. rolling-mill engine and considerable steel works plant had been supplied. With the further payment of arrears now proposed there would, within a period of nine months, have been paid to preference shareholders four years' dividend, or 24 per cent. A greater distribution of profits could not be made in consequence of the taxation demands of the Government. Of every £1,000 earned above the firm's extremely low pre-war standard, there was, after the deduction of profits tax and income tax, only left to the company £140—a mere remnant. The acute desire of the taxing authorities to get money from any available source should be tempered with an adequate appreciation of the efforts which were put forth by manufacturers during the war, and of the equally strenuous exertions which must still continuously be made if we were to win out in the industrial world competition—competition that was bound in the future to be infinitely keener than ever before. Permission to extend the firm's boiler works at Middlesbrough was refused by the Government, and as a consequence the company had now to face a very heavy expenditure in order to meet the requirements of their business.

German Companies. The directors of the *Akkumulatoren Fabrik A.G., of Berlin*, recommend a dividend at the rate of 20 per cent. for 1918.

The Korting und Mathiesen A.G., of Leutzsch, makers of electrical apparatus, intend to distribute 15 per cent. for 1918, being the same rate as in the previous year.

The Elektrizitats Gesellschaft vorm. W. Lahmeyer & Co., of Frankfort-on-Main, reports net profits of £142,000 for 1918, as contrasted with £134,000 in the previous year. It is proposed to distribute 8 per cent., being the same rate as for 1917.

The Welter Elektrizitats und Hebewerkszeuge A.G., of Cologne-Zollstock, reports net profits of £1,700 for 1918, as contrasted with £5,100 in the previous year. It is intended to pay a dividend of 8 per cent., as in 1917.

The Elektrizitats Lieferungs Gesellschaft, of Berlin, which owns or is otherwise interested in a number of supply works, reports net profits of £163,700 for 1918, as compared with £163,500 in the previous year. A dividend of 10 per cent., as in 1917, is in contemplation.

The accounts of the *Kabelwerk Wilhelminenhof A.G., of Berlin*, whose share capital of £50,000 is held by the Felten and Guilleaume Co., show net profits of £12,000 for 1918, or the same as in the preceding year, when a dividend at the rate of 20 per cent. was paid. The method of disposing of the profits for last year is not disclosed.

The Sachsenwerk, Licht und Kraft A.G., of Niedersedlitz, which has a share capital of £375,000, intends to pay a dividend at the rate of 20 per cent. for 1918, as against 30 per cent. in the previous year. It is stated that instead of being paid in cash the dividend is to be distributed "by request" in the form of new shares upon which shareholders will be required to contribute an additional sum of £4 per share.

The Treuhand Bank fur die Elektrische Industrie, of Berlin, which is closely associated with the A.E.G., Lahmeyer group, earned profits of £38,000 in 1918, as against £46,000 in 1917, apart from the balance of £5,000 brought forward. After defraying general expenses and taxes it has been necessary to write off £97,000 for losses on exchange, and the year closes with a deficit of £56,000 on a capital of £500,000. This result compares with a dividend of 4½ per cent. in 1917.

The report of *Hartmann und Braun A.G., of Frankfort-on-Main*, records a decline in the net results in 1918 owing to higher wages and general expenses, and to losses through demobilisation. After writing off £21,000 for depreciation, as compared with £30,000 in 1917, the accounts indicate net profits of £17,000, as against £51,000 in the previous year. The dividend is at the rate of 9 per cent., and compares with 15 per cent. in 1917, 14 per cent. in 1916, and 12 per cent. in 1915. The directors state that the company has been working at a loss since the beginning of 1919, and it is a question whether it will be possible to retain much longer the present number of workmen who are in excess of those employed in peace times.

The report of *Felten und Guilleaume Carlswerk A.G., of Cologne-Mulheim*, states that the maximum output of the works was reached at the end of 1917, and continued until the autumn of 1918. Owing, however, to the greatly increased working expenses the profits experienced a material decrease which was aggravated by the disproportion between the number of workmen employed and the orders on hand at the end of 1918. After appropriating £185,000 for depreciation, as compared with £243,000 in 1917, the accounts represent net profits of £338,000, as against £519,000. A dividend at the rate of 10 per cent. is recommended on the ordinary share capital of £3,000,000, this result contrasting with 15, 12, 11, 8, and 8 per cent. in the five preceding years respectively.

The directors of the *Bergmann Elektrizitats Werke A.G., of Berlin*, reporting on the past year, state that a further increase in the deliveries took place, peace manufactures rising from 50 to 60 per cent. of the total turnover. An installation at 100,000 volts for the Murg works of the Baden Government had proved to be satisfactory, and further and similar plants were in course of execution. A high-speed locomotive built by the company had been in regular service for some time past, and 14 similar locomotives were being completed. The introduction of the 8-hours day and the considerable increases in wages would have such a material influence on the costs of production that serious attention should be paid to the question of competitive capability, especially in the export trade. As extra depreciation was no longer necessary the amount written off has declined from £253,000 in 1917 to £128,000 last year, whilst the net profits have risen from £573,000 to £635,000 in the two years respectively. The directors recommend the payment of a dividend of 12 per cent., being the same rate as in 1917 and comparing with 10 per cent. each in 1915 and 1916, and 5 per cent. in 1914.

Great Northern Telegraph Co.—The directors of Det Store Nordiske Telegraf Selskab, of Copenhagen, at the annual meeting to be held on July 18th, will recommend the payment of a dividend at the rate of 22 per cent. for 1918, this percentage including the 5 per cent. interim payment already made. The sum of 800,000 kr. has been placed to the reserve and renewal fund, 1,000,000 kr. to the cable steamers' renewal fund, 250,000 kr. to the pension fund, and 2,000,000 kr. set aside for extraordinary taxes, whilst 816,379 kr. has been carried forward. The directors have allocated 1,000,000 kr. as gratuities to the staff in connection with the fiftieth anniversary of the formation of the company, which fell on June 1st. In addition, they have presented a fund of 250,000 kr. to the Polytechnic Academy (Laereanstalt) in recognition of the fact that the company's existence was due to H. C. Orsted's ingenious invention, the fund to be known as "H. C. Orsted's Fund for Technical Scientific Investigation and Associated Practical Objects."

Bell Telephone Co. of Canada.—The capital has been increased from $18,000,000 to $22,500,000. Existing holders have the right to subscribe for one new share of $100 for every four shares held.

United River Plate Telephone Co., Ltd.—Final dividend 5 per cent. on the ordinary shares, making 8 per cent. for the year, free of tax. Carried forward £36,707.

Yorkshire (West Riding) Electric Tramways Co., Ltd.—Interim dividend 3 per cent. for the half-year on the 6 per cent. cum. pref. shares.

Shawinigan Water & Power Co—Quarterly dividend 1¾ per cent.

Browett, Lindley & Co., Ltd.—Net profit for 1918, £11,478. After paying the full 6 per cent. on the pref. shares for 1918, and a further 6 per cent. in payment of arrears thereon, both less tax, 8 per cent., less tax, is paid for the year on the ordinary shares. All Government contracts were cancelled in January, and work thereon ceased on February 28th. Since then satisfactory progress has been made in changing over from war production to ordinary commercial business.

Kalgoorlie Electric Power & Lighting Corpn., Ltd.—The directors' report states that the result of operations during 1918 again shows a falling off in profit. The chief factor in this result was the falling off in revenue due to decrease in the power sales. There has been a steady decrease in the amount of current taken by large consumers which the new business obtained is too small to counterbalance. The directors hope that when Peace has at last been signed a more normal condition of affairs will soon prevail on the Kalgoorlie goldfield, and that with a more plentiful supply of labour there will be a larger demand for electric current.

During the year £7,525 was paid off the debenture debt, which has been reduced from £61,200 in December, 1917, to £22,475, as which it stands to-day. The cash for this reduction has been obtained from revenue; no new capital debt has been incurred. The money required for this service last year was £9,625, and the amount required for the current year is £9,073; this will pay the interest and reduce the debt to £14,975.

The profit for 1918 was £10,622, as against £15,910 for 1917. This large decrease is a matter of anxiety to the Board, particularly because it is largely the unavoidable result of the conditions prevailing on the goldfield. There is now hope of some improvement in these conditions.

The company's property has been maintained in good condition, and the plant and machinery in thorough working order. The cost of repairs and renewals have been unusually heavy during the past year. The cost of operating was also increased for some months by the breakdown of one of the most efficient units of generating plant; this has been repaired, and is again in operation.

Madras Electric Supply Corporation, Ltd.—Mr. James Gray, presiding at the meeting held in London on June 4th, said that the improvement was satisfactory considering the restrictions regarding supplies of materials, and other handicaps. The total revenue was £66,112, against £59,057, while the expenditure was £29,546, against £26,532. The total cost of production was 1.16d. per unit, and the revenue 2.48d., against 1.07d. and 2.35d. in 1917. The cost of production always would be relatively high because of the high price of coal in Madras and the scattered nature of their area. They had reason to believe that their application for power to increase the charge for current for lighting and fans from As.4 to As.5 would be granted. A further revision might be considered at the end of three years instead of five under the Indian Electricity Act. This period would enable them to put the undertaking into a sound financial position and to show such a return on the ordinary shares as to attract fresh capital at reasonable terms for extensions. There was ample scope for extension, and the speaker did not see why the company should not continue to show good results.

Danish Accumulator Works.—According to advices from Copenhagen, the annual meeting of the A.S. Akkumulator Fabriken was held in that city at the end of May. Mr. M. Lassius, the chairman, stated that the company's activity in 1918 bore the impress of the difficult circumstances of the times. Not the least had the situation in Germany, whence the company had to procure a large quantity of materials, contributed towards hindering the carrying on of intense activity. The first half of 1918 for these reasons was unfavourable, but the position in 1919 had considerably improved. During the year the company acquired a site in Buddinge, where it was intended to erect a factory, which would presumably be in full operation at the beginning of 1920. The accounts submitted showed net profits of 34,505 kr., which sum has permitted of the payment of a dividend at the rate of 7 per cent.

Stock Exchange Notice.—The Committee has been asked to allow the following to be quoted in the Official List:—

Electric Construction Co., Ltd.—75,800 ordinary shares of £1 each, fully-paid.

Siemens Bros. & Co., Ltd.—120,000 shares of £5 each, fully-paid, Nos. 1 to 120,000; 80,000 shares of £5 each, fully-paid, Nos. 120,001 to 200,000, and £500,000 4½ per cent. debenture stock.

Tramways (M.E.T.) Omnibus Co., Ltd.—100,000 7 per cent. cumulative preference shares of £1 each.

Merthyr Electric Traction & Lighting Co., Ltd.—The revenue for 1918 was £32,798, against £28,978 for 1917. After meeting expenses, debenture charges, putting £3,000 to renewals and £2,000 to deferred maintenance, 6 per cent. is paid on the ordinary shares and £212 carried forward. The gross revenue of the electricity supply system was £14,179, against £13,084. Units sold for lighting and power 827,739, against 695,568. The light railways revenue increased by £2,746 to £18,547.

Birmingham District Power & Traction Co., Ltd.—For 1918 net revenue from tramways and from dividends and interest upon investments was £96,572. After deducting administration and general expenses, &c., surplus remains of £79,185, making, with £6,190 brought forward, available total of £85,375. Deducting debenture interest, debenture sinking fund, £7,854; provision for renewals, £14,527; dividend on cumulative participating preference, there remains £35,003. Directors recommend placing to reserve £6,297 Dividend on ordinary at rate of 6 per cent. for year; forward, £6,030.—*Financier.*

Tramways (M.E.T.) Omnibus Co., Ltd.—After meeting debenture and loan interest, putting £6,373 to debenture redemption fund, and writing £4,385 off preliminary expenditure, the profit is £35,028. A dividend of 2s. per share (against 4s. for 1917) is declared, £15,000 is put to reserve, and £1,056 is to be carried forward.

Shanghai Electric Construction Co., Ltd.—Sir Alfred Dent presided at the annual meeting on 5th inst., and said that, deducting working expenses in Shangai, there was an operating profit of £51,822. The profit on exchange was £22,878, an increase of £5,026. The reserve for renewals had been increased by £9,520 to £73,690. They would have heavy charges against this reserve in future, and as the cost of renewals would be higher they might have to make larger annual appropriations to that account. The chairman referred to the valuable services of the Shanghai staff, the local board, and Mr. McColl, the general manager.

Calcutta Tramways Co., Ltd.—Revenue for year 1918 £135,270, plus £8,434 brought forward, making £143,704. Final dividend 6s. per share, making 8½ per cent. for the year (against 8 per cent. for 1917), free of tax; to reserve for depreciation, &c., £25,000; to reserve for depreciation of investments, £2,000; contribution to staff provident fund, £1,331; balance forward, subject to English excess profits duty and Indian super tax, £28,639.

Swansea Improvements & Tramroads Co.—The revenue increased by £18,657 in 1918, to £95,411. Expenses increased by £14,164 to £80,453. After putting £6,000 to renewals, £2,000 to deferred maintenance, £3,000 to reserve, and paying 6 per cent. for the year on the ordinary shares, £2,214 is to be carried forward.

British Electric Traction Co., Ltd.—After putting £20,000 to reserve it is proposed to pay 6 per cent. on the cumulative participating preference stock and 3 per cent. on the ordinary stock.

National Electric Supply Co., Ltd.—Interim dividend of 2s. 6d. per share, less tax, on the ordinary shares for the half-year.

STOCKS AND SHARES.

Tuesday Evening.

The terms of the Consolidation Loan will be out before we are, so it would be rather superfluous to give estimates current as we write on the day after the Bank Holiday. Nevertheless, these estimates are for the moment exercising considerable influence over prices, and the gilt-edged markets are in a divided frame of mind. Business naturally suffers by the so-near approach of the long-expected, and anticipation stands a-tiptoe to see whether the new Loan will be on such terms as to render it an active, immediate competitor with existing securities.

The holiday had some little effect in checking the stream of new issues, but only to a minor extent, and those which have appeared lately can claim that, on the whole, they have received substantial support. One financial feature of the present year is undoubtedly the rush for any new issues that have promised reasonable security and good return.

The market in electricity supply shares is so quiet as to be almost dormant. No changes in prices have taken place this week. Until more definite information is forthcoming of the Government's intentions, the share market is bound to continue quiescent. Hope has been raised of the Government scheme providing for extension of the London companies' tenure, and, while it may not be safe to build too much upon this ground, it deserves consideration, and proprietors of the shares would doubtless give it hearty support. Fifteen or more years ago the question was debated in these columns as to the basis upon which the undertakings would be taken over in 1931 and thereabouts, but nobody could say for certain, and the time now grows comparatively near when the original concessions will expire. Various authorities have quite made up their minds what the basis will be, but as the opinions differ, the plain investor has shrugged his shoulders and has sometimes said frankly that he preferred shares not tinged with the elements of uncertainty which surround electric lighting issues. Were this handicap to be removed, the share market would certainly pass on to another plane. The Government has issued a memorandum showing that the suggested payment of twenty million sterling, on urgent electrical works, will be spread over the next five financial years.

Although progress in Mexico has once more been impeded by a revolutionary outbreak, speculation begins to concern itself with the question of back interest due upon the bonds of the various Mexican Utility companies. The last coupon paid upon the 5 per cent. first mortgage bonds of the Mexican Electric Light Corporation was that of July, 1914. The Mexican Light & Power and the Mexico Tramways are both in arrears on their bonds, firsts and seconds alike, since the autumn of 1914. In other words, there is about 45 per cent. interest unpaid on the various bond issues, and the matter will have to be dealt with sooner or later. It seems far too sanguine to suppose that this debt will be cleared off by cash payments. The Mexico Tramways Co. has been handed back, we believe, the ownership of its property which had been in the hands of the Mexican "Government" for nearly five years. How much money will be required to put the utility undertakings into good order is an unknown quantity, but that there will have to be a general overhauling, physical and financial, is only too probable, and the process may involve reorganisation on lines with which British holders of American Railroad securities were, in days gone by, unpleasantly familiar.

Active dealings in Marconi shares have had a stimulating effect upon the price, which advanced to 6½ before easing off to 6 5/16. The buyers are on the look-out for a juicy plum as the result of the company's case before the Courts, and the recent evidence led to revival of confident optimism. Manifestly the shares are for the moment something of a gambling counter, and it will be a good thing when the case is settled finally, and the shares rank as industrial investments ex plum possibilities.

Western Telegraphs lost ⅛ at 17⅛, otherwise the share list of cable issues is as featureless as that of electricity supply shares. The manufacturing group is also quiet. British Westinghouse preference have come into strong demand, the price being 5s. higher at 2 13/16. Railway markets are listless and apathetic. Underground incomes are up ½, but the £10 shares can be bought at 3⅞, and Metropolitan Consolidated is ½ lower. In the foreign division, Brazilian Tractions slipped back to 61 after being higher, and the preferred at 92 are also a point down. Canadian electrical issues have hardened in consequence of the strike outlook being less depressing. Anglo-Argentine Trams continue to give way, still on the labour situation. British Columbia Electric Railway stocks hold their improvements.

The chemical group is still dull, and rubber shares are very heavy. The immediate prospect for rubber is closely connected with the raising of the blockade with Germany, and the chance of the enemy declining to sign Peace terms at once is deemed a bear point for the rubber industry.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies

	Dividend		Price June 10,	Rise or fall.	Yield p.c.
	1917.	1918.	1919.		
Brompton Ordinary..	10	8	6¾	—	£5 6 16
Charing Cross Ordinary	4	4	8½	—	6 3 1
do. do. do. 4½ Pref...	4½	4½	8¼	—	6 18 4
Chelsea..	6	8	8⅝	—	4 2 9
City of London	8	8	11⅞	—	6 14 6
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 3
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	6	6¾	—	5 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref...	6	6	8⅞	—	7 14 10
Metropolitan	4	5	8⅛	—	8 0 0
do. 4½ per cent. Pref. ..	4½	4½	8¼	—	6 18 6
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	5	5	2¾	—	7 5 6
South Metropolitan Pref.	7	7	20/6	—	6 16 7
Westminster Ordinary	8	8	6⅛	—	6 10 8
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	100	—	6 0 0
do. Def.	1½	83/6	22¼	—	7 8 0
Chile Telephone	8	8	7	—	6 14 4
Cuba Sub. Ord.	7	7	11	—	*6 4 5
Eastern Extension	8	8	16⅜	—	*4 17 9
Eastern Tel. Ord.	8	8	166½	—	*4 16 1
Globe Tel. and T. Ord.	7	8	16⅛	—	*4 19 3
do. do. Pref.	6	6	10⅜	—	5 13 0
Great Northern Tel.	22	22	82	—	6 17 6
Indo-European	13	13	55	—	5 18 2
Marconi	20	20	6 5/16	+ 1/16	3 3 6
Oriental Telephone Ord.	10	15	2⅜	—	6 6 4
United R. Plate Tel.	8	8	8 3/16	—	*4 17 9
West India and Panama	1/3	1/9	1 7/16	—	*4 6 4
Western Telegraph	8	6	17⅛	−⅛	*4 13 5
Home Rails.					
Central London Ord. Assented ..	4	4	63½	—	6 6 0
Metropolitan	1	1¼	26	−½	4 16 4
do. District	Nil	Nil	24½	—	Nil
Underground Electric Ordinary..	Nil	Nil	8⅞	—	Nil
do. do. "A" ..	Nil	Nil	10/9	—	Nil
do. do. Income ..	4	5	96	+½	*5 4 2
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	3½	−⅛	—
do. do. 2nd Pref. ..	—	—	3¼	—	—
do. do. 6 Deb... ..	6	6	68½	—	7 8 5
Brazil Tractions	—	—	61	−½	—
Bombay Electric Pref.	6	6	11¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	63½	—	7 17 6
do. do. Preferred	Nil	2½	48½	+1	5 8 1
do. do. Deferred	Nil	Nil	44½	+1	Nil
do. do. Deb. ..	4¼	4¼	62	—	6 17 4
Mexico Trams 5 per cent. Bonds..	Nil	Nil	62½	−1	Nil
do. 6 per cent. Bonds..	Nil	Nil	51½	−1	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	69	−1	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	4	—	8 15 0
British Aluminium Ord.	10	10	1 11/16	—	5 16 6
British Insulated Ord.	25	12½	2¼	—	5 11 1
British Westinghouse Pref. ..	7½	8	2 13/16	+¼	5 14 0
Callenders	25	25	10¼	—	6 3 0
do. 6½ Pref.	5	6½	5¼	—	6 3 10
Castner-Kellner	25	20	8	—	6 13 4
Edison-Swan, "A"	—	—	1⅜	—	5 17 0
do. do. 5 per cent. Deb. ..	4	5	75½	—	6 12 8
Electric Construction	10	10	1 3/32	—	7 16 0
Gen. Elec. Pref.	6	6½	10½	—	6 3 10
do. Ord.	10	10	21½	—	*4 13 0
Henley	25	25	2 7/16	—	5 2 6
do. 4½ Pref..	4½	4½	3¾	—	6 0 0
India-Rubber	10	10	17⅝	—	*5 13 6
Siemens Ord...	—	10	6 15/16	—	*7 4 0
Telegraph Con	20	20	25½	—	4 18 6

*Dividends paid free of Income Tax.

REGENERATIVE DIRECT-CURRENT ELECTRIC RAILWAYS.

By E. AUSTIN.

Perhaps nothing in the way of railway electrification is of greater interest or of greater importance at the present time than what is being done in certain quarters in the direction of applying the regenerative principle to electric trains. As far as three-phase railways are concerned, this is not, of course, by any means a new development, for the ease with which three-phase motors can be made to act as generators renders the polyphase system more amenable to regenerative braking than any other system, and on the Italian State railways and the Great Northern Railroad in America, where heavy trains ascend and descend steep gradients, very material benefits accrue from the use of regenerative equipments. The wear on brake shoes and wheels is considerably reduced, trains are controlled with ease and safety, a higher average speed can be maintained when trains are descending gradients, whilst the power saved as the result of current being returned to the line amounts to 15 per cent. or more of the total power consumption. On the other hand, the motors have to carry current for longer periods than they do under mechanical braking conditions, and if electric braking be adopted for stopping trains, especially suburban passenger trains, the increased motor heating becomes appreciable; much more so than is the case when regeneration is only resorted to whilst trains are descending gradients. Electric braking may, therefore, involve larger and heavier motors or increased ventilation. Further, there should always be a load on the line to absorb the regenerated current, otherwise the energy must be dissipated in resistances either on the trains or at the power house. But most of the disadvantages of regenerative electric braking are in many cases more than outweighed by the advantages. The increased weight of the equipments, for example, tends to increase the power consumption, but as this increase is much smaller than the power returned to the line, the extra weight does not constitute a real disadvantage, but merely reduces the advantages of electric braking by a small and often insignificant amount.

Whilst an induction motor readily acts as a generator when the speed of the rotor exceeds that of the revolving field, a simple series motor can only be made to regenerate by separately exciting the field windings. Any series motor will, of course, act as a series generator, but when it comes to making such motors return current to the line, difficulties immediately present themselves. It would be necessary in the first place to reverse the field winding of each motor and then to connect a resistance across the terminals so as to make the machines build up their voltage. Having attained a voltage slightly above the line voltage the machines might be directly connected to the line and made to provide the regenerated current, but in the event of the line voltage falling, as it is very liable to do on an electric railway, the regenerated current would immediately increase, resulting in turn in a stronger field and more current would flow into the system. This effect would be cumulative, until ultimately the circuit breaker would open. Conversely if the line pressure increased the regenerated current would be reduced, the motor fields would be weakened, and as this action is also cumulative the regenerated current would rapidly drop to zero. The field and back pressure of the motors being zero, heavy currents would then be built up in the opposite direction, currents much in excess of the most severe short-circuit currents, for it is to be remembered that when the polarity of the motors reverses they build up a voltage which is added to the line voltage. Reversal may take place so rapidly that excessive and dangerous currents may be established before circuit breaking arrangements have time to operate and serious flashing and other troubles may arise. The use of simple series motors without special exciting arrangements is therefore out of the question. Of course, as the field windings of a series motor consist of only a few low resistance turns they cannot be connected in shunt with the armature, even if the current be limited by resistances, for the energy dissipated in such resistances would represent a large proportion of that returned to the line. The object to be aimed at is to maintain the voltage of the motors (acting as generators) higher than that of the track by an amount sufficient only to overcome the resistance of the circuit involved. This is more difficult in the case of an electric railway than say in the case of a regenerative electric hoist, because in the latter case the voltage is as a rule relatively speaking constant and the resistance of the circuit is constant, whereas on an electric railway, these quantities vary in an irregular manner, owing to the movement of the trains and other conditions peculiar to train operation. To devise means of limiting the regenerated current to a safe and suitable value under all conditions is one of the main difficulties to be grappled with when designing regenerative railway equipments. The regulating gear should not allow the motor exciting current to be increased in large and sudden increments, and preferably any such increment in the exciting current should be taken care of automatically. But sudden changes in the regenerated current are more liable to be set up as the result of variations in the line voltage, and the excitation of the motors must, therefore, vary with this voltage. The regenerated load should obviously be divided equally between all the motors, and sudden and large variations in the braking torque must be avoided. Another no less important point which must receive attention is the avoidance of the machines attaining an excessive pressure in the event of the supply being interrupted, for since railway motors acting as high-speed generators are not as a rule fully saturated, it is quite possible in the absence of proper precautions to obtain voltages much in excess of the normal voltage, and over voltage relays controlling the exciting circuit should therefore be provided.

One practical method of making a series motor regenerate, and one which has been tested with fairly satisfactory results, is to excite the field windings during the regenerative period with current derived from a low-voltage battery. The excitation in this case is, of course, constant, and if the line voltage drops the regenerated current is liable to become excessive, but the trouble may be overcome by a quick-acting controlling device actuated by the regenerated current, and introducing resistance into the field when the regenerated current becomes excessive. In practice this device, which takes the form of a current relay, is continually opening and closing, very much in the same way as the contacts of a Tirrill regulator. Owing to the flat speed characteristic of a system of this sort the braking controller must have a fair number of notches in order to avoid excessive changes in the regenerated current and braking torque when increasing the excitation, whilst precautions must also be taken to ensure that the braking effect does not diminish with increased speed, and before the motors can be connected to the line their voltage must be made approximately equal to the line voltage. The use of a battery, moreover, constitutes another disadvantage, and it is not surprising that this system has not established itself. Many other regenerative systems involving the use of simple series motors have been proposed and tested, but no attempt will be made here to do anything more than to describe some of the most interesting and important. A regenerative system is shown in fig. 1, which has been found to possess the desired characteristics. The main motors A_1 and A_2 are in this particular case connected in parallel, and the motor generator M G with series field windings S T provides the requisite exciting current for the main motor fields during the regenerative period. These main motor fields are shown at F and F the generator G of the motor-generator set being connected in parallel with the fields by means of the contactors P and P′. The sum of the regenerated current and the field current provided by the low-voltage generator G passes through a resistance R, and consequently if the line voltage drops, and so causes the regenerated current to be increased or an increase in this current is brought about by a change in the control conditions, then the voltage drop across the resistance R increases, and since the voltage of the small generator G is either constant or beginning to drop, as a result of the decreased line voltage, the voltage across the fields F and F (the difference between the exciter voltage and resistance voltage) suddenly decreases, thus reducing the field strength of the main motors. By varying the value of the resistance X the speed and torque characteristics of the equipment can be changed at will without involving appreciable waste, the voltage across the resistance R being only a small percentage of the total line voltage. Tests have shown that if the motors, when acting as generators, are connected to the line with a voltage considerably in excess of the supply voltage, the regenerated current is immediately reduced to a permissible value, whilst the load is at all times equally divided between the motors. In the event of the supply failing, the regenerated voltage will naturally rise owing to the regenerated current in the resistance R being interrupted, and the resistance drop consequently diminishing. But a rapid cumulative rise in the motor pressure is nevertheless avoided by the inertia of the motor generator set, which takes a certain amount of time to increase its speed, whilst a damping effect of almost any desired amount may be secured by the use of damping windings on the poles of the small motor generator. It is an easy matter, therefore, to delay the voltage rise until the over-voltage relays have time to open, and so avoid the motors being subjected to excessive pressure. Of course, variations in the voltage applied to the field windings F and F′ due to variations in the drop in the resistance R are instantaneous, this being the special feature of the system. Since the small motor M driving the generator G is series wound it is apt to attain an excessive speed when running light, but this can be avoided by coupling it to the blower which provides the forced ventilation to one end of the motor-generator shaft. If the contactors P and P′ are opened, the main motors act as ordinary series machines, the armature G of the small motor generator set simply adding a few volts to the supply pressure. It is obviously possible, however, when the contactors P and P′ are closed to regulate the field strength during the motoring period, the only objection to this practice being that owing to the motor generator having to carry current for longer periods than when used for regeneration only, the machine must be made larger.

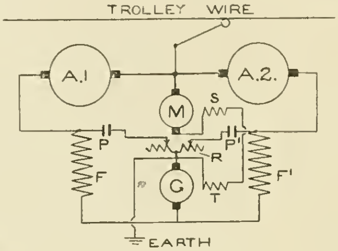

Fig. 1.

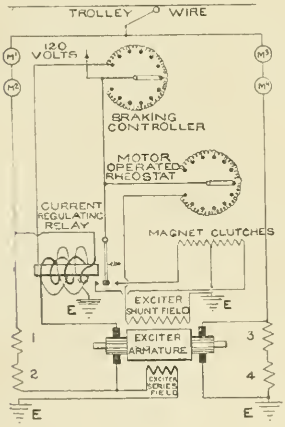

Fig. 2.

A simplified diagram of connections for the regenerative equipments used on the large direct current locomotives running on the Chicago, Milwaukee & St. Paul Railroad is shown in fig. 2. The main traction motors are shown at M_1, M_2, M_3, and M_4, and the main series field windings at 1, 2, 3, and 4. During the regenerative period the brushes at the opposite ends of the exciter armature, shown in the lower part of the diagram, are connected across the field windings, and it is evident the voltage across these field windings can be varied by varying the exciter voltage. This is accomplished by varying the exciter field current by means of the braking controller shown at the top of the diagram, but this controller is not directly connected to the shunt winding of the exciter. All the braking controller does is to alter the setting of a current-regulating relay, having an armature that moves against the action of a spring. This relay, shown on the left of the diagram, has two windings, a thick winding carrying the field and armature current of one pair of traction motors, and a shunt coil supplied with current at variable voltage obtained by adjusting the braking controller. Although the complete connections for this fine-wire coil are not shown in the diagram they will readily be understood, one pole

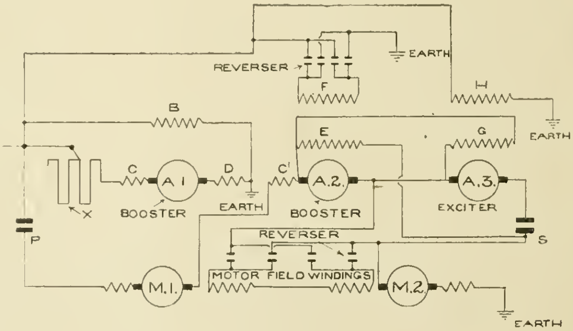

Fig. 3.

of the current source being connected to the braking-controller arm, and the other pole to earth. The spring-controlled relay armature controls by its movement one or the other of two magnetic clutches of a motor-operated rheostat which regulates the exciting current in the shunt winding of the exciter. The small motor which operates this controller runs continuously all the time regeneration is occurring, but the magnetic clutches determine in which direction the arm of the motor-operated rheostat turns, so that the exciter shunt current is increased or decreased according to which of the magnetic clutches is brought into operation by the relay. Normally the spring acting on the relay armature pulls the latter on to the contact that completes the circuit of the clutch, which causes the motor-operated rheostat to cut resistance out of the exciter field circuit. This, of course, causes the exciting current of the main traction motors to increase and more current flows round the series winding of the relay, and when this current becomes sufficiently great to produce enough flux to pull the relay armature away from the right-hand contact the motor-operated rheostat comes to rest. But if the regenerated current increases still further the relay armature is pulled over to the left-hand contact, which brings the other magnetic clutch into operation, and the motor-operated rheostat then inserts resistance in the exciter shunt field circuit. In this way the regenerated current supplied to the line is controlled.

The current in the shunt coil of the relay can be varied at will by the hand-operated braking controller, the flux due to this shunt coil being added to that due to the series coil so that the shunt coil flux assists in overcoming the spring tension acting on the relay armature. When the hand-operated braking controller is in its first position the current in the shunt coil is at its maximum, the result being that the relay acts with low currents in the series coil, but as the braking controller lever is moved from its first position the current in the relay shunt coil is reduced, and the relay setting increased, until ultimately the shunt coil is de-energised, and the operation of the relay is then, of course, entirely dependent upon the series coil. Further movement of the hand-operated braking controller reverses the shunt coil current, thus causing the flux due to this coil to oppose the series coil flux, and consequently a much heavier main current must flow in the series coil before the relay armature will " balance " or move over to the left-hand contact. The shunt coil current flowing in this reversed direction is then gradually increased until the same maximum current is obtained as was flowing when the controller arm was on the first notch, and this gives the maximum regenerative current permissible. For all ordinary variations in gradients, speed, and distances from sub-stations the action of the mechanism described is rapid enough to maintain a uniform braking effect, but when a locomotive is regenerating, and the trolley voltage is suddenly reduced, the motors may be called upon to carry more current than is good for them. This is prevented, however, by providing the exciter with a series winding which carries the line current and opposes the exciter shunt winding, and the demagnetising action of this coil prevents the regenerated current becoming excessive. Further, the exciter is driven by a series wound motor, which naturally varies its speed in accordance with the line pressure. Overload circuit breakers protect the motors in the event of the trolley wire being earthed, and high-voltage relays prevent excessive voltages being generated in the event of the main circuit being interrupted, as the result, for instance, of a circuit breaker opening at a sub-station.

A regenerative system developed by the Jeumont Co. (Ateliers de Constructions du Nord et de l'Est), and tested with results eminently satisfactory on the Metropolitan Railway of Paris, is shown in fig. 3. The control equipment in this case consists of a booster composed of a motor A_1, and a generator A_2, and an exciter A_3, all mechanically coupled, and the exciter serving for exciting the field windings of the main traction motors M_1 and M_2 during the regenerative period. The generator of the booster is used for starting and speed control, the use of starting resistances being thereby rendered unnecessary. The motor A_1 of the booster is connected to the line by means of a starter X in the same way as any other direct current motors. It has a commutating pole winding C, a series winding D, and a shunt winding B. The generator of the booster also has a commutating winding C^1, likewise the main traction motors, M_1 and M_2. Both these traction motors are permanently connected in series with the generator A_2, but it is possible with the aid of the reverser shown in the lower part of the diagram to reverse the direction of the current in the main motor series windings, and the motors can therefore be made to run in either direction. The generator armature A_2 revolves in a field produced by two field windings, E and F, the latter being separately excited from the supply through a reverser, whilst the winding E is connected across the generator and exciter armatures A_2 and A_3. The exciter armature A_3 also revolves in a field produced by two windings, H and G, the former being separately excited at the track pressure, whilst the latter is connected across the armature A_2. When starting the main motors, M_1 and M_2, the lower reverser contactors are closed so as to give the desired direction of rotation, the field winding of the booster being excited in such a direction that the booster voltage opposes the supply voltage, and the exciting current in this winding is adjusted so that when the contactor P is closed the normal accelerating current passes through the main motors. The traction motors are then accelerated by decreasing the booster's excitation. When the excitation of the field winding F is reduced to zero the voltage across the booster's armature becomes zero, and each of the traction motors M_1 and M_2 (connected in series) receives one half of the total track pressure. At this point the current in the field winding F is reversed, and the voltage of the armature A_2 is so caused to build up in the opposite direction, until ultimately the traction motors M_1 and M_2 each receives a pressure equal to the total line pressure. When it is desired to make the main traction motors regenerate the contactor S is closed, thus connecting the exciter armature A_3 in parallel with the main motor field windings. The field windings of the exciter either act differentially or cumulatively, according to the direction of the voltage generated by the booster armature A_2. In braking from full speed (when the booster is giving its full voltage and assisting the line voltage), the winding G opposes the winding H, and the voltage generated by the exciter armature A_3 is consequently small. But when the booster's voltage is decreased with a view to increasing the braking effect the current in the opposing winding of the exciter diminishes, and the exciter voltage consequently increases, thus decreasing the excitation of the main motor fields. Finally, the excitation of the booster is reversed, when the booster generates a pressure in opposition to the line pressure, and at the same time the current in the winding G of the exciter reverses, thus causing the windings G and H to assist one another. More exciting current therefore flows into the main traction motor fields, which still further increases the braking effect. By the use of the two shunt windings on the booster it is possible to obtain a gradual variation of the voltage generated in the armature with only a few steps in the field rheostat, whilst the two shunt windings on the exciter give automatic control of the excitation of the main traction motors.

THE ELECTRICAL EQUIPMENT OF MODERN SMALL HOUSES.

A joint meeting of the Institution of Electrical Engineers, the Electrical Contractors' Association, and the National Association of Supervising Electricians, was held at Caxton Hall, Westminster, on May 27th.

Mr. W. Cross read a short paper on the above subject, and explained that the primary object of the meeting was to find out the best way to advance the use of electricity in private houses. The principal advantages of its uses were: convenience and adaptability, cleanliness, healthiness, and economy. Labour saving was probably its greatest advantage. The consumption of a 10-roomed house for lighting was only about 300 units per annum: ordinary service conditions were almost equal to test conditions, and there was not the depreciation in lamps or heating elements as with gas or oil. Broadly, there were two classes of consumers: One did not consider capital expenditure if an economical, decorative, and efficient installation was obtained. To secure such a customer good publicity and advice in arranging the installation were required. The other class could not afford large capital cost, and was indifferent about decorative effect or convenience. In that case it was necessary to reduce the cost of the service and installation to the minimum. In suburban houses the lighting service must be conveniently arranged, and the amount of illumination required was more than when 8-c.p. lamps were used. For sitting-rooms, one-light, semi-direct fittings, with half-watt lamps were most popular. In bedrooms there should be two switches, one near the door and the other near the bed. Electric heating was now also usually installed. Electric baths were very convenient, as full heat could be obtained soon after switching on, and the cost of energy was less than that of lighting a coal fire for an hour or two. Baths were usually loaded with 2 or 3 kw., but 1 kw. would be sufficient in many cases. Electric ovens were increasing in use; about 45 units per week would be used for cooking for six persons, the cost being saved by the reduced cost of coal. The thermal efficiency of electricity for water heating and most other thermal processes was extremely high, and electricity would most certainly be used for other purposes than lighting if brought to the notice of consumers. Such appliances as kettles, which would boil water in two minutes (a two-pint kettle using 0.06 unit for that purpose), irons, vacuum cleaners, and buffing machines for cleaning silver reduced the amount of labour very considerably. The apparatus should be let on hire, if the cost was too high for the average consumer, and in most cases it would be eventually purchased. Wiring was very safe if properly carried out; wood casing, closed-joint steel tubing, and screwed steel-tubing systems were satisfactory if carried out in accordance with the Institution Rules. The methods adopted for bonding were, however, in most cases poor. The cost of wiring, in cases where capital cost was of greater importance, could be reduced by the use of metal-covered cable properly bonded and earthed. In many places where lighting only was used, the mains were only earning money for the supplier during a small proportion of the year. In some cases a single cable might be lead from the street to a block of houses, and energy for other purposes than lighting could be supplied at a less charge per unit, as the mains would be in use more fully, and energy used at times other than that of lighting peak load. Where no public supply was available and private plant was installed, the cost was surprisingly low. There should be closer co-operation between supply authorities, manufacturers, and contractors, and the Electrical Development Association could be of great help if it started its publicity work by sending out circulars asking for the support of individual firms and associations.

Discussion.

Mr. J. S. Highfield agreed with Mr. Cross as to the desirability of all interested in the supply and means of using electricity working closely together. Each branch of the business was entitled to a profit, and each should help the other to get as good a profit as possible. The ignorance of the public concerning the price of electricity was amazing. A tariff should be so framed that energy could be used at any point on the installation for any purpose. The customer should pay a rental plus a uniform low price for units consumed. For the hot-water system it was essential to burn coal, and it was, therefore, their business to recommend and install the right sort of stove. Electrical contractors would get a far greater share of the job of fitting new houses that were to be built if they were in a position to fit everything, not only electrical fittings. They wanted installations as simple as possible, with as few fuses and circuit boards as possible, and the electrical people should be able to give every sort of advice and sell the apparatus as well as dealing with the hot water difficulty.

Mr. W. R. Rawlings thought that every house that was built under the new housing schemes should have electric lighting in every room, and also be fitted for electric cooking up to a point. Electricity should not be wasted in trying to boil water. The cost of installing wiring and fittings equalled about eight years' current bill, therefore a man who paid 6s. per week for a cottage (or £30 per annum for a house) on a three-years' agreement would not expend money on wiring and fittings which he would have to leave behind. The installation should be supplied with the current. He thought the Fixed Price Light Co.'s system might be fostered. No meter was used in the house; practically nothing but the lamps and a single-pole switch at the door. One line, with an earthed return, was brought into the house, and the consumer was charged 2¼d. per week for light in summer, and about double that in winter. He hoped everyone at that meeting would become a member of the Electrical Development Association; it would do much to cheapen installation work and educate the people in the use of electricity. Many supply companies had no spirit of adventure. He had guaranteed a demand for consumers, because the company required a guarantee.

Mr. Pinkney explained that with water-heating and cooking installations it might be worth while to have a change-over switch to reduce the maximum demand; a lower charge could be made for cooking if lights could not be used while cooking. It was preferable to hire cookers; if they were bought, and something went wrong, the consumer did not trouble about it. The running of a single cable into blocks of buildings had been found unsatisfactory at Newcastle on account of wayleaves. In the North they expected to get electricity supply in the new housing schemes for lighting, and also for cooking and heating in many cases. On visiting the Model Homes Exhibition he was greatly disappointed to find no electrical exhibits. A company was building a village in his district, and all houses would have electric lighting and cooking. One coal fire would be provided in the living room, which would heat the water. In the sitting-room and all bedrooms there would be electric heating, and in the wash boiler, supplied from the domestic hot-water supply, electricity would be used to raise the water from, possibly, 150 deg. to boiling point. The cost of wiring would have to be reduced, or supply authorities would have to help further with the wiring.

Mr. W. T. Revell did not see why in a block of houses the supply should not enter at the centre, run up to the roof, and be tapped off with a double-pole switch and fuse on to the first floor. D.O.R.A., or some similar regulation, might be invoked to deal with anyone making trouble about wayleaves. An open wiring system run down the walls in wood casing, with a pair of double-pole cut-outs and a double-pole switch on the landing would meet the case. With the cleated system the wires could be run through the joists, single holes being made for each wire. A low-grade cable could be used, and it was not necessary to bush cables passing through joists. Insulation did not matter, there was always air between them, and where wires ran longitudinally to the joists they could be cleated on porcelain cleats. The system was absolutely the cheapest, and if the Institution would adopt it it would receive the necessary fillip. One cause of the present-day high cost of installation was that they were endeavouring to idealise instead of materialise.

Mr. C. Faraday Proctor maintained that a kitchen grate well constructed would furnish a constant supply of hot water. He had a water cistern 6 ft. horizontally and 5 ft. vertically from the fireplace, and on a recent occasion the house was left on a Friday, and upon returning, on the Monday morning, the water was found to be warm enough for baths. A central heating system would take the chill off the whole of a small house, and radiators could give the finishing touch to the rooms. In the North the cost of a coal fire was about 3d. per room, and 4d. for the kitchen fire. Adding another 1d. to the cost of the kitchen fire for the water heating, that system would be the best for workmen's houses. In an electric oven heat escaped each time the door was opened. This could be avoided by making the oven in the form of a bell, with the elements in the top. To boil an egg, instead of using a pan as big as a hat, a scientific way would be to use a vacuum-jacketed pan slightly bigger in diameter than the egg and heated electrically, which, when once brought to boiling point required no further heat.

Mr. A. J. Stirling mentioned that he was connected with the wiring of a number of houses on the cleat system 12 years ago; 20,000 lamps were installed which gave every satisfaction, and two men and a boy did the whole of the maintenance work. It would be difficult to get the Board of Trade to permit the earthed wire. He would like to see a standard cable, and suggested that it should be 3/22. It was safer to eliminate flexible as far as possible.

Mr. F. W. Marshall thought too much stress had been laid on cheap wiring; the cost of the proposed small house was £450, and that of the wiring about £12 with some of the methods suggested. The more flexibles were eliminated the better it would be; also, he did not think the cleated system good, or called for on the score of expense. With co-operation between the architect, builder, and wiring contractor, screwed tubing could be installed as cheaply.

Mr. W. Ellerd Styles was of opinion that installations had always been over switched, and that switching had not been judiciously carried out. He advocated inspection by competent inspectors to eliminate jerry wiring. The suggested cleat wiring shocked him; it lent itself to pilfering, and was hideous, and the builder, who generally paid for the wiring in a modern suburb, would not hesitate on the margin of ¼ per cent. between the two systems. Convenience was required, and the workman now could afford to pay for it. He preferred the Henley and Stannos systems to conduit, and there was also tough rubber-sheathed cable for clumsy workmen, which cost only 20 per cent. more than cleating. He would like the Institution to assist the Contractors' Association in getting the registration of contractors.

Mr. J. W. Beauchamp (Electrical Development Association, communicated) said it was seldom that an opportunity occurred of wiring a large number of houses at the same time in quantity and in a businesslike manner, and at a time when the fabric of the houses was not completed. Generally they had to be content with wiring the houses one at a time, and to find them in quite a completed condition, which involved a lot of extra work. Assuming the case of an average villa, say, £45-£50 a year, same being situated about a mile from the depôt or works of the wiring contractor, it would appear that at pre-war prices some 10 to 15 per cent. of the money paid for labour on wiring houses was expended on "walking time" and the transport of materials to the job, leaving only 85 to 90 per cent. of the labour cost for effective operation within the house. To-day, the percentage lost in this way was of the order of 15 to 20 per cent., owing to the alteration in the working hours. It was obvious that everything possible must be done to reduce the number of days spent on any job of this kind, and to expedite the transport of men and materials to the job; very strong arguments in favour of using some form of mechanical transport for conveying both men and materials. Where an estate or block of houses was being wired a clerk of the works and a hut could be set on the job, stores accumulated, and a great deal of loss avoided. Another point was that the underlying principle of improved wiring systems was to get a larger proportion of the money spent in a factory, and a lesser proportion spent actually in the house being wired, *e.g.*, referring again to the standard villa wired in a simple way throughout with plain pendants, the usual class of material and conduit, and full-price trade union labour, it would appear that the total cost (without overall charges and profits) divided up as follows:—

	1914.	1919.
All fittings and accessories ...	14 per cent.	17 per cent.
Cable	15 per cent.	12 per cent.
Conduit	13 per cent.	17 per cent.
Labour	40 per cent.	41 per cent.
Lamps	18 per cent.	13 per cent.
	100 per cent.	100 per cent.

Thus, although the total cost was almost exactly doubled, there had been no great change in the relative proportion of the cost of the several items. The manufactured fittings, conduit, and the labour were up a little; cable was relatively down a little; lamps also relatively reduced by a substantial percentage. For the reasons above stated, there was no great prospect of reducing the labour cost, excepting where large blocks of houses were being wired at once and better organisation and more division of labour could be brought to bear. But the more they could cut into the labour by handing to the workmen more completely manufactured articles than coils of cable and lengths of tubing, the more they would bring the wiring of houses within the four walls of a factory, and the less there would be to do in the house itself, and that appeared to him to be the guiding principle to which they must look in connection with this matter. Having taken advantage in every way of the regulations, or amended the regulations if possible to admit of simpler and less elaborate wiring, they would then have to look for a wiring system of such a character that the wiring, its covering, and the production of fittings to be used in connection with it, were adapted to one another, and produced in the most finished possible form in the factory, leaving the smallest call upon the skill and time of the workmen to fit them up neatly to the structure of the house. It seemed to him that the percentage of total cost expended on labour, both before the war and now, was very high compared with that obtaining for other accessories of the house, for instance, the fixing of fire grates, hot-water systems and baths. In the case of those fitments the cost of the goods as purchased by the builder was very much higher in relation to the cost of fitting them in the house than was the case with electric wiring.

Mr. A. P. Trotter, referring to the Board of Trade and the question of earthing, said there was a regulation that a circuit should be earthed at one point only, and for many years that was adhered to, in spite of there being several earthed systems. No supplier cared to put an earth on his mains except at his station, so that he could test his mains. The firm with which he was now connected used Stannos wiring on an A.C. system with the outer earthed. The Board of Trade was appealed to for approval, and he saw that the question of electrolysis could be dismissed, and that the system could be cut up with transformers. After some hesitation it was tried at Egham, and later at other places, with complete success. He was not convinced that it would do for D.C., as there might be electrolysis caused by the out-of-balance current on the middle wire.

Mr. H. J. Cash thought that cheapness could only be obtained by standardisation of articles and methods to reduce first cost. Much could be looked for in the direction of cab-tire sheathing. Flexibles across ceilings were not good; probably the thing to do was to improve the flexibles. C.T.S. flexible would get over the difficulty at the holders. It was up to them now to advise how the whole of the engineering work in a house should be done.

Mr. W. Cross, in a brief reply, said that although interesting points had been raised, he was rather disappointed, as the discussion had turned on cheap wiring, whereas he had hoped to hear more about heating and cooking. He mentioned that it was safer to put two wires of opposite polarity in the same groove of a wooden casing than in opposite grooves. He had seen a 3-amp. arc cause the wooden casing to become red hot, and yet it did not burn. The great point about electricity in the house, which should always be in mind, was that it was a labour saver.

ELECTRIC FURNACE PRACTICE.

(*Concluded from page* 678.)

Large Electric Steel-Melting Furnaces.

By VICTOR STOBIE.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

The wiring diagrams (figs. 11, 12, and 13) give what the author considers to be the best connections for three sizes of furnaces. Fig. 11 is for furnaces up to 6 tons' capacity: two-phase, each phase maintained entirely separate from the other, with one end of each phase connected to separate electrodes above the bath and the other end of each phase connected to separate electrodes embedded in the hearth of the furnace at opposite ends of the furnace to their relative top electrodes. This arrangement gives exactly the requisite bottom heating for small furnaces, and is characterised by the crossing of the currents in the direction of flow through the bath.

Fig. 12 is for furnaces from 6 tons' up to 24 tons' capacity: two-phase, each phase maintained entirely separate from the other, with each end of each phase terminating in an electrode above the bath. Bottom electrodes, whilst essential in small furnaces, are very undesirable in large furnaces.

Fig. 13 is for furnaces above 24 tons' capacity: three-phase, each phase maintained entirely separate from the others, with each end of each phase terminating in an electrode above the bath.

The most favourable shapes for tilting electric furnaces would appear to be: Up to 6 tons: Rectangular in plan and in elevation with a curved bottom. From 7 to 24 tons: Octagonal in plan. Above 24 tons: Octagonal with lengthened back and front walls. Stationary furnaces should always be rectangular, figs. 11, 12, and 13.

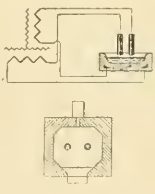

Fig 11

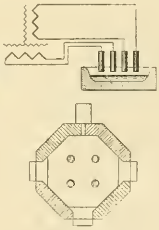

Fig. 12.

The above shapes ensure the most convenient position for the electrodes in the furnace and help to keep the furnace walls at the average greatest distance from the electrodes. It is most essential that electrodes should not be opposite to doors.

Experiments were made at the Stobie Steelworks at Dunston-on-Tyne, near Newcastle, to obtain data as to the cause and effect of the direction of travel of the flame from the electrode. Some control was obtained over the direction of the flame by alterations in the direction of rotation of the magnetic field of the supply currents. A certain change of direction of the flame resulted also from varying the phase reaching each electrode. The extent of the control over the flame was sufficient to make a decided change in the speed of working of a furnace and in the wear and tear of the lining. No definite rule for guidance can be laid down at present, as the matter further depends upon the position of the flames in relation to each other, and, possibly, the magnetic fields external to the melting chamber.

Experiments on the blowing of the arc flames in furnaces by strong external continuous magnetic fields were made in order to eliminate the uncertainty of coincidence of the revolving magnetic fields with some of the arcs in the polyphase systems of electric furnaces. Powerful lifting electromagnets were used for this purpose. Again, the many other factors existing within the arcing zones prevented any definite rule from being framed, but by a careful disposition of the electrodes and cables in an installation so as to cause the magnetic fields coincident with certain arcs to blow the arcs in a desired direction, a most important increase in speed of melting and reduction in wear and tear of furnace lining are undoubtedly obtained.

Recent experience teaches that, so long as a steel is thoroughly deoxidised before casting, only the temperature of casting is of moment.

The requirements in the design of the transformers are: That the current density of both the L.T. and E.H.T. windings shall be low enough to prevent the inevitable overloads from unduly heating up and deteriorating the insulation. The ventilating channels in the windings must be specially well considered so as to provide low resistance paths for the cooling oil without excessive magnetic leakage. That windings shall be braced on all sides. The L.T. windings shall be taped with such material as empire tape, in addition to press-spahn or similar stiff insulation. All clamps, no matter how small they may be, should be anchored to the transformer framework. The whole of the apparatus must be as unyielding to magnetic stresses as mechanical skill can make it. As much as possible of the total reactance required in the whole of the furnace installation should be incorporated in the transformers.

All tappings brought out from the H.T. windings of furnace transformers should be brought away from the central portions of the winding, the complete H.T. winding being divided into two at the mid-point and the tappings bridged across the mid-point to cut out equal portions of each half of the windings when required. In this way the insulation of the end turns of the H.T. windings can be suitably reinforced to withstand any abnormal voltage stress.

On the practical side, useful results have been obtained at the Stobie Steelworks by limiting the current density in transformer windings to 1,250 amp. per sq. in., the induction in the iron to about 12,000 C.G.S. lines, and the temperature rise on continuous full-load to 45 deg. C., measured by the increase in resistance. In addition to pressure-testing at twice the working voltage, an over-potential test at this double voltage is made on the H.T. side, the periodicity being increased to keep down the magnetising current. The L.T. windings of large furnace transformers should be tested at a potential several times greater than normal by being connected in series, the L.T. coils almost invariably being designed for parallel working.

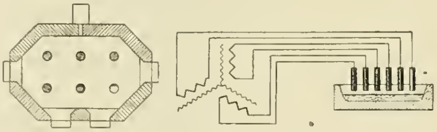

Fig. 13.

If the furnace circuits contain two arcs in series, it is necessary that the energy in each such two arcs should be balanced, whatever current is flowing. This is accomplished in Stobie electric furnaces by operating one electrode motor by an automatic current controller and the other by an automatic potential controller. The current controller is adjusted to give the limits of current required, and will keep its electrode at any position at which such desired current will flow. The potential controller is adjusted so that half the phase voltage, *i.e.*, the normal voltage between one electrode and the furnace charge, is maintained on the electrode it controls. The result is that the potential-regulating motor will keep its electrode at the same distance from the molten steel as the current-regulating motor keeps the other electrode, as at that distance the current will be normal and the voltage balanced.

On some electric furnaces which the author is building for other steelworks the current regulator is connected to one electrode as in the previous system, whilst the potential regulator connected to the other electrode is operated as follows:—

A shunt from each electrode to the bath is passed through separate solenoids placed side by side. An armature in the shape of a bar suspended by the middle hangs over the two solenoids. When the pull of one solenoid exceeds that of the other, one end of the bar is pulled down on to contacts which operate, thrugh contactor switches, the electrode motor in one direction. When the voltage is greater on the other solenoid, the other end of the lever is pulled down by that solenoid, and the electrode motor is operated in the opposite direction.

The total impedance at the moment of starting a large furnace with poor scrap sometimes reaches over 90 per cent. With average scrap it ranges between 40 and 60 per cent. When melting armour scrap or other clean heavy material it little exceeds the reactance.

A 15-ton Stobie furnace gives the following power factors:—On melting, 0.84; when half melted, 0.85; when almost melted, 0.87; when melted, 0.93.

The average (in relation to the magnitude of the load) power factor over the total of units consumed at the Stobie Steel Co.'s works, including all motors for fitting shop, cranes, furnace auxiliaries, and the furnaces themselves, varies between 0.86 and 0.88. The furnace load is about 90 per cent. of the total load, and the balance is taken by intermittent lightly-loaded low-power-factor motor circuits. Large furnaces give an average power factor of fully 0.88 over all units consumed.

It has been stated that furnaces can be worked safely at almost unity power factor. Sooner or later one hears of the collapse of some part of such gear due almost certainly to serious current surges. Experience teaches one to aim for safety before unnecessarily high electrical performance, and this rules out of consideration furnace installations with less than 20 per cent. impedance voltage when short-circuited across the electrode terminals. The author aims at installing plant in such a manner that on dead short-circuit the power factor is momentarily reduced to 0.4 or even 0.3. This need not mitigate against the excellent normal power factors already mentioned.

The following table gives the comparative data of both types of electrodes, including the diameter of electrode sufficient to carry, in practice, 10,000 amp. safely:—

	Specific resistance per cm. cube.	Lowest temperaturo of combustion.	Diameter to carry 10,000 amperes.
Amorphous	0·00332 ohm.	513° C.	12 in.
Graphite	0·00114 „	624° C.	20 „

Graphite electrodes have not, in the author's opinion, progressed among electric furnace users so well as they would have done had unsupportable claims not been made in their favour. A very important point, almost invariably overlooked, is "skin effect." The early users of graphitic electrodes obtained their experience on non-ferrous furnaces using direct current. The average current density in the main current-carrying area of an electrode in an A.C. steel furnace is roughly twice the average current density of the whole area, due to skin effect, the electrode will not usefully carry as heavy a total current as is generally claimed. This same phenomenon will attain considerable importance in other parts of large furnace plant and lead to great loss of energy and materials, unless studied in detail.

At first sight it may seem a simple matter to close up the clearance between the roof of a furnace and the electrodes passing through it. The difficulty has now been successfully overcome. Observations showed that at about 2 ft. above the roof in most furnaces the electrodes, even when raised for charging, are seldom at a temperature at which they can burn; therefore, that is the only point at which a permanently good seal can be made round the electrodes.

In practice, a light metal cylinder a few inches larger in diameter than the electrode and about 2 ft. in length is fixed on the roof round each electrode. The top end of the jacket is covered with a sealing plate, which prevents the passage of the flames, the electrode passing through a neatly fitting hole in the centre of such cover. Fig. 14 illustrated the apparatus.

K and L shows the same principle of economiser in telescopic form suitable for furnaces having only a short electrode travel. The effect of current regulation is that the electrodes are moved an average of once each 5 to 10 seconds during the first third of the process, an average of every half minute during the second third, and an average of every minute during the last portion of the process.

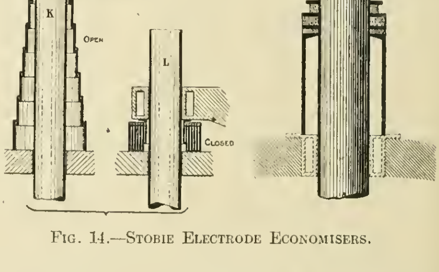

Fig. 14.—Stobie Electrode Economisers.

A careful research on the subject of circulation has been carried out at the Stobie Steelworks, and the results are of interest.

It was decided to devise means whereby closer observation of the effects of electric circuits through molten metal could be made than was possible in a steel furnace working at temperatures up to 1,800 deg. C. Mercury presented itself as a suitable substitute for a hot steel bath, as it resembled molten steel in being a liquid metal and magnetically inert. The resistivity of mercury at atmospheric temperature is approximately two-thirds that of molten steel. Its specific gravity is twice that of molten steel.

Separate experiments with single-, two-, and three-phase currents, and representing every known type of furnace with arcs playing on the bath, were made. The size of the bath, the quantity of mercury, and the current flowing were proportioned to represent average practice, but on a reduced scale. Two voltages were separately used for each system of connections: one low enough to enable the full current to be passed through the bath without arcs, and a higher one to pass the current through arcs above the bath as in normal steel melting. All the different furnace systems exhibited the same effects when current was switched on.

At low voltage, with the electrodes immersed in the metal, the observed motion of the bath consisted of a very faint pulsation coincident with the periodicity of the current. The amplitude of the pulsation was greatest near each electrode, and diminished with distance according to the law of inverse squares. These vibrations which originated at each electrode were so small that they were detected at the surface only by the minutely throbbing reflection of incident rays. There was no trace of a circulating or swirling motion in any part of the molten bath.

As solid conductors heavily loaded with alternating current always vibrate, it was considered that the minute waves observed in the mercury bath might originate from the vibration of the electrodes immersed therein, and not from the passage of the current through the liquid metal, in consequence of the much greater area of the latter. Therefore the current was next made to flow round entirely-insulated copper circuits immersed in the bath. The same types and strength of electric current were employed as in the previous experiments. Exactly the same pulsations were noticed at the surface of the bath, and a total absence of flowing motion.

The flowing movement of the slag under the arcs, visible in an electric steel furnace when the bath is covered with a fluid slag, has doubtless given rise to the common belief in a stirring of the metal bath by the current. The movement in the slag results, however, from the blowing action of the electric arcs, and it will stop immediately if the electrodes be lowered into the slag.

During the course of the above experiments it was noted that the greatest pulsating disturbance of the mercury was when the arcs played directly upon it. That disturbance was purely local, and diminished considerably when a highly conducting fluid "slag" was placed on the metal. The violence of the blowing action of an alternating arc on liquid metal is observed in a commercial electric furnace if an arc is struck on to the bare steel after the removal of the slag. The steel will be blown away downwards from the electrode end, and, on rebounding, will usually short-circuit the arc. The addition of a fluid slag will relieve the metal of the disturbance, as the slag will take up the flowing effort. The research conclusively proved that no circulatory or other stirring movement of the bath results from the electrode circuits in an electric arc furnace. The more or less complete diffusion of added elements which takes place in a bath of molten steel is a metallurgical phenomenon that occurs in all steel-melting furnaces, whether electric or other, and does not depend upon magnetic or convection currents. No special conditions exist in any electric arc furnace which will relieve the good steel melter from the necessity of properly rabbling his furnace bath.

Application of Electrical Energy to the Melting of Metals.

By H. A. GREAVES.

(*Abstract of paper read before the* Institution of Electrical Engineers.)

Some years ago, in collaboration with Mr. Etchells, the author discovered an electrical law which enables three- or two-phase current to be applied to a furnace with an unequal resistance in one of the phases and still maintain a truly balanced load as regards both power and power factor on the primary phases. The connections of such a furnace are shown for three- and two-phase working in figs. 15 and 16 respectively, the length of O C being determined by the resistance of the furnace hearth.

It may be of interest to know that an arrangement, as shown in fig. 17, with an unequal primary star and an unequal secondary delta connected to the furnace will give a truly balanced primary load when the two electrodes are carrying equal currents, the transformer ratios varying according to the relative resistance of the furnace hearth to that of one of the arcs.

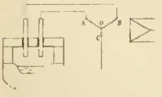
Fig. 15.

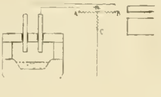
Fig. 16.

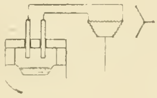
Fig. 17.

With the systems shown, each electrode is independent and regulation of the electrodes, either automatically or by hand, is perfectly simple, while the heat generated in the hearth of the furnace maintains the metal in constant circulation. These systems also give an extremely steady load on the primary phases, due to the buffer effect of the resistive hearth and the phase displacement caused by short-circuit currents.

Up till recently furnaces of the bottom-connection type have not been operated with an acid lining, as such a lining is considered to be non-conductive, although one furnace is made with a water-cooled stud in the hearth to maintain contact with the charge. Water-cooling in the hearth of an electric furnace is surely a dangerous and inefficient makeshift. A conductive acid lining has been discovered which has operated satisfactorily for some months, and this invention, full particulars of which the author is unable to give at present, will also solve the main difficulties in regulating top electrode furnaces when operating "acid."

A number of furnaces have been built where the full load of the transformers cannot be obtained owing to the drop in power factor with an increase of current, and it has been found in practice that the full-load current per electrode on a 50-period circuit should not exceed 8,000 to 9,000 amperes.

For furnaces of 5 tons' capacity with transformers of 1,300 K.V.A., two-electrode furnaces are satisfactory, but above that size three or, preferably, four electrodes should be used. Fig. 18 shows three combinations of the transformer system illustrated in fig. 15, E, E, E, E representing the four upper electrodes and H the hearth. In fig. 18A the current transmitted by the hearth when the electrodes are in equal adjustment will be approximately 0.7 times the sum of the currents in the four electrodes; in fig. 18B the current transmitted by the hearth will be nil, and in fig. 18C it will be approximately 0.35 times the sum of the currents in the four electrodes.

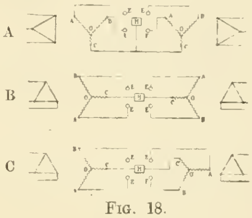

Fig. 18.

It is possible by suitably connecting the voltage-changing switch to arrange for different degrees of bottom heating effect for the different stages of each heat, the best circulating effect being necessary, of course, when the metal is molten and alloy additions are being made to the bath.

ELECTRICITY SUPPLY IN N.E. LONDON.

A preliminary report has been submitted by Mr. E. M. Lacey, M.I.E.E., on a proposed joint scheme for electricity supply, to the Electricity Committees of West Ham and Poplar. Mr. Lacey estimates that the probable increased consumption in the area considered would justify the erection of a power station designed for 90,000 KW., and capable of extension to a total capacity of 400,000 KW. The most suitable site is at Dagenham, where plenty of space is available on the bank of the Thames; for circulating water 8,000,000 gallons an hour would be required for 90,000 KW., and the pumps would be erected on a ferro-concrete jetty. An existing jetty would provide for the delivery of sea-borne coal, by vessels up to 5,000 tons. Ashes could be largely used for making up adjacent low land, but the bulk would have to be tipped or barged out to sea. By using them for raising the level of 100 acres of land near the site, a profit of £500 per acre could be made, which would more than cover the cost of depositing the ash.

The generating sets would be five in number, of 18,000 KW. each, with an auxiliary set of 1,000 KW. The cost of sea-borne coal is taken at 30s. per ton. The system of generation would be three-phase, at 50 cycles. There would be 20 boilers, with superheaters and economisers, rated at 54,000 lb. each per hour, at 315 lb. per sq. in., and provided with steel chimneys fitted with forced and induced draught. The steam temperature would be 700 deg. F.

The transmission pressure would be 33,000 volts, and the trunk mains would have conductors of 0.15 sq. in. cross-section; each cable would carry 7,278 KW. at 0.85 power factor. The average distance of transmission is 7.5 miles.

The station load factor is taken as 40 per cent., and the coal per watt-hour to the 33,000-volt feeders at 21 B.TH.U.; the annual output to feeders is 252,500,000 units, and allowing for 6.1 per cent. loss in transmission and transformation to 6,600 volts at sub-stations, the annual output to sub-stations at 6,600 volts is 237,000,000. The estimated cost of the power station is given as £1,826,000, equivalent to £20 6s. per KW. of plant capacity; the cost of the transmission line and sub-stations is estimated at £924,000, to deal with 72,000 KW., or £1 14s. per KW.-mile. Taking interest at 5 per cent., and coal at 30s., the annual expenditure for the power station is £493,000, or 0.499d. per unit at sub-stations, of which coal accounts for 0.303d.; the cost of transmission is £69,644, or 0.081d. per unit, making a total of £506,264, or 0.58d. per unit sold at sub-stations.

A table is given in the report, showing the cost per unit at load factors from 20 to 90 per cent., the cost ranging from

0.852d. to 0.394d. The details of capital expenditure are as follows:—

	£
Buildings, foundations, roads, &c.	310,000
Twenty boiler units	410,000
Coal and ash-handling plant and bunkers	80,000
Feed pumps, heaters, piping	90,000
Turbo-alternators and exciters, &c.	580,000
Switchgear, transformers, &c.	150,000
Land, 150 acres	40,000
Engineering expenses and contingencies	166,000
	£1,826,000
Sub-station buildings	36,000
Transmission mains	702,000
Transformers and switchgear	102,000
Engineering and contingencies	84,000
	£924,000

The details of operating expenses are:—

	£	Per unit at sub-station.
Coal, 200,000 tons at 30s.	300,000	0.303d.
Oil, water, waste, stores, &c.	3,000	0.003d.
Salaries and wages	30,000	0.030d.
Repairs and maintenance	23,000	0.023d.
	356,000	0.360d.
Capital charges on £1,826,000	137,000	0.139d.
Total for power station	£493,000	0.499d.
Transmission: Salaries and wages	4,500	0.005d.
Repairs and maintenance	9,000	0.010d.
	13,500	0.015d.
Capital charges, 5.8 p.c. on £968,000	58,878	0.066d.
Total for transmission	£69,644	0.081d.
Total for generation and transmission	£506,264	0.580d.

It will be noticed that there are discrepancies between some of the figures; these occur in the original report.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,152. "Semi-automatic telephone systems." T. Pettigrew & Siemens Bros. & Co. May 26th.

13,161. "Emergency system of relighting electric tramcars and connecting pulleys with overhead wires." A. Garner. May 26th.

13,169. "Fool-proof fuse switch." G. Andre & R. Polleeeyt. May 26th.

13,172. "Automatic and semi-automatic telephone systems." L. C. Bygrave. May 26th.

13,175. "Electric cable junction boxes, &c." Siemens Bros. & Co. and H. G. Wood. May 26th.

13,181. "Electric replaceable fuses." M. H. Goldstone & J. Lightfoot. May 26th.

13,189. "Microphones." J. Neale. May 26th.

13,191. "Fusible electric cut-outs." A. C. Smith. May 26th.

13,196. "Electric lighting systems using low-tension single-phase alternating-current generator." R. Butler, J. Sanderson & G. A. Winsborrow. May 26th.

13,198. "Electric step-by-step signalling apparatus." B. E. D Kilburn (Ford Instrument Co., U.S.A.). May 26th.

13,199. "Radio-signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 26th.

13,201. "Electric fires." H. H. Berry. May 26th.

13,247. "Process for continuous production of copper wire by electrolytical methods." S. O. Cowper-Coles. May 26th.

13,267. "Attachment of electrical apparatus, instruments, &c., on mechanical-propelled vehicles." J. Gibson & W. H. Weaver. May 27th.

13,290. "Sparking plug." W. U. R. Goreham. May 27th.

13,298 "Electrically-heated coverings." A. Negromanti. May 27th.

13,317 "Electric transformers." J. W Howard, L D Morphew and Siemens Bros. Dynamo Works. May 27th.

13,328. "Radio-signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 27th.

13,353. "Electric conductors and methods of sealing same in glass bulbs, &c." G. Calvert. May 27th.

13,362. "Telephone systems." W. J. Mellersh-Jackson (International Callophone Corporation, U.S.A.). May 27th.

13,391. "Electric impulse controlling devices." Automatic Telephone Manufacturing Co. (Automatic Electric Co., U.S.A.) May 27th.

13,409. "Telephones." J. H. T. Roberts. May 28th.

13,428 "Electric bells." H. L. Todd. May 28th.

13,435. "Sparking plugs." T. Morgan. May 28th

13,442 "Instrument for indicating electrically whether net, &c., is at assigned depth of water." H. J. Buchanan Woollaston. May 28th.

13,447. "Sound-signalling devices." L Chollet. May 28th

13,453. "Electric switches" V. E. Joyce & Park Royal Engineering Works. May 28th

13,455 "Electric gramophone mechanism" J. S. Bradshaw May 28th

13,479. "Signalling systems" British Thomson-Houston Co (General Electric Co., U.S.A.) May 28th.

13,482. "Device for converting ordinary clock into electric alarm clock." H. E. Vine. May 28th.

13,485. "Electric storage battery." Fuller's United Electric Works and D. A. Palmer. May 28th

13,488. "Electric signalling lamp." W T. Coulson & Optalite, Ltd. May 28th.

13,494. "Oil-immersed water-cooled electric transformers." W. Lelofs May 28th.

13,498 "Safety relays for starting and regulating apparatus." Allamanna Svenska Elektriska Aktiebolaget. May 29th

13,503. "Electric chain welding machines." G. J. Armstrong. May 28th.

13,510. "Electron valves." Connecticut Telephone & Electric Co. May 28th. (U.S.A., August 8th, 1918.)

13,512. "Distributor devices for ignition apparatus." Remy Electric Co. May 28th. (U.S.A., April 4th, 1917.)

13,521. "Electromagnets." G. H. Bryant, T. M. Inman & Relay Automatic Telephone Co. May 28th.

13,523. "Radio signalling apparatus." Marconi Wireless Telegraph Co. May 28th. (U.S.A., July 12th, 1918.)

13,526. "Switch contacts for multiple switches." R. L. Murray & Telephone Manufacturing Co. May 28th.

13,527. "Sparking plugs for internal-combustion engines." L. Macquaire. May 28th.

13,552. "Electric control gear for dynamo-electric machines." R. H. Barbour & J. R. Walton. May 29th.

13,581. "Electric heating apparatus." A. Berthier. May 29th.

13,582. "Electro-pneumatic braking apparatus." Westinghouse Air Brake Co. May 29th.

13,587. "Adjustable supports or brackets for carrying electric lamps." H. M. Macnaughton-Jones. May 29th.

13,625/6/7/9. "Coil-winding machines." Igranic Electric Co. & S. R. Wright. May 29th.

13,628. "Applying insulation of high-tension coils." Igranic Electric Co. and S. R. Wright. May 29th.

13,634. "Amplification of electric currents." British Thomson-Houston Co. (General Electric Co., U.S.A.) May 29th.

13,663. "Magnetic cores and method of making same." B. Ames. May 29th.

13,664. "Magnetos." B. Ames. May 29th.

13,665. "Electric generators." B. Ames. May 29th.

13,666. "Electric coils." B. Ames & P. J. Gilinson. May 29th.

13,667. "Electric condensers." B. Ames & P. J. Gilinson. May 29th.

13,673. "Devices for attachment of electric conductors to insulators." F. H. Krebs. May 29th.

13,678. "Increasing power factor in alternating current-apparatus on three-phase systems." H. A. L. Barry. May 30th.

13,693. "Plug and socket for connecting electric lighting, heating, &c., apparatus to wiring installation." F. W. Coomber & R. Smith. May 30th.

13,697. "Permutation switch-lock for connecting or disconnecting electric currents." T. A. Harmer. May 30th.

13,714. "Sparking plugs." K. Smith & J. Walker, Ltd. May 30th.

13,738. "Automatic or semi-automatic telephone systems." Automatic Telephone Co. (Automatic Electric Co., U.S.A.) May 30th.

13,739. "Telephone and telegraph systems." Automatic Telephone Co. (Automatic Electric Co., U.S.A.) May 30th.

13,751. "Electric radiators." J. R. Quain. May 30th.

13,773. "Telephone systems." G. H. Bryant, B. B. Johnson, Relay Automatic Co. & F. M. Ward. May 30th.

13,792. "Ignition means for internal-combustion engines." N. Stell. May 31st.

13,795. "Insulators for overhead telegraph, telephone, &c., wires." E. A. Chantler. May 31st.

13,812. "Electric generators or dynamos." R. T. Norton. May 31st.

13,855. "Lampholders for incandescent electric lamps." H. F. Wheeler. May 31st.

13,857. "Electro-magnetic timing or time-lag device." E. M. Cohen and Sterling Telephone & Electric Co. May 31st.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

18,332. Flash signalling apparatus. O. Lucas. December 21st, 1916. (126,338.)

18,387. Dynamo-electric machines. G. Plaisant December 22nd, 1916. (126,340.)

1917.

1,050. Detectors for wireless telegraphy and other purposes. T. Harvey. January 22nd, 1917. (126,381.)

1918.

2,032. Electrically-controlled devices. A. C. Heap & A. B Field. February 4th, 1918. (126,407.)

2,134. Removable electrical fuse carriers or connecting devices. British Insulated & Helsby Cables, Ltd., & L. B. Wilson February 6th, 1918. (126,408.)

2,265. Electrical heating systems. Vickers, Ltd., R. J. A Pearson and C R. Mathews. February 7th, 1918. (126,409.)

6,243. Driving couplings for magneto-electric machines. M-L Magneto Syndicate & C. E. Hulse. April 12th, 1918. (126,426.)

7,364. Electric motor starters and controllers. E. Schattner & J. R. Waltoo. May 2nd, 1918. (126,433.)

7,513. Insulator carriers for overhead telephone and like wires. H. W. Laxton. May 4th, 1918. (126,440.)

7,514. Methods of connecting tungsten filaments to electrical conductors. British Thomson-Houston Co. (General Electric Co., U.S.A.) May 4th, 1918. (126,441.)

7,888. Electromagnetic devices for use in signalling circuits. J. J. Ghegan. May 10th, 1918. (126,470.)

8,094. Electric filament lamps. A. Copelin & Edison Swan Electric Co. May 14th, 1918. (126,483.)

8,538. Apparatus for regulating the strength of electric currents for medical purposes. M. Nicoletis. May 22nd, 1918. (126,493.)

8,664. Multiplex telegraphy. F. J. Mackenzie. May 24th, 1918. (126,498.)

9,023. Electric torches. F. J. J. Gibbons & Efandem Co. May 31st, 1918. (126,504.)

11,628. Electric cord protector. C. R. Dodge. July 16th, 1918. (126,540.)

14,284. Electric lamp and switch holder. A. P. Rutherford. September 3rd, 1918. (Addition to 116,239.) (126,552.)

17,829. Contact breaker and pivot bearing therefor. W. Finch. October 31st, 1918. (126,572.)

20,189. Ignition systems for internal-combustion engines. A. H. Midgley & C. A. Vandervell & Co. June 5th, 1918. (Divided application on 9,282/18.) (126,583.)

20,576. Protective arrangements for electric distribution systems. Electrical Improvements, Ltd., P. V. Hunter & J. R. Beard. December 11th, 1918. (126,584.)

1919.

1,971. Electric clocks. N. Collins & A. G. Wallis. January 27th, 1919. (126,590.)

2,130. Electrical discharge gap apparatus. British Westinghouse Electric and Manufacturing Co. February 8th, 1918. (123,064.)

3,252. Devices for varying the point of ignition in electrical ignition apparatus. Scintilla. February 9th, 1918. (122,315.)

THE
ELECTRICAL REVIEW.

VOL. LXXXIV. JUNE 20, 1919. No. 2,169.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

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Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

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Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 3s. 10d. ($5.80). To all other countries, £1 10s.

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THE DOMESTIC APPLICATIONS OF ELECTRICITY.

NEVER before have the conditions been so favourable to an enormous development of the applications of electricity to domestic purposes as they are now—not merely as they are *going* to be, but *now*. It may be useful, as it is certainly timely, to draw attention to some of the factors which, in our opinion, have established these conditions.

In the first place, the insistent demand for more and more electric power for the manufacture of munitions has come to an end; our future needs in this respect will be trifling in comparison with those of the strenuous years that have passed, and while the operation of changing over to peace-time production is in progress, the uncertainty of conditions in the labour world, the delay of the Government in defining its future industrial policy, the high cost and scarcity of raw materials, and other opposing elements, all tend to hamper and defer the resumption of industrial activity on the extended scale that we look forward to. Hence there is at present a considerable surplus of available power in most districts. Not only is this the case, but also many large extensions of plant which were being carried out during the war, and others which have been put in hand, are approaching completion, thus further adding to the excess of supply facilities over the needs of industry.

Next, the war has given a tremendous advertisement to the elasticity, universal applicability, convenience, and economy of electricity in its innumerable uses, and has not only taught the general public what it can do, but has even educated the Government to a realisation of its necessity to the social and economic life of the nation, with the result that Parliament is considering proposals for the development of electricity supply throughout the whole country. The extended and successful use of electric cooking in national kitchens, in large works canteens, and elsewhere during the war, has greatly helped on this application, and the demand for electric heating apparatus has grown amazingly.

Again—and this is one of the most important factors—the domestic servant situation has assumed an entirely new phase. No doubt it will be materially modified as time goes on, but no one will suggest that pre-war conditions will ever return in this respect. Domestic help in future will always be far more costly than in the past, and at present it is, to a vast number of the public, at a prohibitive figure. The obvious corollary, as in the case of the organisation of factories to meet the new conditions, is that mechanical power must be substituted as far as possible for manual labour; the housewife must seek the assistance of the electrical engineer to solve the problems of domestic economy.

Without further labouring the point, we claim to have shown that our introductory assertion is well-founded.

What follows? What are we doing about it? and what can be done to cope with the requirements?

Up to the present, though we have made excellent progress with the development of electric cooking and heating apparatus, we have done little else to cater for the needs of the housewife. In this connection we are 20 years behind the United States, which found it necessary long ago to seek a solution for the domestic labour problem, and found it in electricity. Some years ago, Mr. R. Borlase Matthews came to the rescue of the housewife with his "Electric Mary Ann"—a portable combined electric motor and driving gear, so arranged that one apparatus could drive any standard domestic labour-saving machine[*]; the idea was ingeniously worked out, and may prove extremely useful in many cases. Electrically-driven washing and ironing machines, baking machinery, potato peelers, &c., have been widely used in laundries, hotels, and other large business premises, but, as a rule, they are ordinary machines to which the electric-motor drive is merely incidental, and the machines are not designed specially with electric driving in view. In the United States, on the other hand, the electric drive forms an integral part of the design, as it should, and a great variety of electrical machines—washers, wringers, refrigerators, dish-washers, &c.—has been on the market for years; we give elsewhere in this issue a number of examples of such apparatus, and wish to emphasise the fact that they are in no sense "novelties," but are firmly established in domestic use. There is an immense field for development in this business, and it will be seen at once that the great bulk of the demand would fall in daylight hours, entailing no addition to the capacity of the existing generating plant and mains, while the demand would have a high diversity factor and would greatly improve the load factor of the power station. Moreover, in this field our gas friends are unable to compete with us.

Now is the time for British manufacturers to "get busy" with this proposition. We may have to depend on American imports for a time—the import restrictions have been largely removed—but, as in the case of electric tramway equipment years ago, we shall soon be able to supply our own requirements, and to develop an export trade in addition.

Turning to the heating and cooking question, which is already the subject of keen enterprise and admirable manufacturing ability in this country, we may draw attention to a significant movement on the part of our rivals the gas engineers. A big combine has been registered, under the title "Radiation," Ltd., with a capital of £2,750,000, to purchase the businesses of the Wright, Richmond, and Davis gas stove makers, and others; obviously we may expect, therefore, the standardisation and cheapening of gas cooking and heating appliances, and increased rigour of competition with electrical apparatus. According to *The Times*, the directors state that such a union of interests is essential in view of the unexampled difficulties of manufacture under present conditions, the substantial economies that will be effected by eliminating competitive expenditure, the avoidance of duplication, and the benefit of mass production and standardisation. All these considerations apply, with even greater force, to the manufacture of electrical heating and cooking apparatus, which at present is in its youth and is carried on upon a relatively small scale by individual firms. In these pages we have repeatedly urged the standardisation of electrical cooking and heating apparatus, *so far as it is practicable*—for the course of evolution must not be hindered by an excess of standardisation: the construction of heating elements, for example, is constantly being improved, and the elements themselves cannot be standardised, but there is no such objection to the fixing of standard sizes of elements, shape and distance apart of terminals, &c., to enable the householder to replace elements without trouble or difficulty. In view of the new gas combine, we suggest a further step—the formation of an association, if not a combine, of cooking and heating apparatus makers, to co-operate in producing the most efficient electrical apparatus on the most economical lines of production, in order to bring down the cost of the equipment to the lowest possible amount. Further, we think the coming autumn would be a most favourable time for the holding of an Exhibition in London devoted wholly to the actual demonstration of such apparatus, together with any other electrical labour and fuel-saving devices that can be brought together. The Coal Controller has announced the necessity of continuing the rationing of coal, gas, and electricity, and there is no doubt that by the adoption of electrical methods not only will the householder be assisted in keeping within the ration, but also the total quantity of fuel consumed will be diminished. Steps should be taken publicly to demonstrate the fact last mentioned.

We have no doubt that the Electrical Development Association will cordially support all efforts of this nature; but "Eda" is as yet youthful and unorganised, and her present capacity for work is doubtless limited. We therefore urge the manufacturers and sellers of domestic electrical apparatus themselves to get a move on, for the matter is very urgent.

Business Influenza.

Under this title there recently appeared in *Ways and Means* a most interesting article on the very prevalent slackness of to-day. This slackness is by no means confined to the wicked Trade Unionist, and is not exclusively the result of the malign activities of Labour agitators. It may be found amongst "respectable suburbanites and proud adherents of the worst forms of Toryism and mediaevalism," such as draughtsmen, city clerks, and typists—and even in the Post Office. Before the war, we are reminded, a 20-year-old typist of real efficiency was paid 27s. 6d. a-week; to-day, without the efficiency, she receives £2 10s. Overhead charges have increased as well; her desk, chair, and cabinet are worth £20, instead of £5, and her machine, which cost £21 new, is now worth £50 second-hand. On the top of all this, she gives half the pre-war output of letters, and encumbers the telephone with her social engagements. As our contemporary summarises it: "Trade is, after all, a mere matter of exchange, and it is a little hard to see how the account is likely to work out when a young woman gives in exchange for silk stockings and everything else to match, with a bowl of flowers thrown in, a matter of ten or a dozen badly-done letters in the course of a day. Such a bargain is entirely fictitious, and has in it the seeds of disaster somewhere."

All of this is very true, and we are glad to read it; but why end with the typist? Those of us who are honest are bound to admit that it goes against the grain to do a good day's work ourselves. Although we would deny it were another to say it, we have *not* our old keenness; it is a labour to carry on from day to day, even from hour to hour, with the routine of life. We say we are contending with greater difficulties—shortage of material, labour troubles, uncertainty as to what the next week will bring forth or what fresh folly the Government will commit. Difficulties do exist, but many of them we ourselves can overcome; most of them are caused only by other people being as slack as we are ourselves. There is a complete absence of well-directed endeavour, and the result is nerveless invertebrate dilly-dallying. Business is allowed to trickle through our works, and an effort to hurry delivery from contractors only produces, like the typist, "ten or a dozen badly done letters" of excuse.

We are at an *impasse*. It is useless to blame the community, because it is individual effort that is lacking. It is useless to blame the individual, for each is as bad as the other. It seems to be high time for the whole world to have a cold bath.

---

[*] Electrical Review, March 11th 1910, p. 384.

DOMESTIC ELECTRICAL APPLIANCES.

In our leading article to-day we draw attention to the importance of developing the demand for electricity in the household, and the unique opportunity afforded by the present conditions for extending the scope of its applications to labour-saving apparatus in this country. To point our remarks, we have thought it well to bring together a number of such devices which are in use in the United States, by way of illustration and to indicate the variety and degree of development to which they have attained in that country, where this branch of the industry has been cultivated for many years. For the examples given below, we are indebted to the *Electrical World*, and the *Electrical Review* of Chicago. We give a selection only, from numerous types :—

Clothes-Washing Machines.

Fig. 1 shows an electric washing machine for use in residences, &c., with an automatic safety stop on the power wringer by means of which, if clothes wind around the rubber rolls or if the operator should catch her fingers between the rolls, the wringer is automatically disconnected from the driving motor. The machine is practically "foolproof," and thus all danger as far as operation is concerned is completely eliminated. The tub is driven by means of a belt operating two revolving gears, which pull the washing tub forward and backward, creating oscillating motion. It is driven by a $\frac{1}{6}$-H.P. motor which may be fed from any lighting circuit. The cost of operating the motor is from 1 cent to 1½ cents an hour, according to the price of energy.

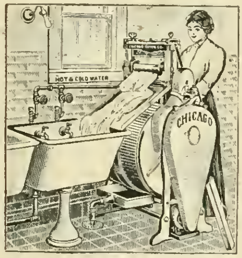

Fig. 1.—Foolproof Electric Washer.

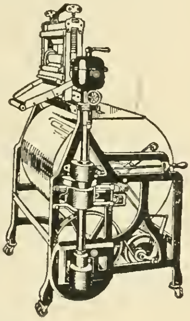

Fig. 2.—Noiseless Machine with Safety Features.

Fig. 2 shows an electric washing machine over which the operator has absolute control at all times; the wringer can be stopped, started, or reversed at will, and is provided with a safety relief for use in case of emergency. The washer can also be started or stopped, as desired, while the wringer is in operation. In addition, an electric switch is provided on the washer for stopping the entire machine when desired.

The tub made for this electrical washing machine, which is built of copper, polished on the outside and tinned on the inside, moves on central bearings, and is so designed that the oscillation of the tub forces the hot suds through the garments. The machine is driven by a motor rated at ¼ H.P.

Fig. 3 represents a platform washer which has a peg-type dasher. It not only does the washing, but takes care of rinsing, wringing and draining as well, without the necessity of lifting the tubs either during the washing or after it is finished. The sliding wringer attachment and the drain from the tub make this heavy labour unnecessary.

The sliding-wringer feature makes it possible to operate the wringer in either direction from any place on the bench. Double control gives the user convenient speed and safety in operation. The hand lever placed conveniently at the top of the side frame enables the operator to start, stop or reverse the wringer by hand alone. A foot attachment is also provided which permits the operator to use both hands in rinsing the clothes and in feeding the wringer, starting and stopping the wringer at will by application of slight pressure on the foot treadle.

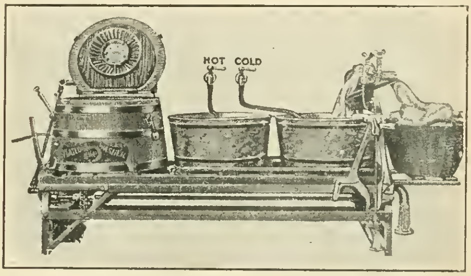

Fig. 3.—"Platform" Washer.

Fig. 4 shows an electric washing machine which has an inverted cone-shaped device projecting below the usual "dolly" agitator in the centre of the tub. Through its use the clothes are kept from collecting in a heap in the centre of the washer, and are forced into a wide circle and a greater volume of water, the slant of the cone causing the water to be greatly agitated. In this way hot soapsuds are forced through the clothes.

With the exception of the tub, made of Southern cypress, the entire machine, including the double folding platform for two extra tubs, is constructed of metal. All the machinery and gear are enclosed and out of the way. Attached to the transmission gears is a small pulley, which may be used to run an ironing machine or other labour-lightening devices. A lever, conveniently located, controls the operation of the washer, another feature of which is the three-position, tilting, ball-bearing wringer having tension springs to adjust the rolls for thick and thin clothes and a positive safety release which unlocks the top roll when lifted.

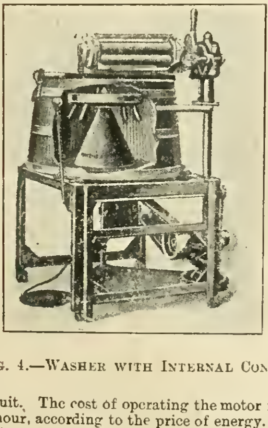

Fig. 4.—Washer with Internal Cone.

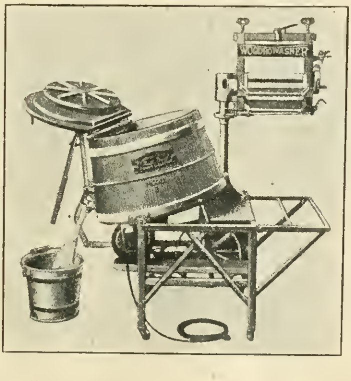

Fig. 5.—Washer with Tilting Tub.

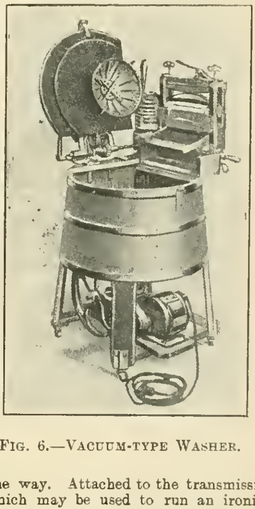

Fig. 6.—Vacuum-type Washer.

The variety of motions provided for in these washers is well illustrated in fig. 5, which speaks for itself: this machine has a tilting tub, which is claimed to save much time and to drain itself rapidly and completely.

The frame and folding bench are of rust-proof galvanised steel; the wringer swings to four positions, and has reversible rolls. cut gears are used, and the drive is by belt from the motor.

Fig. 6 is a totally different type, in which the tub forms the body of the machine, the ¼-H.P. motor being fixed below it. The gears are cut, the wringer is reversible and has three positions, and the washer is of the so-called "vacuum" type—*i.e.*, with a conical plunger.

A totally different type again appears in fig. 7, which shows a combined clothes washer and drier. Two separate machines—a washing cylinder and a centrifugal extractor—are mounted on one frame: the frame is made of steel throughout, while the two tanks are of vitreous porcelain. In one of the tanks the washing cylinder, of perforated brass, revolves at a speed of 35 R.P.M., and in the other tank the extractor operates at 1,500 R.P.M., which removes the water from the clothes in from three to five minutes and leaves them just damp enough for ironing. A ball-bearing motor is used, and the friction-drive mechanism is said to prevent shock to the driving parts and to prolong the life of the motor. This machine can be used for washing and drying separately, or both at the same time.

It is suitable for large families, small hotels, hospitals, &c.

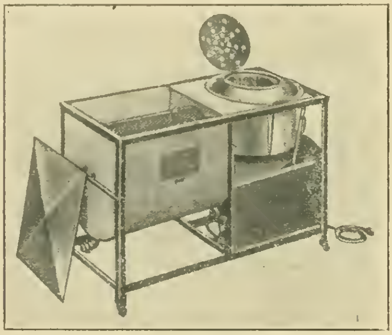

FIG. 7.—COMBINED WASHER AND DRIER.

Lastly, in fig. 8 we have the "locomotive" type of washer, a new device, in which the washing is effected by causing the tub to reciprocate on a horizontal runway forcing the water through the fabric of the clothes; there are no moving parts inside the tub, which makes 60 strokes a minute. The tub is of copper or galvanised iron, and is kept hot by a burner beneath it. A swinging wringer with a safety attachment is provided.

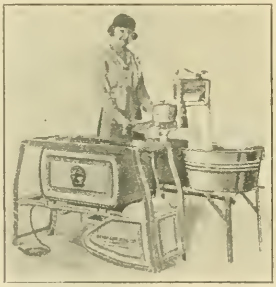

FIG. 8.—LOCOMOTIVE WASHER.

IRONERS.

Fig. 9 represents an ironing machine, which can do a big family ironing in one hour, costing only 3 cents an hour for energy, and doing the work far better than by hand.

Fig. 10 shows an electrically heated and driven ironing machine; the motor is fixed underneath, where it is quite out of the way and where the belt is in no danger of getting entangled with clothes. Pilot lights next to the three-heat snap switches controlling the heating units afford a complete indication of the amount of heat being used. In the smaller sizes of these ironers there is only one heating unit, but in the 42 to 56-in. sizes there are two, one for each half of the ironing shoe. This divided heating element feature makes for economy in ironing small pieces, since only one side of the ironing machine need be used.

DISHWASHERS.

Machines for washing dishes are, perhaps, too expensive and elaborate for household use, though there is probably no domestic duty which bears so heavily upon the unassisted housewife as "washing-up," and the inventor of a cheap and suitable device to lighten this labour would be hailed as blessed by countless British matrons, the victims of domestic drudgery. But hotels and restaurants require such machines. In one type, with a capacity of about 12,000 plates per hour, the dishes are fed into one end of the machine, travel on a belt conveyor, sprayed from above and below by washing and rinsing water, and come out cleaned at the other end.

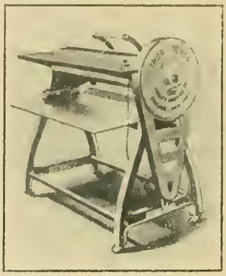

FIG. 9.—ELECTRIC IRONING MACHINE.

A 2-H.P. motor is directly connected to the driving shafts of two centrifugal pumps, which elevate the washing and the rinsing water to the sprays from two cast-iron tanks below the dish conveyor. The machine is said to be easily operated, since the water is renewed automatically, the operator's duties consisting of feeding and unloading the dishes.

No baskets are used for the dishes, these being placed directly on the conveyor, but mesh-wire baskets are used for washing silverware. Removable doors enclose the entire mechanism, glass windows being provided in front so that the operation of the machine may be observed by the attendant. Beneath the conveying belt are placed perforated screens which catch all particles of food washed from the dishes. Another and finer screen is placed over the pump channel to prevent food-stuffs from being drawn into the pumps and sprayed back on the dishes.

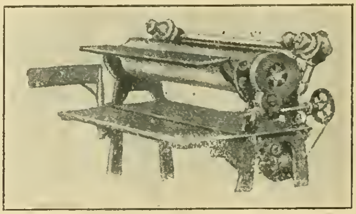

FIG. 10.—ELECTRICALLY-HEATED IRONING MACHINE.

Many types of machines for this purpose are sold in the United States, with capacities from 3,000 to 15,000 dishes per hour. One which deals with 5,000 dishes per hour occupies a floor space (apart from the receiving and drying tables) of only 2 ft. × 3 ft.; the dishes, &c., are placed in baskets, which are rotated by a ¼-H.P. motor. For washing milk bottles in dairies an electrically-driven bottle washer is made, as illustrated in fig. 11; this machine is mounted so that the brush rotates over a tub of water. The bottles are filled about half full of water and forced over the brush

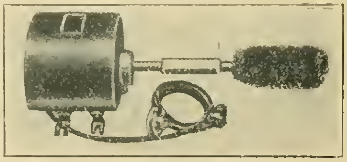

FIG. 11.—ELECTRIC MILK-BOTTLE WASHER.

which rotates at a high speed, coming in contact with all parts of the bottle's interior and cleaning it thoroughly.

The motor used to rotate the brush is of ⅛-H.P. rating, and is equipped with an iron shield to protect the windings from moisture. Connection may be made with any lamp socket.

Peeling Machines.

Machines for peeling potatoes, &c., are not uncommon in this country, but we know of no pattern designed expressly for electric driving. We illustrate in fig. 12 an American type which operates on the cylinder and disk principle, both parts being concrete-lined by a special process. A stream of running water washes the vegetables clean during the peeling operation. The machine is equipped with an electrically-operated controlling instrument, which may be set so that the peeler will be operated only so long as is necessary to peel the vegetables it contains. The motor is fitted with a raw-hide pinion, making the machine noiseless, and ball bearings. All the lubricating devices are centred at one point, and the entire mechanism is enclosed and shielded to eliminate any possibility of accident to the operator.

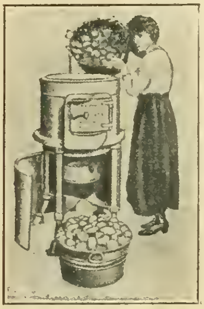

Fig. 12.—Vegetable Peeling Machine.

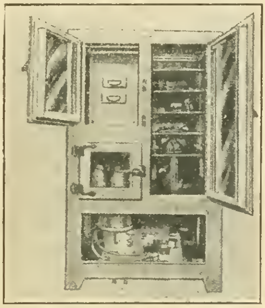

Fig. 13.—Iceless Electric Refrigerator.

Refrigerators.

Of all domestic loads that the electrical engineer welcomes, there is hardly any more desirable than refrigeration. "Iceless refrigerators" are made by various U.S. firms, and one pattern is illustrated in fig. 13; this machine is of household size, self-contained, and automatically operated, and in addition to maintaining food at the proper temperature, it can make 150 small ice cubes for table use and special purposes.

A brine tank in the upper left-hand portion of the refrigerator is maintained at a temperature of approximately 15° F., and this promotes a rapid circulation and cooling of the air in the food compartments. The tank absorbs heat from the air, and in turn the expansion coils in the tank absorb the heat from the brine. Refrigeration is effected by sulphur dioxide, which is readily liquefied at room temperature and at low pressure. The liquid sulphur dioxide is evaporated in the expansion coils and is then sucked down by a pump into a condenser, where it is liquefied, and the process is repeated. The pump is driven by a ¼-H.P. electric motor. The temperature of the cabinet is maintained constant by an automatic controller, which starts the motor when the air temperature rises above normal and stops it when the temperature goes below normal.

Another type of refrigerator uses ethyl chloride instead of sulphur dioxide.

We have made no reference to electric cooking and heating apparatus or suction cleaners, because these are already familiar to British readers; we believe we are right in saying that of all such devices there is none which is more eagerly adopted by the housewife than the electric iron—when once it has been properly introduced to her notice—and many an elaborate electrical outfit traces its initiation to a trial given to an electric iron. It is really worth while to *give* an iron to every likely consumer. Another invaluable aid to the matron is the electrical sewing machine, of which examples have been illustrated in our columns. But space forbids further development of this subject, and we conclude by pointing out that our selection of items is far from exhausting the list of domestic electric appliances; there is hardly any household duty which cannot be lightened by the aid of electricity.

Birmingham.—New Plant.—Orders have been placed for two 15,000-KW. alternators and two sets of condensing plant for use at the Nechells, the total outlay incurred by the contracts, which have gone to Rugby and Glasgow, being £200,000. Formal approval by the Ministry of Munitions has to be obtained.

PRE-WAR AND PRESENT PRICES OF ELECTRICAL ENERGY.

As mentioned in our last issue, we have issued a table of "Pre-War and Post-War Prices Charged for Electrical Energy by 240 British Electricity Supply Undertakings," showing the various tariffs in force in the spring of 1914 and 1919, and the cost of coal at those periods. In previous years we have published more condensed lists of a similar nature; but having been invited by the Incorporated Municipal Electrical Association to repeat the inquiry, with some additions, we have found it necessary to embody the data in a separate sheet, which will, we believe, be found much more convenient for reference than our columns. The table does not profess to be exhaustive; the smaller undertakings have not been included, and returns have not come to hand in time from some of the larger ones; but as the main purpose of the table is rather to indicate the trend of tariff revision than to state the prices charged by each individual undertaking, we have not thought it necessary to wait for the last returns to come in. We hope that the data will prove useful to station managers, electricity committees, and supply companies generally.

Before commenting on the changes, let us congratulate the Aberdare Urban District Council and its engineer, Mr. A. J. Abraham, on the unique position of its undertaking; no change has been made in the tariffs for any supply, and the tramway fares have actually been reduced! This happy result is due to the fact that no coal is used; the station depends entirely upon the destruction of refuse for the generation of electricity. The next best record appears to be that of Runcorn and Widnes, supplied by the Mersey Power Co., Ltd. (Mr. G. W. Malcolm, engineer and manager); but here 95 per cent. of the output is sold under contract with the benefit of a coal clause. The North Wales Power and Traction Co. (water-power) has also maintained its average price—for power only—unchanged, though an addition of 6 per cent. has been authorised to cover the increased cost of labour.

The causes which have led to the general rise in price of electricity are, of course, only too familiar to most of our readers, and we will merely put on record that they are (1) increased cost of fuel, (2) increased cost of labour, (3) increased cost of materials, and (4) increased cost of management. Roughly speaking, coal and oil have gone up by 100 per cent.; in some cases the ratio is far greater, in others somewhat less—a strict comparison is not possible with the data available, because many stations which used smudge or slack in 1914 are using nuts or anthracite in 1919, or *vice versâ*. There is general agreement that the quality of the coal, of the same class, is far lower than five years ago, the ash content having increased from 10 per cent. to 25 or 35 per cent. Where crude oil was used exclusively in 1914, tar oil or a mixture of oils is used in some cases in 1919, again rendering comparisons misleading.

With regard to labour, the average increase in wages appears to have been about 120 or 125 per cent., and the same applies to the cost of materials. The cost of management has not increased at anything like the same ratio, though we know of no reason why the brains of an undertaking should always be the last to receive adequate remuneration; the management factor, however, is a small percentage of the cost of production.

Other expenses which have contributed to the advance in price are such as rates and taxes, increased repair costs due to overloading and overworking plant, and allowances to men on military service.

In the past the cost of a kilowatt-hour has been made up of capital charges approximating to 50 per cent., with coal, labour, &c., making up the other moiety. Now, the only items in the cost of production which have remained stationary during the war—apart from the small item of rent—are the interest and sinking fund payments in respect of capital expended before the war; the bulk of the capital charges. Nearly all other costs have advanced at least 100 per cent. It will be seen at once that the effect of the change in conditions has been to reduce the relative importance of the capital charges, and, in fact, the cost of electrical energy has increased, generally speaking, by only 50 per cent. The price of gas, however, has doubled. Consequently, so far as pre-war installed plant and mains are concerned, the position of electricity supply undertakers has been *relatively* very much improved, although the actual price is higher than before the war. There is, indeed, no ground for reference to the "high price" of electricity nowadays; the value of money has fallen 50 per cent. or so, and if we divide all prices and costs by 2, we shall in effect restore pre-war values, when the fact will emerge that in reality, compared with commodities if not with currency, electrical energy has decreased in price by 25 per cent.

These figures are, of course, but rough approximations, but they may serve to correct erroneous impressions on this subject. The unfortunate feature of the matter is that the same cannot be said of conditions abroad, except in the case of European nations; hence, while we are not greatly prejudiced by the change in the value of currency within our borders, we are handicapped in competition with manufacturing nations which have not suffered a like change. So far as electrical energy is employed for the production of goods for export, its present "high price" places our industries at a disadvantage.

In scanning the table, it will at once be noticed that to determine the actual percentage increase in price with any close approximation to the truth is practically impossible; maximum demand tariffs and sliding scales can only be compared on the basis of the average prices received, which are not known. Only flat rates can be directly compared, and it is on this basis that we put the general increase for lighting supply at about 50 per cent.

We have not, so far, alluded to the change in the character of the load during the war; but it must be recognised that this exerted a very material influence on the cost and selling price. The demand for power in industrial districts—and in many districts which became industrial during, and because of, the war—increased enormously, to the great advantage of the load factor and output. The cooking load also developed, and the demand for heating apparatus greatly exceeded the supply; these loads also benefited the load factor and output. The policy adopted with regard to the prices charged for loads other than lighting varied widely in different places. Some managers simply added a fixed percentage to the accounts regardless of the nature of the load, and without altering the existing tariff; others added different percentages, according to the class of demand, whilst others devised entirely new tariffs. Hence it is difficult to institute comparisons or to draw general conclusions from the data. But one thing made itself markedly and painfully evident—that an extraordinary variety of systems of charging is in use by our electricity supply undertakings, and sometimes even by a single undertaking.

Of course, it is all due to the peculiarities of the supply industry—the lack of storage, the dependence upon load factor, and the heavy capital charges—and we do not impute blame to station managers on this score; it is somewhat strange, however, that out of the welter of sliding scales, maximum-demand systems, rateable-value tariffs, &c., no one or two systems have proved themselves pre-eminently adapted to the circumstances to the exclusion of others. It would be interesting to analyse the tariff systems embodied in the table, but this must be left to another occasion.

(To be concluded.)

Blackburn.—L.G.B. Inquiry.—A L.G.B. inquiry has been held into the application of the Corporation to borrow £250,000 for the erection of a new generating station at Whitebirk. The town clerk said the suggested new site at Whitebirk consisted of 64 acres, on a lease of 999 years at a yearly rental of £480, with option of purchase at any time within the first 10 years. There were good transport facilities by railway and canal. Electrical reorganisation was at the root of the scheme which had been drawn up with the approval and sanction of the B. of T. There was no big electricity station in the district, and no possibility of Blackburn being supplied from any other source. The Corporation had applications for over 6,000 KW. for power purposes, the great bulk of which could not be touched at present.

COSTING IN RELATION TO EFFICIENCY.

By MAJOR E. A. PELLS, R.E.

Although standards are the foundation upon which all efficiency work rests, yet the importance of carefully allocated and kept costs cannot be accented too much as they constitute the pulse or indication of what is happening, and might very well be called control accounts, as it is only through these that a business can be efficiently controlled.

The correct allocation of costs is an important factor, and very difficult to procure, even where there is a skilled cost clerk available, for so much depends on the general organisation of the industry concerned. Costs must show "what really happened," not "what might have happened," and such costs well kept, show up every little inefficiency, thus enabling the efficiency engineer to locate and prevent a recurrence of such.

The costs of production should be kept quite distinct and always considered separately, as, for instance, the condition of the works is nothing to do with the cost of production, and any large sum spent on maintenance must not be allowed to creep into the production costs, as this charge affects the employer as a property owner rather than as a manufacturer, and if brought in, confuses the issue.

In careful production costing there is a bogey which it is always necessary to keep out, if one desires really useful results, and that is the method of allocating proportionate charges such as stores, transport, organisation, management, &c., by average or percentages, which are not based upon definite information. Unless an expenditure subserves in some way the efficient working of the machine or operation to which it is allocated, it is either incorrect allocation or wasted expenditure. Overhead charges on unemployed space and machinery show a condition which should not exist, and should therefore be shown separately as a measure of works inefficiency. This can be carried further, and the following could be considered as waste rates: Shop inefficiency, measured therefrom; idle machines; spoiled work; removals and rearrangements of plant, &c.; loss through stoppage by accidents, &c.; extra payment for overtime.

The use of the measure of inefficiency must act as an aid to efficiency, as it directs definite attention to things which if submerged in the general mass of costs, would often escape unnoticed.

On the other hand, production costs should include a direct ratio of overcharges carefully computed as follows:—

Land and building	Floor area occupied.
Power	Horse power used.
Light	Floor area occupied.
Heat	Floor area occupied.
Stores and transport	Bulk and length of time handling.
Organisation	Floor area or proportion.
Supervision	Bulk and length of time handling.

This will eliminate the averaging microbe from the costs, and each operation will, therefore, bear a correct burden instead of being often saddled with a heavy burden of cost which tends to favour the future or some other inefficient operation.

While one does not wish to get in any charges which should not be made or are inequitable, all up-to-date charges must be brought in to prevent "carrying forward," which favours present-day production at the expense of the future.

It is only the accumulation of carefully compiled records and the careful analysis of same that can enable those responsible to set up accurate standards; and when they are set up it is only careful records that can facilitate their useful application.

THE ELECTRICITY SUPPLY BILL.

(*Continued from page* 687.)

In view of the exceptional position which it occupies as the most important public body next to Parliament, and the purchasing authority for the company-owned electricity supply undertakings in the Metropolitan area, the attitude of the London County Council towards the Bill is of special interest. As shown below, the Parliamentary Committee welcomes its introduction, but seeks to retain to the Council its power to sanction loans, and to ensure that the Council shall have an influential voice, even if it does not take a predominant part, in the future of electricity supply in London. The Committee's recommendation that "special orders" should require the approval of both Houses of Parliament is redundant, for this is already provided for in the Bill. In common with other municipal authorities, the Committee wishes to see the terms of purchase that are offered to companies applied to local authorities also, and objects to the transfer of the powers under the Bill to the Transport Ministry, a proposal which seems to have no friends outside the Government.

The Finance Committee of the Stepney Borough Council understands that in transferring a public undertaking from one public body to another, no liability other than that outstanding at the date of transfer ought to be imposed upon the transferee, and also sees no substance in the fear expressed by some municipalities that the Bill will be used to establish companies to take over municipal undertakings; nevertheless, it endorses recommendations of the Electricity Supply Committee dealing with these points.

London County Council.

The report of the Parliamentary Committee, dated May 29th, on the Electricity (Supply) Bill, referring to past action by the L.C.C., points out that Acts passed in 1908 and 1910 transferred to the Council, subject to certain conditions, the powers of purchase previously vested in the several borough councils, so far as regards the undertakings of most of the London electricity supply companies, and empowered the Council to purchase the undertakings (or parts of undertakings) in the county of those bulk supply companies which were not previously purchasable by a local authority. The powers of purchase may be exercised in 1931, or at subsequent periods of ten years. The special powers of purchase possessed by the City Corporation and the Camberwell and Lambeth Metropolitan Borough Councils are preserved to those authorities until 1927 or 1928 as the case may be.

On November 10th, 1914, the Council decided to seek powers in 1915 for the establishment of a new electricity undertaking for London and certain adjoining districts. The principal feature of the Bill was the combination of public ownership, by means of a new authority to be known as the "London Electricity Authority," with company operation. It was necessary for the Council to proceed under the Borough Funds Act, 1872, but the necessary majority under that Act was not obtained to the resolution that the Council should confirm its decision to promote legislation, and the proposal therefore lapsed.

The Parliamentary Committee recommends: "That the Council welcomes the introduction of the Electricity Supply Bill, 1919, as forming a basis for a settlement of the question of the supply and distribution of electricity."

At the present time the Council is the sole authority for sanctioning loans to the Metropolitan borough councils, but there is an appeal to the Local Government Board. The Finance Committee considers that this position should be maintained, and the Parliamentary Committee recommends:—

"That in the opinion of the Council Clause 21 of the Bill, relating to the transfer to the Electricity Commissioners of powers with respect to the sanctioning of borrowing by local authorities under the Electric Lighting Acts, should be amended so as to enable the Council and other sanctioning authorities to retain their powers, but to require that in exercising such powers they shall act in consultation with the Electricity Commissioners."

With regard to the District Boards, the Committee recommends:—

"That in the opinion of the Council in cases where an elected public authority or authorities within the area of a district electricity board agree to assume financial responsibility, the representatives of such authority or authorities should consitute a majority of the Board, and that such authorities should be given the first option of assuming such responsibility."

"That in the opinion of the Council, the Council should have representation upon any district electricity board dealing with London, even if it should not assume any financial responsibility in connection with such board."

"That in the opinion of the Council special orders made by the Electricity Commissioners under Clause 5 of the Bill creating districts and constituting district electricity boards should be required to be approved by both Houses of Parliament before they can become operative."

Referring to the acquisition of existing generating stations and electricity supply undertakings, the report says the provisions are of great importance to local authorities, and also to the Council in view of the possibility of Greenwich generating station being acquired by a district board. It will be seen that local authorities will be compensated on the basis of outstanding debt, while companies will be compensated on the basis of cost, less depreciation. The compensation payable to local authorities may be increased only if a substantial part of the cost has been defrayed out of revenue. Most of the London undertakings have applied revenue to meet the cost of new works, but the amount relating to generating stations and main transmission lines is probably insignificant. On the other hand, a very considerable portion of the capital cost has been, by means of the sinking fund, paid out of revenue, but this provision is clearly not included. The object of excluding the value of renewals effected out of revenue is not clear, as the local authorities would appear to be entitled to some consideration under this head if they are only to receive the equivalent of the outstanding debt. If companies are to have the benefit of the present value (cost less depreciation) of their plant, it is difficult to justify different treatment to local authorities as regards past expenditure on renewals and replacements. In the interests of the consumers of the whole area it is of course desirable that the district board should be able to acquire the generating stations at the lowest possible cost, but the consumers and ratepayers of those districts which have made a provision out of revenue in excess of actual depreciation are entitled to some benefit from their past contributions, and it would seem reasonable that both undertakings should be treated on the same principle as regards the assessment of the compensation payable. The Committee recommends:—

That in the opinion of the Council, the standard price to be paid under clause 7 of the Bill in the case of a generating station or main transmission lines belonging to a local authority should be the same as that proposed to be paid in the case of a generating station or main transmission lines belonging to a company or person.

The Special Committee on Electricity Supply is strongly of opinion that local authorities should be given power to represent the interests of the small consumers before the Electricity Commissioners, so as to ensure that all the benefits arising from any reduction in price of electricity, resulting from the Bill, shall not go to the large consumers. The Special Committee has also suggested that the Electricity Commissioners should be enabled to give authority for the powers and duties of a District Board as to generation and supply of electricity to be exercised and performed, not merely through any authorised undertakers or through a company established for the purpose, but also through any local authority whether that authority is an authorised undertaker or not. It should also be made clear in the Bill that a District Board may lease a part and not necessarily the whole of its undertaking. The Parliamentary Committee recommends accordingly.

With regard to the transfer of the powers of the Board of Trade, the Committee states that it may be anticipated that the Ministry of Ways and Communications will be by far the largest consumer of electricity in the country, and its main concern, in connection with the supply of electricity, will naturally be directed towards meeting the special needs of railways and other means of transport. It is, however, generally recognised that an ample and cheap supply of electricity is of the utmost importance for the industrial welfare of the country. The Special Committee on Electricity Supply strongly urges that the Board of Trade should retain all its powers and duties under the intended Act, or that they should be transferred to some appropriate department which would be in a position to take a broader view than might be expected from a department which was specially interested in one phase of the question. The Parliamentary Committee concurs in that view, and recommends:—

"That in the opinion of the Council, the powers and duties of the Board of Trade referred to in Clause 44 of the Bill should not be transferred to the proposed Ministry of Ways and Communications."

Stepney Borough Council.

The Finance and Parliamentary Committee, commenting on a reference from the Electricity Supply Committee, points out that the basis of compensation to local authorities and to companies respectively contained in the Bill, where generating stations and "main transmission lines" have been transferred to District Electricity Boards, are in accord with the findings of the committee appointed by the Board of Trade, which was composed of some of the greatest experts in the electrical profession, the reason for the differentiation being, presumably, that local authorities having become undertakers for electrical supplies in the *public* interests and not constituted for *profit sharing* purposes, no liability, beyond that devolving upon local authorities at the date of transfer, should devolve upon the District Electricity Boards, which are also to be public bodies working for the public good in an endeavour to supply "a cheap and abundant supply of electricity."

Further, the Finance Committee does not think that it is the intention of the Government, particularly at this time, when the principle of "nationalism" is being so strongly advocated, to use a district board as a conduit for transferring a municipal electricity undertaking to a private company, but agrees that the point should be made clear by express words being inserted in the Bill prohibiting any such transfer. The Committee approves of the recommendations of the Electricity Supply Committee, which provide that the Council be recommended to request the local Members of Parliament to endeavour to secure an amendment of the Bill in order to place the local authorities, the companies, and persons affected by the Bill upon the same basis as regards standard price; that all generating stations should—good or bad— be taken over, with the exception of stations where the generation is trivial in amount or where the undertaking is so situated as not to lend itself to a general scheme; and that, as, under Clause 16, it would be competent for the powers and duties as to the generation and supply of electricity, instead of being exercised and performed by a District Electricity Board, to be (*inter alia*) carried out through a company established for the purpose, and as it would obviously be unfair that a municipal undertaking built up upon the credit of the ratepayers and managed in its development by representatives of the ratepayers, should be leased to a company, the Council be recommended to call the attention of the local Members of Parliament to the matter with a view to the amendment of the Bill to prevent such a contingency occurring.

(*To be continued.*)

THE STILL ENGINE.

The advantages of the internal-combustion over the steam engine in certain directions are admitted, and yet, in spite of the growing fuel costs, the former type of engine fails to eliminate the latter, and for large powers fails even to keep up with it. The reasons for this state of affairs are also common knowledge, and we now come to the juncture where the bad points, if they can be so called, of each form of engine are improved and used to advantage by the other.

We had the pleasure of being present at a most interesting and instructive demonstration last week, at the Engine Development Co.'s laboratory, at Chiswick, when an opportunity was given of inspecting and seeing those Still engines running, on which were obtained the results given in Capt. F. E. D. Acland's recent paper before the Royal Society of Arts. Remarkable economies are claimed for these engines, and they are certainly capable of very surprising performances. We saw a 3-cylinder engine running on petrol, which was built in 1910, and still apparently as good as ever. It was rated at 15 H.P., but actually when overloaded it has developed 35 H.P. quite comfortably. A larger single-cylinder engine which was also run under varying conditions put up a no less creditable performance. The cylinder dimensions of this engine are 13.5 in. diam. by 10 plus 12 or 22 in. stroke, with a brake thermal efficiency of, it is claimed, 42 per cent. It is rated at 360 B.H.P. at 360 R.P.M., and on overload has comfortably developed 540 H.P. These engines will run on both light and heavy oils, there may be more than one of the combined cylinders, and part of the steam may be used in separate cylinders, compounded or otherwise. An impressive feature is the ease with which such engines may be manœuvred; the power can be varied from zero up to overload, and the steadiness with which they run under varying conditions is remarkable. The highest efficiency claimed for the Still engine, namely, 41 per cent. brake efficiency, is the total efficiency without any added steam. With regard to sizes, cylinders up to 22 in. have been built at the present time, and Mr. Still is confident that no trouble is to be expected with sizes varying from 4 in. upwards. The latter size is being considered in connection with tractors and road vehicles. In the Still engine the final exhaust temperature is stated to be as low as 150 deg. F., so that the working temperature range is very large. Efficiency is improved by the high jacket temperature resulting in a higher mean temperature than usual in the combustion stroke. All heat rejected to the jacket is recovered directly as steam, and the steam cylinder, it is claimed, gives unusually good results, since as it is preheated by the combustion stroke, there is no condensation. It is claimed that the compression pressure may be reduced by 50 per cent. with entirely reliable ignition, due to the higher mean temperature of the cylinder, and this simplifies constructional difficulties. From the operating point of view, the steam warms the engine before starting, and there are, therefore, no sudden temperature changes, and it allows the engine to be started against load.

These are the main considerations on which arguments for economy are based. The engine is certainly an extremely interesting one, and it is to be hoped that it will be developed and become of importance, since it would appear that it has already demonstrated its practicability.

The following abstract of the discussion on Capt. Frank E. D. Acland's paper,[*] on the principles of the Still engine, read before the Royal Society of Arts, is taken from the *Journal* of that society.

Sir Dugald Clerk, K.B.E., F.R.S., explained that he had had the pleasure two years ago of inspecting the engines in question. Many experiments had been made on the variation of compression volume—compression space—and the limit seemed to have been approached. Above a compression ratio of 20 the curve became very flat, and practically no further good could be obtained by increasing it above that figure. In an ordinary-designed internal-combustion engine, it was always found that with properly designed valves and a properly designed combustion space with a minimum port surface, it could be reckoned on getting 0.7 of the air standard efficiency in indicated power; or with an engine with about 20 range of compression an actual indicated efficiency of about 49 per cent. could be obtained. After going into the past history of gas engines, the speaker said he doubted whether an engine of the type shown by the author on the screen, with the long sleeve and the clearances that there must be there could be expected to give efficiencies approaching 20 per cent. additional. Was the highest efficiency the author claimed for the Still engine (about 41 per cent. brake efficiency) the total efficiency without any added steam? In addition to the thermal question, there was the practical one of the locomotive. A compound steam and internal-combustion engine would be a very handy piece of apparatus, and there were certain advantages to be gained, no doubt, from the heating of the cylinder. He did not think it could be said, from the author's experiments, that the mechanical stresses, due to the heat flow, were really reduced. The mechanical stresses found in the internal-combustion engine, within the cylinder, combustion space and piston, were not those due to the difference of temperature between the cold water jacket and the hot water outlet. They were due to the cyclic change within the cylinder, because at one instant there was a flame playing on a piece of metal with a temperature of nearly 2,000 deg. C., and the next instant there was part of the cold air playing on the same plate of metal. The consequence was, there were obtained expansion stresses which had nothing to do with the water jacket system at all.

Prof. W. H. Watkinson remarked that he had had the pleasure, about a year ago, of seeing one of the engines at work at Chiswick, when he had been very greatly impressed by the ease with which it could be manœuvred. Its power could be varied from zero up to an overload within a few seconds. Regarding the possible destruction, or reduction at any rate, of the vacuum due to leakage past the piston, leakage sooner of later would occur, and that, with the arrangement shown must involve a great reduction of vacuum and a greatly increased amount of the work to be done by the air pump. As to whether steam cooling would suffice for much larger cylinders than those which had been experimented with, the speaker's impression was that steam cooling would not suffice, and he believed that it would be well that that arrangement of steam cooling, steam on one side of the piston and internal combustion on the other side, should be departed from, and that the steam should be used in, say, the uni-flow type of engine, or in one of the Parsons steam turbines. In either of those ways, a more practical engine for big scale work could be obtained. He should have anticipated that, owing to the heating of the charge during its admission and compression by the heat transmitted from the hot water in the jacket, preignition would inevitably have occurred both with gas and petrol engines. He thought that would be the case if fairly large engines were used. It was exceedingly difficult to accept the author's figure for oil consumption of .302 lb. per shaft H.P.-hour. It might be a snap result, but he thought it was too good to be obtained in regular working over several hours. If it was, even in spite of the great complexity of the engine, there must be a very great future for it.

Prof. C. Vernon Boys, F.R.S., said he had been privileged some years ago to conduct some tests on the engine as Mr. Still had been developing it from the beginning, and he should like to say how he had been struck with the perfectly scientific manner in which Mr. Still had arranged the series of tests with a view to the determination one at a time of the value of each individual step. These tests showed conclusively the value of the Still combination. The steam on the one side of the piston enabled the explosion operation to do better than it did previously. The explosion operations put the steam into a position not found in any engine before, and instead of having condensation, loss, waste, and all the things that went to damage the perfection of the steam engine, the steam picked up heat and did better than it could even in a theoretical engine. He would like to correct a misapprehension which he thought Sir Dugald Clerk was under with regard to the stresses set up due to the thermal differences in the engine. He (the speaker) thought that in the Still type of cylinder the mechanical stresses set up were less, because the thickness of the wall space between the hot gases inside the cylinder and the circulating water was not the thickness of a cylinder which was strong enough to carry the pressure; it was a relatively thin casting between the inner wall of the cylinder and the series of water spaces.

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[*] Elec. Rev., May 30th, 1919, p. 643.

and that did not take the explosion stress which was borne by a jacket outside it. So that stresses set up in the cylinder by the gradient of temperature between the interior and the exterior were taking place in metal which was of a form more able to withstand them, because at least it was free from the bursting strain of an ordinary cylinder, and there was less stress to withstand. In conclusion, he referred to the present universal panacea of world-wide electrification. Surely there was too much being promised about universal electrification, and a paper of the sort read that afternoon might go a long way towards an appreciation of what was possible.

Mr. J. B. Stokes said the Electricity (Supply) Bill was before Parliament, and the question he would put, not to the author, but to the audience was: Were they sufficiently interested, and was their faith in the engine such that they considered it worth while continuing further research work on a large scale? If they thought that, then he would urge them to do what he had done that morning. He had gone to the Houses of Parliament, had met his representative, and had asked him whether he was prepared to back up a full inquiry being made into all types of prime movers before the Government finally settled upon the best one to adopt. He thought the audience should get their representatives to do the same. He thought that locomotive work was the line along which the first great development would lie. With regard to designing the particular engine under discussion with larger pistons, there were ways of getting over that trouble besides going in for larger pistons—namely, by multiplying the number of pistons. For instance, some aeroplane engines had about 36 cylinders. At any rate, 12 cylinders of 22 in. by 36 in., could be utilised quite well. In locomotive work there was already a size of cylinder which was suitable for the type of engine mentioned, and he would suggest that, to enable the locomotive to start readily from any point, arrangements might be made by which steam could be admitted, not only to the regular steam ends, but also to the combustion space.

Mr. Frank Bailey understood that the size of the generators must necessarily be governed by the limitations of the system so far as the size of the cylinder was concerned, and therefore power above a certain limit could only be obtained by increasing the number of cylinders, and the number of lines of moving parts. He did not say that was a disadvantage for a moderate output, but, so far as electricity supply was concerned, it opened an interesting feature. It was not now a question of the engine being in competition with the steam turbine, so much as it might affect the demand on the electrical power works by the ability of power users to utilise a more efficient generator. If the load factor was to be materially influenced in the future by the development of a better type of prime mover, clearly it would pay many users, who were now glad to use the electric motor, to put in power units of a limited size but sufficient for their own supply. He thought in that way the paper had a very vital bearing on the matter, especially in developing small generating works in those areas which would otherwise require costly transmission mains from a distant source.

Mr. F. Leigh Martineau said it might be of interest to see figures which would result from what might be called the "De-Stilling" of the best Diesel engine. If the same type of engine was converted or rebuilt, so as to adopt the Still principles, the following results would be obtained. The indicated thermal efficiency was 17½ per cent., and the brake thermal efficiency was 36 per cent., so that there was a friction loss of 11½ per cent. The total waste heat was 52½ per cent. The radiation loss would be about 2½ per cent., and the stack loss 8 per cent.; so that the waste heat available as steam, which gave a boiler efficiency of 80 per cent., would be 42 per cent. Using compound on the steam side with the superheating during expansion, there was no reason why there should not be 20 per cent. available from the actual steam used in the cylinder as indicated power. Therefore 8.4 per cent. would be added in efficiency to the 36 per cent., which would increase the brake thermal efficiency up to 44.4 per cent., and the indicated thermal efficiency up to 55.9 per cent., or an increase of efficiency of 23½ per cent. on the brake. These figures did not take into consideration one or two small gains which actually occurred in practice. No decrease of friction was allowed for, and the friction of a Still engine was always less than that of a normal engine of the same size. Again, certain other friction losses, although present in the engine, actually gave back a certain percentage of their friction heat as steam. For instance, piston-ring friction created steam in the jacket, or helped to do so.

Mr. W. J. Still, dealing with lubrication, said he had gone into a long series of experiments on that point, and had found that if the temperature rose to about 450 deg. F. difficulties began; but below that point perfectly good lubrication was obtained under very heavy loads in the cylinder with a mixture of heavy cylinder oil and graphite. His experiments with the engines when they were built had substantiated that position. He had never had any trouble whatever in regard to lubrication. In fact, he was using much less lubrication than was used on ordinary combustion engines. A set of trials made for a certain Government, gave a consumption of lubricant equal to 1.4 per cent. of the amount of fuel oil used in the combustion cylinder. Better results even than that had been obtained, but that result had been obtained over long trials at three-quarter load, which was not, of course, the most efficient condition so far as lubrication was concerned. During that trial the engine's mechanical efficiency was 87 per cent., and after the run the engine was examined very carefully, and the surfaces were found to be in absolutely good condition. As to "complexity," it should be borne in mind that the engine is not a prime mover with parts added to it, but two prime movers both earning dividends. With regard to complication, each application of the engine must be dealt with separately; but, considering one type only, viz., large marine Diesel installations, these would be found usually to contain more parts, and those of a more troublesome character, than were essential to a Still engine equipment. Large Diesel engines were often constructed with piston rods and crossheads, in order to obtain better running conditions, and all Diesels were fitted with air-starting valves. The latter were equivalent to the steam valves of a Still engine, so that the only added gear the engine contained was a cover and stuffing box for each cylinder; these were not moving parts, and a well-known firm of Diesel engine builders fitted its engines with these parts merely to avoid chilling the combustion chamber with compressed air when manœuvring. The large business carried on by this firm indicated that the added parts justified their existence although their use was momentary and they added no power to the engine equipment. With regard to auxiliaries, the boiler, burner, and feed pump were usually to be found installed with Diesel engines merely for cooking and heating purposes, these engines also required at least one set of large auxiliary engines attached to air compressors of equal power, and were often fitted with two such sets. In addition, they required compressed air receivers and cooling water pumps, with, in recent systems, a water-cooling element (practically a condenser), and a circulating pump. From the foregoing, many large Diesel installations contained far more parts than those necessary for a Still engine, and even the simplest of them were more complicated. Most of the Diesel auxiliaries consisted of very fine high-class machinery, which required far more attention and upkeep than steam auxiliaries; the functions they fulfilled were non-remunerative, and the fuel consumed in them when "standing by" was wasted. In respect to comparisons of thermal efficiencies these should be confined to such engines as were of similar size, and working on like cycles; the 41 per cent quoted was obtained from a high-speed Still engine operating on a two-stroke cycle, and was not properly comparable with the engine tested by Mr Mathot, which was a slow-speed engine working on a four-stroke cycle. This Still engine gave in normal service four times the output per square foot of cylinder cross section obtained from that particular Diesel; it must not therefore be expected also to add 25 per cent. to the heat efficiency of that exceptionally efficient engine. That it did add 14 per cent. was sufficiently remarkable. If this high-speed, two-stroke engine was compared with Diesels of a similar class, such as the Nobel Diesel, it would be seen that although it gave twice the output per cylinder cross-section, it also added 38 per cent. to the thermal efficiency of that engine as tested, at full power, and 27 per cent. to its best efficiency; at the latter load the Nobel gave less than one-third of the relative power output of the Still engine.

The Chairman (Sir C. A. Parsons) agreed that in a system with a large number of gas engines he would rather take the combined steam direct into the turbine, if a turbine was to be used. One wanted the highest possible vacuum, and one high-pressure cylinder with a reciprocated piston would admit gas to the steam side and that would partly vitiate the vacuum; so he thought in a large system he would prefer to keep the steam entirely separate from the gas. But for engines of moderate size it made a very convenient unit, and was much simpler than the separate steam engine. Before the war, designs had been got out to apply combustion engines to a cruiser of 30,000 H.P., and it had worked out to 150 cylinders all geared on to four screw shafts. They covered nearly the whole bottom of the ship. The only way to get a large power on to an alternator or dynamo was to gear a number of internal-combustion engines through frictional spring couplings, on to, say, one reasonably large sized generator. One got a cheaper and more reliable engine by keeping the size of the unit small, and also a less total weight. He looked forward to a great future for the gas-steam engine for locomotive work, especially in waterless districts, like Australia, where there ought to be a very great future for it.

Capt. F. E. D. Acland, in view of the lateness of the hour, communicated his reply in writing, as follows: Engines with high compression ratios remained ideal like their efficiencies. The Still cycle was quite logical in that it dealt with the lower limit of the temperature scale and increased the brake efficiency in a practical manner. The percentage of heat passing to the cylinder walls and pistons was found to be less than in normal engines, and the cooling of larger pistons could therefore be carried out successfully with the quantity of steam available. To use the steam in turbines or external engines was possible, but implied loss of efficiency, both in the combustion and steam cycles. Details which depended on the specific application of the system had been avoided as much as possible in the paper whose object was to submit for examination and discussion the principles of a new prime mover. The best consumption of .302 lb. per B.H.P.-hour was over an observed period of one hour after the engine had been run continuously to obtain steady conditions. The special construction adopted with a view to meeting the anticipated difficulty of maintaining an efficient vacuum had proved effective. Mr. Still submitted the whole of the basic principles on which he intended to work to Prof. C. Vernon Boys, F.R.S., in 1909.

Lieut.-Col. D. J. Smith (communicated) said that so far, for high powers, the steam turbine had things all its own way, but it was doubtful if this could continue if the promise of the Still engine was fully borne out, and it would not be remarkable if in marine practice a return was made to reciprocating machinery for large powers. That this seemed very probable was due to the great improvements recently made in gas producers. Gas producers would make an almost ideal combination with the Still engine, and would furnish power at a fuel expenditure hitherto considered impossible. The high cost of fuel was a great handicap to the most easily handled and controlled form of power they had—electricity. The extreme advantages possessed by electricity were such that they almost counterbalanced high cost; but if it was possible, as it appeared to be, to generate electricity by the Still engine and improved gas producers at a much lower cost than was now possible, it would give an enormous impetus to electrical development in every direction. Even after spending millions in building vast central stations, it was only expected to reduce coal consumption per H.P. to 1.5 lb. As this figure could be greatly improved upon now in any small generating plant using a good gas engine, it was hard to see where the coal conservation came in. If they are to be forced to use electricity in order to justify enormous State controlled electrical generating stations, it was to be hoped that the Still engine would be fully investigated before the plant was ordered, as there existed now millions of tons of so-called waste fuel which could be successfully used n certain new gas producers, and, in conjunction with the Still engine, would use the nation's resources to far greater advantage.

THE INSTITUTION OF ELECTRICAL ENGINEERS.

The visit of the Scottish Centre of the Institution of Electrical Engineers to Aberdeen, on June 6th, was favoured with delightful weather. The day's programme opened with a visit to the Fish Market at 8 a.m., and later between 70 and 80 ladies and gentlemen were present at the Town Hall when Lord Provost Sir James Taggart gave the Centre a civic welcome. This was acknowledged by Mr. J. F. Neilson, Glasgow, chairman of the Centre, who also emphasised the importance of the formation of an Aberdeen Sub-centre of the Institution.

Mr. C. H. Wordingham, president, in the course of a short address, said that no question of any importance in the industry had emerged which had not been taken up by the Institution. Alluding to the Electricity Supply Bill, he said they were now at the most critical point in the history of the supply industry. For some reason the electrical industry had an extraordinary fascination for the legislator. In the past, legislation had been wholly evil, but some thought that they wanted more legislation. It was a very dangerous experiment to put any industry largely under Government. They were in for legislation, and they would have to make the best of it. He spoke of the value of the Institution in improving professional and industrial relations with foreign countries, allied, and neutral.

Prof. Maclean, Glasgow, delivered a lecture on "Water Power." He said he was concerned with it not merely as an industrial proposition, but as a means of elevating the national life, of restoring its man power, of relieving the congestion in the large centres, of resettling the people on the land, and of furnishing them with better houses, better food and clothing, better religious and educational influences, and a more natural life in the country. Agriculture and afforestation alone would not bring a happy and contented population in the Highlands. A little industry here and there to supplement the local activities and at the same time utilise more fully the local resources was what was needed. For that purpose water power was immediately available, and was so distributed by nature that there need be no congestion as in the large centres, but it might be easily portioned out to serve large areas. Elsewhere than in the North they might have their own railways and machinery worked by a more simple and, in the Highlands at least, more readily available natural resource. In spite of the invention of the electric motor and the development in electrical transmission over long distances, water power was less used in the Highlands to-day than it was a century ago.

He quoted a paper by Mr. A. Newlands on the subject, and also the recent interim report by the Government Committee dealing with nine possible water power schemes in the Highlands, capable of giving 183,500 continuous E.H.P., transmitting electrical energy to Glasgow, the Clyde Valley Edinburgh and district, Aberdeen, and Dundee, and capable of delivering at least 1,000 million B.T.U. per annum within a radius of supply of from 80 to 85 miles. Taking the efficiency of transmission as 80 per cent., and the number of B.T.U. per ton of coal as 650, this would mean a saving of coal of 1.85 million tons of coal per annum. In the Highlands, besides other purposes, the power might be used for sawmilling, mealmilling, for laundry work and dye works, as well as for the making of yarn and woollen and tweed The cost of the scheme was estimated at £7,075,000. enterprises during construction would afford employment thousands of men, probably 6,000 alone being needed for t at Lochs Ericht, Rannoch, &c. Most of the schemes would originate in Inverness-shire, and there as elsewhere the decrease of population would be staunched.

The Committee on Water Power Resources said there had been strong evidence regarding the lack of adequate training facilities in the universities and technical institutes for young engineers wishing to enter the field of hydroelectric development. Universities and institutions were prepared to participate in the fullest possible manner in the training, and it was not fair to expect that the moment the country had become alive to the value of water power the colleges should be ready with complete equipment and staff to help in the work. The college with which he was associated had hitherto had scant encouragement to develop that side of its work, but had a select course for the young engineer wishing to enter that field, and the number of students engaged on works abroad, particularly in Canada, showed that the subject had not been entirely neglected.

Mr. Newlands, chief engineer, Highland Railway Co., said the views expressed were very largely and universally held by the Highlander. There was undoubtedly a very strong determination on his part to secure such an amount of power as existed for his own particular need. If the Highlands were simply to be looked upon as the power-house for the South, he would be up in arms. There were many sources of social and economic development which in themselves were not essentially dividend-paying concerns. They paid indirectly in the value they were to the State as a whole, and if these powers created a settlement of the population, it seemed to him the question whether they were to pay fat dividends or not did not enter very largely into the solution of the problem.

While the members of the Institution were holding their meeting, their lady friends made a tour of the city in the Suburban Tramway Co.'s 'buses, visiting Duthie Park and the West-End.

At noon the members visited Marischal College and later the Art Gallery.

An hour later a company of about 100 were entertained at lunch in the Grand Hotel by the Electricity Committee. Lord Provost Sir James Taggart presided.

The Lord Provost gave "The King," and then "The Institution of Electrical Engineers," whose growth and increasing influence he commented on.

In reply, Mr. Wordingham said Aberdeen had been a revelation to those who had never seen it before. They were to have legislation with far-reaching effects on the industry, and every town which had embarked on electrical supply had a vital interest in the Bill, which should be closely scrutinised.

The toast of "Bon-Accord" concluded the proceedings, and the party went off to visit Rubislaw Quarries, Donside Paper Mills, Old Aberdeen to see Oldmachar Cathedral and King's College, and the electricity works, where tea was served.

Mr. Archibald Page, assistant manager, Clyde Valley Power Co., expressed great pleasure with the afternoon's entertainment. He proposed a hearty vote of thanks to Councillor Gibb and to Mr. Bell and his staff, which were given.

We are indebted to the *Aberdeen Journal* and the *Aberdeen Free Press* for material upon which the above report is based.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Mr. Wordingham's Address to the I.E.E. Territorial Centres.

I wish, as a member of the E.T.U., to take this opportunity to record my opinion of Mr. Wordingham's address to the territorial centres of the I.E.E. I can imagine many members of the Institution immediately bristling with rising ire and outraged dignity at the idea of a mere plebeian of the electrical industry daring to criticise anything originating from such a superior and infallible source. Personally, I feel impelled to this course, through the attitude of Mr. Wordingham (in so far as it affects my interests) upon the question of the organisation of power station engineers, the Government's attitude towards industries (arising from the Whitley Report), and, finally, the intention to apply for a Royal Charter. I take the following extracts from the address, as published in the *Journal of the I.E.E.* for the month of April, and *not* from *your* condensed and palatable version which is appearing periodically in the Review. It says: "Towards the end of last year the Council were informed that very strenuous efforts were being made by the Electrical Trades Union to bring within its membership not only workmen but engineers of all ranks up to and including chief engineers of central stations. . . ." That was intolerable. "The Government have compelled us to organise." "They (the Government) will not deal with individuals." "The

Whitley Report recognises only two classes: workmen and employers." "The brains are left out altogether." The address further continues to recommend the E.P.E.A. as a suitable *trade union*, and says: "The trade union idea was a very little pill for most of us to swallow. . . . Some of us have more or less choked over it; but it has had to be swallowed." Now that class of man the E.T.U. is endeavouring to bring within its ranks (and who Mr. Wordingham is strenuously aiming to retain) has undoubtedly been sadly disturbed, during (and as a result of) the war. Usually a member of the middle class, he, and his fellows in their youth, have provided a splendid field for the employers to exploit (at the expense of the working-class youth), and eventually, as regards status, he evolves into an individual half-way between the employer and the worker. At present the workman, in the matter of wages and conditions, is in a superior position, due entirely to the fact that he has paid, organised, and fought for these advantages, and, further, he has forced an unwilling Government to accept the fact that in industrial matters there *are* only two sides. (In passing, I would like to say that this was an equally bitter pill for the Government to swallow, and it is on record that *they* choked over it, more or less.) Now the position at present is that, owing to force of circumstances, the "brains" (as per Mr. Wordingham) can no longer remain a "buffer class" in industrial matters. Keeping in mind that they *are* workers, they have two paths open to them. The first is Mr. Wordingham's scheme (as unfolded in his Address) to join the E.P.E.A., when they will be represented on the proposed Grand Council of the I.E.E., and will complacently sit with such philanthropists as the E.C.A., I.M.E.A., and the I.A.E.P.C., &c., in fact he will become a modern Daniel. The second is *my* hideous suggestion; that is, that as a worker and an employé, he throw in his lot with the workman and join those "brainless" station-engineer branches of the E.T.U. I will not labour the second alternative, because 99 per cent. of the brains will fall in with the former scheme. It will appeal to them from the point of view of their *infra dig.* and class-consciousness. It is an unenviable truth that the English middle-class (which comprises the so-called "professional brains") is the possessor of the majority of that unutterable human entity known in common parlance as the snob. Further, I submit that the sentiment most apparent in this extract is an earnest attempt to bolster up this snobbery for fear some members of the "technical brains" should so far forget themselves as to embrace the (so-called) revolutionary methods of the workers. I think Mr. Wordingham is to be congratulated on this exhibition of class-rancour, and the Institution should be proud of this new preacher of class-war. Reading further, I find Mr. Wordingham exchanges the whip for the "lollipop" with reference to the E.T.U. "After all, what we have to fight is a common enemy. With regard to the E.T.U., we do not even want to fight them." I would draw the attention of the "technical brains" to the former phrase in this extract, as it is addressed to them. I would also ask them to analyse Mr. Wordingham's projected scheme, and I think they should agree (from the point of view of their interests) that they will be in the position of the ostrich with its head buried in the sand when they find themselves sitting on that Grand Council with *their* "common enemy." I hardly think that responsible members of the E.T.U. will be under any illusion as regards the attitude to be adopted towards Mr. Wordingham and his ideals. *We* know them from experience, and I think every trade unionist has food for thought when he thinks of the mental indigestion Mr. Wordingham and his colleagues suffered when they had to swallow that trade union pill. With reference to the intention to apply for a Royal Charter, &c., it is only natural from the class tone of the Address that in the intention to consolidate professional class interests that relic of feudalism—the Royal Charter—should be invoked. It is the duty of all workers in the electrical industry to watch this move whereby a pampered minority will very deliberately "pick the best plums for themselves" under the direct patronage of the Crown. I would venture to say as a worker and a member of the E.T.U., that, of the many effusions of Mr. Wordingham, this address is the most revolting and nauseous exhibition of "class *versus* class" that we have had the privilege of reading. My earnest sympathy is extended to those unfortunates who will swallow this bait so temptingly held out to them by the President of the I.E.E. In conclusion, I would reiterate the fact (for their benefit) that there *are* only two sides to industrial questions, and that no matter how much they may pride themselves as to the possession of superior "brains" it is to their benefit to be organised with the workers.

M. Boyle, E.T.U.

Newcastle-upon-Tyne,
June 15th, 1919.

The E.P.E.A. Award.

Like "rare and refreshing fruit" in this hot weather comes the laboriously facetious letter of "Connaught T. Smith." Such a delicious sense of humour is simply priceless, and must go far to sustain the drooping spirits of the author what time the payment of the award tarrieth.

Who, regarding the tone of his former effusions, would have credited him with the possession of a dual personality? The forbidding Mr. Hyde of the past few weeks has metamorphosed into the genial Dr. Jekyll of to-day, whom the heady vintage of his exuberant high spirits has inspired to the giddy jazz with which he has just occupied so much valuable space in your columns. His concluding remarks, however, seem to point to its being a valedictory address, for which relief much thanks!

When I rashly ventured to use metaphor to illustrate my points, I confess I did not envisage all the possible results that might follow the reckless unsheathing of the lethal weapon which has afforded Mr. Smith so much hilarity. He desires to *use* the sword—so much was already obvious from his previous letters—but the usual preliminary to doing so is to release it from its scabbard, the cutting edge of the latter being less efficient than that of the naked blade. To "strongly draw," the expression to which Mr. Smith takes exception, and which, by the way, is not of my invention, but is a quotation from a very famous piece of literature, implies that the drawer is strong, has a strong cause, and is prepared to use his weapon strongly and resolutely until his purpose is effected; moreover, the mere demonstration of potential force has been known to prove quite successful in bringing an enemy to reason without proceeding to extremities, provided the will to make good the threat is present and recognised, so that Mr. Smith's humorous dissertation loses its point, while the sword does not.

As to charming the kernel out of a nut by moral suasion, such an absurd suggestion was never made. As long as moral suasion is effective in securing a desired end (this, observe, has nothing to do with nuts) as it often is in spite of the scorn poured on the idea, it is foolish to adopt hostile measures. These should only be employed when all other legitimate means of obtaining justice have proved futile. The tone of Mr. Smith's previous outpourings gave the impression that he had no use for anything but drastic action, first, last, and all the time.

Your correspondent stigmatises the statement that "a very considerable percentage of E.P.E.A. members have received the award" as incorrect, and cites in support of his contention the latest report of the Association. In his haste to ridicule my metaphor it has evidently escaped his observation that "members" and "undertakings" are not synonymous. Even a few undertakings may employ a large number of members, and conversely.

With "Connaught T. Smith's" grievance, and that of many other members of the Association, I can sympathise, but, as I have already said, to sneer and gird through the columns of the Press at the only organisation with the power of redress is to crab its usefulness, and to weaken the hand on which we depend, when necessary, to "strongly draw" the sword.

Shift Engineer.

June 11th, 1919.

Further to correspondence on the above, I think you will quite agree, Mr. Editor, that Mr. Connaught T. Smith and myself have done our best through your columns to get at the truth about this award. Up to now we have been unsuccessful. Will not the secretary of the association give us a straight answer? Is the award backed by any authority? And what is the remedy to a point-blank refusal by the committee to accede to the award? Your correspondent "Wessex" has misconstrued my letter of May 6th. Many of us have refrained from joining up till now, as anyone in outlying districts will realise the difficulty however much one is in sympathy with the movement. I sincerely hope I shall become a member of either or both unions, but am afraid I shall be ineligible for the E.T.U.

Regarding wages being *dangerously near* your own, I know cases where they are *above*, more by good luck than ability, and where far less hours are worked, and no responsibility. I quite agree that competent labour should be well paid, but where the price for the "duds" is the same I cannot agree with E.T.U. methods.

I can assure Mr. Connaught T. Smith that I have met, conversed, and shaken hands with, these elusive supermen, who have received the award, but they belong to the super-stations, and having got it, I am sorry to say, they prefer to lie low. To go further, I will cite a case to committeemen, directors, and a very few chiefs: A large Corporation undertaking was severely criticised recently (and it required it) not very far from here. The whole staff joined the E.P.E.A. with disappointing results, in fact no result, month after month; in desperation they joined the E.T.U. What happened? With the backing behind them of practically the whole of the men, both inside and out, they immediately received the grant which they had been trying to get through the E.P.E.A for months and months. There is no need to ask why! and comment is unnecessary. "Change over" puts the matter very neatly.

I cannot agree with "Shift Engineer" (I do wish your correspondents would put their names, surely there is no need for camouflage). I saw page 648 ELECTRICAL REVIEW; very nice! But instead of the association worrying over power Bills, let it get the award applied to its members. I will never believe "Bolshevik" a term applicable to any Britisher; a deal more publicity to the whole affair is what is required, and Mr. Connaught T. Smith's criticisms are justly deserved. What about a new association, the C.E.E.A.

(Chief Electrical Engineers' Association) as an offshoot to the E.P.E.A. and E.T.U. I have heard of a very good man who might take the secretaryship.

H. A. Harding.

Bognor Electricity Works,
June 11th, 1919.

Working Speeds in Radio-Telegraphy.

In your issue of the 6th inst., under the heading of "Working Speeds in Radio-Telegraphy," Mr. E. Raymond-Barker asks for some information in the interests of the telegraphing public, which I have pleasure in supplying.

The delays complained about in respect of the Madrid-London service were mainly due to the strike of the telegraph staff of the land lines in Spain, which resulted in a great accumulation of messages in the telegraph stations throughout that country.

The wireless stations, however, would have been able to cope with that accumulation if modern installations had been available, but the stations which are at present serving are old, and were not constructed for a commercial telegraph service between the two countries, and they are only being used temporarily pending the construction of up-to-date and efficient stations for this work.

The wireless stations which have been erected to conduct a commercial service which I had in mind, and to which reference is made, have been devoted to war purposes ever since they were constructed, and have not yet been completely released.

The wireless service has, nevertheless, greatly relieved the congestion of the cables, and, apart from the delays referred to above in consequence of the accumulation resulting from the Spanish telegraph strikes, has given great satisfaction.

Marconi's Wireless Telegraph Co., Ltd.,
Godfrey C. Isaacs,
Managing Director.

London, W.C.,
June 13th, 1919.

Mathematics in Illuminating Engineering.

I read with much interest the article in your issue of the 6th inst. by Mr. G. W. Stubbings regarding the importance of elementary mathematics to engineers. Although not myself an engineer, may I add to his remarks that if gentlemen in the electrical and allied industries embraced that subject in their studies it would assist them to initiate improved ideas in their commercial organisation and sales campaigns, and thus enable more successful competition against much of the cheap and inefficient instruments and accessories introduced to the commercial market. It would command better prices in transactions, and correspondingly tend to forbid entry of that ignorant class who impudently pose as engineers, by exposing their inability to uphold foolish arguments and misleading statements upon subjects which mathematics can always successfully guard in science.

My mind is carried at the moment to the absurd statements issued and accepted regarding the relation of reflectors to visual "efficiency." The prevailing interpretation implied by advertisers of these, for commercial motives, gives inference which deludes the average engineer and public into the belief that foot-candle intensity is a more important factor to the eye than uniformity of that intensity (*i.e.*, diversity factor).

It is well known to a few, and can in fact be proved by practical test, that an intensity of illumination may be from 33⅓ to 50 per cent. less in one case than another, but yet give perceptibly clearer vision when the installation is engineered by mathematics.

Uniformity in distribution of light upon surfaces, whether distributed by opal, prismatic, or any other reflectors, is equally in each case purely an application of mathematics, and if each or any or all (when properly manufactured) be adjusted by correct calculations taken from a photometric curve of the units employed, no eye would be able to distinguish a difference between the resulting foot-candle intensities obtained.

It cannot be too strongly urged in the interests of *bona fide* engineers and the promotion of more profitable commerce that "efficiency" in lighting is dependent upon mathematical, and not upon the so-called reflector efficiency, which latter is relatively an unimportant factor.

The much accepted "constant" ratios employed in adjusting lighting units should, I venture to say, be discouraged from an engineering point of view, because it will be found that mathematics do not support the claim to efficiency in distribution by such "constants," which have been accepted far too apathetically. Such systems also disguise the value of the engineering services actually needed, and make them apparently merely auxiliary to reflector service, which cannot assist the industry either as a profession or a science.

All this can be readily ascertained by those who care to calculate foot-candle intensities in varying ratios upon a square served by four units (any make of reflector) with one placed at each corner.

Space prohibits my offering examples here, but publication will issue shortly.

Sydney O. Cook.

London, S.E., *June 16th*, 1919.

LEGAL.

"Unlicensed" Tramcars.

Before Fleetwood Magistrates, on June 12th, the Blackpool and Fleetwood Tramroad Co. was summoned for using an unlicensed tramcar. Mr. Cottam, for the Fleetwood Council, said the case was brought to establish the right to require the licensing of all cars on the defendants' tramway. The company had challenged the right of the Council under the Act which it secured in 1896. It was admitted for the company that in past years it had paid a licence at the rate of 5s. per car, but its solicitor contended that this was not a legal charge. The Council might just as well try to licence the railway company running through the town. Mr. J. Cameron (tramways manager) said the licence had been paid in past years under a false impression. The Bench ruled that the Council had a right to license the cars, and the Tramway Co. was fined 20s. A case was stated for appeal.

Compensation for Cut Telegraph Wires.

At Ballymote (Co. Sligo) Quarter Sessions, before County Court Judge Wakely, the Postmaster-General was granted £20 compensation, together with £7 for expenses, for the malicious cutting of telegraph wires between Ballymote and Kilfree, by parties unknown.

BUSINESS NOTES.

The "Electrical Review" Index.—As it is still necessary to effect every possible economy in paper consumption, the Index to Vol. LXXXIV of the Electrical Review, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding or other purposes is asked to make early application therefor to the Publisher, Electrical Review, 4, Ludgate Hill, E.C. 4.

New French Companies.—There has been formed at Paris the Société des Lampes Eldea (L. D. Avellar et Cie.), with a capital of 500,000 fr., for the manufacture and sale of all kinds of electrical apparatus.

L'Etoile (Société pour la Fabrication d'Accessoires Déstinés à la Mécanique, l'Electricité et les Mines) is the style of a company formed at Aubervilliers, with a capital of 300,000 fr., for the purposes indicated in its title.

The Anciens Etablissements Berger has been converted into a company with a capital of 2,250,000 fr. Its specialities are the making and sale of all kinds of electrical goods, and in particular submersible and centrifugal pumps.

There has been constituted at Paris the Compagnie d'Exploitation Radio-Electrique, with a capital of 2,500,000 fr., whose objects are the purchase, sale, installation, and working in France and abroad of all kinds of telegraphic, telephonic, and wireless signalling apparatus.

Under the title of the Société P.M.E., a company has been formed at Paris with 102,000 fr. capital, to make and sell all kinds of mechanisms and electric motors.

The A.S.E. Ballot for a 44-Hours' Week.—The *Times* states that the result of the ballot among the Amalgamated Society of Engineers on the 44-hours' week is :—For, 64,908 ; against, 2,599.

According to the *Manchester Guardian*, a conference of delegates of the Amalgamated Society of Engineers is being held in Manchester. Among the questions to be considered is that of amalgamation with other Unions. This not only affects the A.S.E. in this country but also in America and Canada, where the Society has branches, with a considerable membership. The International Association of Machinists of America has sent over two representatives to investigate the matter. It has also been decided to invite to this country delegates from the Councils of the A.S.E. in America and Canada to take part in the discussion of the question.

Export Trade.—The British and Allies Merchants' and Brokers' Association (Parent), Ltd., has been constituted with offices at 343-5, Dashwood House, New Broad Street, London, E.C. 2, with the object of linking-up and consolidating the interests of manufacturers and traders within the Empire, and to foster the keen desire of the Allied nations for reciprocal trade with the British Empire. It is desired by means of a strong organisation to secure these objects and to annex a large proportion of Germany's pre-war export trade. The matter is fully explained in a folder that has been issued.

Factory for Sale.—Among the national factories for sale by direction of the Disposal Board, Ministry of Munitions, is that of the Willesden box factory, situate about one mile from Park Royal Station. The buildings comprise main shop, including machine, assembly and polishing shops, power and boiler houses, timber and loading sheds, offices and stores, and cover an area of over three acres.

Fire.—By a fire at Trafford Park on Thursday night, last week, two large warehouses, an engineering stores, two timber yards, and the estate office of the Trafford Park Co. were destroyed.

The Protection of Australian Industries.—The *Times* correspondent in Australia states that the Industrial Protection League has been inaugurated in Melbourne, under the patronage of Mr. W. A. Watt, Acting Prime Minister. The policy of the League predicates high Protection, its general purpose being set out as that of bringing to bear upon Parliament such a pressure of public opinion as will compel the Legislature to give Australian producers command of their own domestic markets and facilitate the development of a great export trade and of supporting candidates who will vote for an efficient Protective Tariff to Australian industries, especially key industries, which will make Australia, as far as possible, independent of external supplies.

Australian-made Cables.—In a note headed "The Real Australian Spirit," the *Industrial Australian and Mining Standard* states:—"The Electric Supply Committee of Melbourne City Council has given the lead to other public bodies in the matter of the encouragement of Australian industries. At a recent meeting of the Council it was announced that for the first time it had been possible to purchase Australian-made copper cables. The Committee recommended the acceptance of the tender of the British Insulated and Helsby Cables, Ltd., at £2.273 for the supply of 16 tons of assorted gauges. It was stated that the tender accepted was 9 per cent. higher than a British tender, 7 per cent. higher than an American. 14 per cent. higher than a Canadian, and 15 per cent. higher than a Japanese tender. The cable will be produced at the works of Metal Manufactures, Ltd., Port Kembla. New South Wales."

Engineering War Bonuses.—Two proposals are put forward just now regarding war bonuses in the shipbuilding and engineering trades. The employers seek a reduction of 5s. per week in the war bonus of skilled and unskilled men; the employés are asking for an advance of 15s. per week for skilled men, for time and piece workers.

A Belgian Metal Trust.—It is reported that Belgian manufacturers are endeavouring to form a metal trust with a capital of 300,000,000 fr. (£12,000,000), the object being to replace the numerous works destroyed in Belgium during the war by three or four large works each of which would specialise in the manufacture of certain articles.—*Times.*

German Industrial Investigation.—A German wireless message reports the foundation of a Society for Comparative Industrial Investigation, to study all questions connected with the reconstruction and development of German industry.—*Times.*

Business Correspondence with Germany.—It is announced, with reference to the General Licence of the Board of Trade authorising, on certain conditions, the supply and negotiations for the supply of foodstuffs to Germany, that, although the licence covers direct negotiations with firms in Germany in connection with the supply of foodstuffs, there is at present no direct postal communication between this country and the parts of Germany that are not in the occupation of the Armies of the Associated Governments, and that traders should therefore send their letters for those territories on matters covered by the General Licence through an intermediary in a neutral country.

Technical Teachers at Westinghouse Works.—Delegates attending the annual Conference at Bolton of the Association of Teachers in Technical Instruction, on June 11th, visited the works of the British Westinghouse Electric and Manufacturing Co., Trafford Park, where they found the works school of special interest.

Sales of Government Stores.—In connection with the sales of surplus Government property, samples of surplus and captured electrical instruments, telegraphs and telephones, have arrived in London, and have been arranged at the Exhibition at the Agricultural Hall. A reference to these stores will be found in our advertisement pages to-day.

Brazilian Industrial Delegation.—The Federation of British Industries is holding a luncheon at the Savoy Hotel, on Friday, June 27th, to afford members an opportunity of meeting the delegation from Brazil, who are coming to this country at the invitation of the Federation. The delegates will later visit the following centres:—Birmingham, Bradford, Bristol, Edinburgh, Glasgow, Leeds, Leicester, Liverpool, Manchester, Newcastle, Nottingham, Sheffield, and Swansea.

The delegation includes Dr. Pandia Calogeras, the Ex-Minister of Finance, Agriculture, and Commerce; and other eminent Brazilians. Members of the Federation of British Industries attached to the tour are Mr. Guy Locock, C.M.G.; Brig.-General A. H. Leggett, C.M.G.; Mr. Edmund L. Hill, general secretary; and others.

Electric Lamp Competition from the Continent.—A very considerable inflow of imports will ensue upon the decision to admit bulbs for electric lamps at the rate of 50 per cent. of the 1913 volume of business. Before the war we derived our principal supplies from outside, chiefly from Germany. For the present, Denmark and Holland look like profiting most by the modification of the embargo. It will require a good deal to convince some of the British manufacturers, however, that Germany is not the real country of origin as regards a large proportion of the supplies of glass goods which have been awaiting the moment for shipment from the Continent. Whatever warrant there may be for it, the belief is widespread that quantities of German glass have been passed over the frontier. This is assigned as one explanation of the offers of glass at the comparatively low prices which are being received from districts contiguous to Germany. During the last five years we have learnt to make electric lamp bulbs for ourselves. Special departments have been created for this manufacture at most of the glass houses of Birmingham and Stourbridge, and other districts have helped in overcoming past deficiencies. Progress has been rapid since 1917. Youths trained for the work have attained such skill that, mainly by dint of higher proficiency, factories have trebled their output. But with the best that we could do the shortage has not been overtaken. The readmission of a limited volume of imports will leave plenty of trade for the home producer—for the present. As to the possibilities of this branch in the future, some of our manufacturers are not too confident about holding the ground won unless effective means are taken to prevent unfair exploitation of the market. Many of them have gone into the business to rescue the country from a position which was full of peril. Their hope is that, in view of the importance of the industry to the safety of the State, the Government will not suffer it to be strangled by outside competition. The quality of the British-made bulb is spoken of very appreciatively, and it is stated that the output amounts to a quarter of a million a week. It is understood to be the intention to import bulbs wired ready for use.—*Birmingham Post.*

Foreign Trade.—The May Figures.—The following are the electrical and machinery figures given in the official returns of imports and exports for May:—

Imports.	*May,* 1919.	*Inc. or dec.*	*5 months,* 1919. *Inc. or dec.*
	£	£	£
Electrical goods, &c. ...	124,134	+ 43,005	+ 190,850
Machinery	1,118,144	+ 127,427	+ 2,128,375
Exports.			
Electrical goods, &c. ...	454,114	+ 79,113	+ 762,274
Machinery	2,664,378	+ 969.556	+ 3,187,210

Plant for Disposal.—The Disposal Board Ministry of Munitions is offering for sale the electrical plant for "Cottrell" precipitator at Oldbury Explosives Factory. For full particulars see our advertisement pages to-day.

Spain's Resurrection is Indubitable.—The Spanish Ambassador to the United States, Senor Juan Riano, contributes an article under the above heading to the May issue of *Ingeneria Internacional* (New York). After giving a *résumé* of recent industrial developments in Spain, he concludes:—

"Spain has now definitely started on several large undertakings, such as the new railway from the French frontier to Algeciras, the new railway from Madrid to Valencia, and from Madrid to Vigo. Further, she wishes to construct a railway to connect the naval base of Corunna and Ferrol, with Gijon, and thus complete the communication between Galicia, Asturias, and Vascongadas, by means of a line running along the Cantabrian coast. She wishes, too, to complete the network of strategic and military railways within the country, and to this end the Government guarantees a return of 5 per cent. per annum on the capital involved in its construction. She wishes to construct a port at Vigo in order to furnish adequate facilities for the big liners of the Vigo—New York Line.

"In addition to the important projects cited above, Spain offers many other openings for the investment of both Spanish and foreign capital, among which may be mentioned the electrification of some sections of the railways of the North; the construction of a good number of inter-urban tramways, such as that from Corunna to Santiago; the construction of dockyards in Malaga, in San Felui de Guixole, and in other parts; the installation and exploitation of the free ports of Barcelona and Cadiz; the utilisation of large water-falls for the production of electric energy; the intensive exploitation of a large number of coal mines, mines of iron ore, copper, lead, wolfram, &c.

"All these offer, not solely a very lucrative return to American capitalists, but also grand opportunities for the United States to supply enormous quantities of material, machinery, tools, and manufactured commodities. This, of course, is well known to the directors of that powerful movement in America, which, since the cessation of hostilities, has devoted its energies towards capturing the markets of those neutral countries formerly dominated by the Central Empires. A large number of American financiers, engineers, manufacturers, and merchants, are already in the country studying its needs and possibilities, and many important firms are now establishing branches and agencies, or appointing representatives, in Spain."

Aerodromes as Factories.—Several aerodromes that are not permanently required for Government purposes, are to be disposed of. They are situated at Goldhanger and Stow Maries in Essex: two in Suffolk at Burgh Castle and Covehithe; one at Lilbourne, on the borders of Northants and Warwickshire; and the others are at Ramsey (Hunts), Telscombe (Suffolk), and Edzell (Kincardine). The various buildings are of brick, corrugated iron, and timber, with water supply and electric light installed, and could readily be adapted for factory purposes. Particulars from the Disposal Board, D.B.I.a.3., Room 135, Charing Cross Buildings, Villiers Street, W.C. 2.

Catalogues and Lists.—The General Electric Co., Ltd., 67, Queen Victoria Street, London, E.C. 4.—Reprint of "S" Section catalogue dealing with electric lighting supplies. This has been brought up to date as far as prevailing conditions will permit by the inclusion of as many new patterns as are already available. Minor adjustments have been made in some of the list prices, which, however, stand approximately at the pre-war level, so that a single uniform advance applies to the whole catalogue section. Temporarily the prices of a few articles listed are withdrawn, as is intimated by a printed slip, but in most of these cases special quotations can be given on application. The issue of an entirely new catalogue with fixed list prices presents innumerable difficulties at the present time, whilst conditions are in such a state of rapid fluctuation. In consequence the company have decided to tide over the period of transition by continuing to operate for the time being on reprints of the pre-war lists, each embodying such revision as can already be made. The "S" Section catalogue embraces distribution and cut-out boards; all kinds of branch switches, wall plugs, adaptors and connectors, ceiling roses cut-outs, lampholders, &c.

Messrs. Higgs Bros., Sand Pits, Birmingham.—Stock list of shunt-wound interpole motors for 110, 230, and 460 volts.

Sterling Telephone and Electric Co., Ltd., 210-212, Tottenham Court Road, London, W. 1.—Advance copy of new folder ("Has Anybody here seen Mr. Brown ?") briefly describing the Sterling staff signalling system.

Book Notices.—*Faraday House Journal.* Vol. VIII, No. 3, June, 1919. London: Faraday House.—In this issue, besides the usual supply of notes of interest to students, reference is made to Dr. N. Campbell and Mr. C. C. Paterson's recent paper on "Some Characteristics of the Spark Discharge and its Effect in Igniting Explosive Mixtures," read before the Physical Society of London. The object of the investigation was to determine the relation between the electrical characteristic of a spark discharge and its power of igniting explosive mixtures. Regarding the 1918 edition of the Standardisation Rules of the A.I.E.E., criticism is levelled against the lay of a wire of a stranded conductor being defined as the "pitch of the twist" of a wire. Dr. Alex. Russell, in an interesting though rather mathematical contribution on how to obtain constant current circuits from constant potential circuits and conversely, describes three of the simplest methods of doing so.

"George Westinghouse: his Life and Achievements." By F. E. Leupp. Pp. vii + 303 and 11 illustrations. London: John Murray. Price 15s. net.

"Physical Laboratory Experiments for Engineering Students" (Part 1—Mechanics, Sound, Heat, and Light). By S. Sheldon and E. Hausman. Pp. v + 134 40 figs. London: Constable & Co. Price 6s. net.

"Circular No. 24 of the Bureau of Standards." Contains lists of the publications issued by the Bureau, consisting of scientific and technologic papers, circulars, and miscellaneous publications, also Supplement No. 1 to the Circular. Washington: Government Printing Office. Price 25 cents.

The Provincial Electric Supply Committee of the United Kingdom.—At the second annual meeting of the General Committee of the Provincial Electric Supply Committee, on May 27th, 1919, Mr. H. B. Renwick, chairman of the Committee, said that the year 1919 was likely to become one of the most momentous in the history of the industry, which was at last to be freed from the paralysing parochial fetters which had bound it all these years—at least, that is what people said. It was now admitted by Parliament to be a key industry—the one industry which was to rescue the trade of the country from possible bankruptcy. All he would say at that moment was—better late than never. He saw no reason why they should not make a good job of it now, if it were handled in a statesmanlike way—on big, broad lines, freed from party politics, and with a proper regard to the fair claims of the supply industry and the real needs of the country.

The subscriptions had increased to £244, while working expenses for the year amounted to the modest sum of £114. Two special items—the subscription to the Federation of British Industries and arbitration expenses under Award 2,772—were met by funds specially contributed by certain member-companies. The balance in hand was £280. The membership had increased from 106 to 120, and covered practically all the provincial provisional-order companies in the United Kingdom.

The Committee had taken effective action in connection with the Statutory Undertakings (Temporary Increase of Charges) Act, and the Ways and Communications Bill. Another matter which had engaged a great deal of time and attention was the Labour question; the past year had been one of almost unintermittent demands for increases of wages by Trade Unions and of awards under the Ministry of Munitions or the Ministry of Labour, and the Committee had dealt with all these cases whenever they affected the Provincial Electric Supply Committee. The thanks of the Association were particularly due to its two representatives—Mr. Wigham and Mr. Scott-Moncrieff—who had both devoted to these matters a very considerable amount of time during the year.

The question of Labour was the one disturbing element, not only in this industry but in all other industries, which threatened to retard indefinitely the commercial recovery of the country after the war, and to interfere with production, which was the one vital factor in post-war problems.

The Committee was doing its best to give the Government proposal of National Industrial Councils every chance. The Ministry of Labour called the first meeting of the Industrial Council on May 1st, and the Association was fully represented on that Council. He was a firm believer in the principle of closer co-operation between employers and employés as a solution of Labour difficulties, but he was not sure that the machinery adopted under the National Industrial Councils would give the favourable results which many anticipated.

The Committee had become a member of the Federation of British Industries, through the generosity of the bigger companies on the Committee.

In the matter of income-tax allowances, the Committee had obtained some concession. It had obtained the provisional consent of the Somerset House Authorities for Electricity Companies to be included amongst those entitled to the special assessment on buildings detailed in a memorandum sent to members. The question of rating, too, had engaged a good deal of attention.

The Committee was invited by the Institution of Electrical Engineers to co-operate with them in forming a Committee to establish a national proving house; this matter had a very important bearing for electric supply companies, and called for their support. The Committee was also represented on the Electrical Standards Committee.

In connection with the Household Fuel and Lighting Order, 1918, the Committee was represented at the numerous conferences which took place. From an electric supply point of view, the Order was as satisfactory as could have been attained under the circumstances. He thought it was now fully appreciated, as they had always insisted, that small reductions in electricity used for lighting purposes did not necessarily result in any appreciable saving of coal at generating stations. The Committee assisted the Coal Controller in connection with circulars urging on the public the necessity of economy in coal for household use, and a large number of member-companies distributed circulars in their correspondence, &c,, both in the National interest and also as having a bearing on their own interests.

Mr. Renwick's remarks on the Electricity Supply Bill will be abstracted in a later issue; a private discussion on the subject followed his address.

Trade Announcements.—Messrs. R. H. Longbotham and Co., Ltd., who have been established at Wakefield for over 30 years as engineers and machinery merchants, and have carried on an extensive business in general machinery, especially mining, electrical, and contractors' plant, are removing this month to Doncaster. They have sold their works at Wakefield, and are making their head office at 41, Station Road, Doncaster. The Newcastle office will remain at Milburn House (a).

Messrs. Pinkney & Forster have set up in business as electrical engineers and contractors at 11, Princess Street, Newcastle-upon-Tyne; and they wish to receive catalogues from manufacturers of fittings, accessories, heating and cooking apparatus, &c.; also country house lighting plants, batteries, and so on. Both partners have just been demobilised. Mr. Pinkney was a captain in the Tyne Electrical Engineers, R.E., being in command of No. 3 Anti-Aircraft Company, R.E., York., at the time of his demobilisation, and Mr. Forster was a lieutenant in the 6th Northumberland Fusiliers. Prior to the war both gentlemen were with Messrs. Robson and Coleman, electrical engineers and contractors, of Newcastle.

Messrs. Hamilton & M'Pherson have commenced business as electricians at 34, Caledonian Road, Wishaw.

Messrs. Hooper's Telegraph and India-Rubber Works, Ltd., have removed their City offices to 5, Drapers' Gardens, London, E.C. 2. Telegraphic address: "Linear, Stock, London." Telephones: "London Wall 401."

Messrs. Speedy & Eynon have removed from Duke Street, Adelphi, to 22, Essex Street, Strand, W.C. 2. They will be glad if firms will send copies of their new catalogues with up-to-date prices.

Mr. H. T. W. Bowell has relinquished his work at the War Office, and resumed the management of the Silent Electric Clocks Co.'s business at 192, Goswell Road, E.C. 1. During the war every man of military age in the employ of the company joined the Forces, and several over age undertook work of national importance; but, nevertheless, a considerable number of installations were carried out. The staff are now returning to work, and a new catalogue is in preparation.

Messrs. Sidney & Ellis have commenced business as electrical engineers and contractors at 12, Barton Street, Bath, and they desire to receive catalogues and prices from manufacturers and factors.

T O K Rotary Switches.—We are glad to be able to divulge this week the secret of the mystery attaching to the word T O K, which has appeared in our advertisement pages for some weeks without explanation. The T O K Manufacturing Co., Ltd., of Empire Works, West Ham Lane, London, E. 15, is putting on the market a line of rotary switches to take the place of the American switches which have been widely used on British cooking and heating apparatus. The T O K switches will be made in England, of British materials, by British labour, with British capital. They are new only in that sense; the company has adopted a design of approved merit, and will keep the fixing and wiring centres the same, so that there will be no hindrance to the substitution of the British for the foreign switch. For some time it has been difficult to obtain a supply of these rotary switches; that difficulty is now removed, and we are sure that users will be only too glad to place their orders with a British firm. The business is in the capable hands of Mr. H. H. Holmes, the late sales manager of Marylebone electricity supply department, and Mr. E. E. Sharp, of Venner Time Switches, and Chamberlain & Hookham meters (he is giving up the latter connection), and we wish all success to the new venture.

Liquidation.—Engineering Proprietary, Ltd., 97, New Bond Street, W.—First meeting of creditors and contributories, June 24th, at Carey Street, W.C.

Electrical Trade in the Dutch East Indies.—In the course of an article in the *Bulletin* of the F.B.I. on "Trade Prospects in the Dutch East Indies," the writer says :—"Electric lighting is very popular, and it is extending all over the Archipelago. Even the smaller towns have, or are about to construct, electricity works, and many of the estates have their own electric supply. There is, therefore, a constant demand for electric lamps switches, and all kinds of equipment. Small sets for estates, driven by oil engines, would find a ready market. This trade was largely in the hands of Germany before the war."

LIGHTING AND POWER NOTES.

Aberystwyth.—Proposed Purchase.—The Electricity Supply Corporation has acknowledged the Council's offer of £20,000 for the Aberystwyth electricity undertaking, and states that the directors are prepared to enter into negotiations, and asks for an interview with a Committee of the Council. The matter has been referred to the Public Works Committee, with power to appoint a small Committee.

Accrington.—Proposed Extensions.—Ald. Higham, referring to the proposal to borrow £85,000 for extensions to the electricity works, said the L.G.B. was going to have an inquiry into the application. Sir John Snell had already granted an application for a large sum of money for extensions—in fact, the erection of an entirely new station at Blackburn, involving well over a quarter of a million. In all probability, Accrington would have no difficulty in getting its grant for the extensions. A similar concession of borrowing powers was foreshadowed at Burnley, and he believed Nelson and Colne had also been advised to get on with their schemes. This was in contradiction to the policy of erecting a big power station which was going to do the whole of the generating for them.

Argentina.—E.L. Scheme.—An electric generating station for power, light, heating, and general purposes has been authorised for the port of Santa Cruz according to the *Boletin Oficial* of April 9th. The concession is for 25 years, and applies to the municipality of Puerto Santa Cruz, but the village of Paso Ibanez must also be supplied with energy when its population reaches 1,000 inhabitants. The generating station must produce 200 KW. per hour. The types of cables for various voltages are specified, also the tariff to be imposed for lighting, heating, installation, and other purposes. There are also a number of obligations imposed on the concessionnaire and on the public who may use the energy.

Batley.—Loan Sanction.—The T.C. has received L.G.B. sanction to borrow £4,118 for extensions of electricity mains.

Burnley.—A report regarding the proposed extension to the electricity works had been prepared by Mr. E. M. Lacy, the electrical expert, which is to be forwarded to the B. of T. for consideration in connection with the general scheme of generation in the district.

Blackpool.—Price Revision.—A charge of 33⅓ per cent. is to be made for electricity instead of 15 per cent. as heretofore. The present lighting and power tariffs will remain but the heating and cooking tariff of 1¼d. will be increased to 1½d. per unit.

Bolton.—Loan Application.—The Corporation has decided to apply to the L.G.B. for sanction to borrow £5,582 in addition to the sum of £23,032 for the cost of alteration to the system of distribution and sub-station equipment to enable the electricity department to carry out the work which was contemplated when the application for sanction to borrow was originally made in 1915.

Price Revision.—The following increases have been decided on :—Lighting and power charges to be increased by 0·1d. per unit ; bulk and special agreement rates to be increased by 0·02d. per unit.

Broadstairs.—Public Lighting.—The U.D.C. has decided to have tried on the sea front, for use during July, August and September, 10½ watt lamps, on the understanding that the Isle of Thanet Electric Tramways and Lighting Co. installs the lights, and maintains them, for 18s. each per month.

Bury.—Year's Working.—There was a loss on the year's working of the Corporation's electricity department of £1,983, against an estimated profit of £1,650. This was due to the reduction in the demand for power since the Armistice was signed. Coal cost £20,200, against £14,600 during 1915-16, and wages went up from £5,132 to £10,706 during the same period.

Callington.—Loan Application.—The Urban Council is to apply to the L.G.B. for sanction to a loan for the installation of electric light.

Colchester.—Price Revision.—The T.C. has decided to increase the charge for energy for lighting to the statutory maximum of 8d. per unit, and for power, including the tramways, by about 25 per cent.

Canada.—The annual report of the working of the Toronto hydro-electric system for the year 1918 shows a gross income of $2,353,413, while working expenses amounted to $1,485,613, leaving a gross profit of $867,830. Deducting interest, depreciation, and sinking fund charges ($816,163), there remained a surplus of $21,666. During the year, in accordance with statutory requirements that charges for municipal services be on a cost bases, the system was required to pay to the city $22,317 as a rebate on the 1917 street-lighting account, and to reduce the rate for the year 1918 from $8 to $7 per lamp per year, which resulted in a saving to the city of approximately $15,000.

During 1918 230,113,561 units were sold as compared with 171,691,213 in 1917, the connected load amounting to 184,930 H.P. and the peak load to 60,151 H.P. ; the meters in use numbered 53,598, against 50,161 ; street lanterns, 29,527, against 45,841. The increase in the gross income over that of 1917 was 14·9 per cent., and the increase in the commercial income over that of 1918 was 24·7 per cent. The commercial income for the year amounted to 78 per cent. of the total, compared with 71·8 per cent. in 1917 67 per cent. in 1916, and 55·05 per cent. in 1913. Power purchased from the Hydro-Electric Power Commission of Ontario during 1918 cost $821,251, compared with $684,470 in 1917.

Chobham.—E.L. Scheme.—The Woking Electric Supply Co. has informed the P.C. that it has taken the necessary preliminary steps with a view to supplying electricity to the parish, and that mains would be laid directly the consent of the B. of T. had been secured. The company is to be asked for terms for public lighting.

Continental.—France.—The growth of water-power undertakings in the French Alps in the last few years is, according to M. Blanchard, truly noteworthy. In the pré-Alps du Nord little progress is to be noticed, but along the sub-Alpine lowlands, and especially in the basins of the Arly and the Drac rivers, it is very considerable ; here the H.P. has risen from 171,000 to 233,000. In the great inner Northern valleys the increase is 24,000 H.P. on the Romanche, and 27,300 H.P. in Maurienne. An outside group is in full development on the streams flowing beyond the Alps system. These comprise the Bellegarde, Fier, Jonage and Lower Isère regions. The power here utilised has grown in two years from 31,000 to 129,000 H.P. In the Southern Alps, the Durance Valley has been further equipped by the Ventavon and Sisteron works, and by the St. Tulle works, under construction ; the growth is equal to 63 per cent. on 1916. Up to the middle of 1918 therefore, the progress in the Southern Alps stands for a total of 250,000 H.P. installed ; in the Northern Alps, 800,000 H.P., or a total for the French Alps of 1,650,000 H.P., a figure which exceeds those of Italy and Switzerland ; moreover, schemes shortly to be completed will easily swell this total to 1,500,000 H.P.—*L'Electricité.*

The Société Hydro-Electrique de la Bridoire has been formed at Lyons, with a capital of 1,250,000 fr., for the working of a waterfall on the Tiers and erection of a hydro-electric station at Bridoire, Department of the Isère.

The Société des Forces Motrices de Vercors is the applicant for a concession to generate electricity on the Isère. A station is to be built on the left bank of the river at Pisançon, Department of the Drôme.

The Energie Electrique du Littoral Méditerranéen has applied for a further concession on the river Durance, making the fifth owned by this company on this river, three of which are working, generating 70,000 H.P., another works of a capacity of 40,000 H.P. being under weigh, and expected to be finished by the end of the year.

Italy.—There has been established at Genoa the Società Electrica Alto Tanaro, for the working of a hydro-electric plant on the Tanaro river and other purposes. Capital, 100,000 lire.

To study and promote the use of electric furnaces, erect factories, &c., in the Trentino region, the Industrie Elettriche Trentine has been formed at Milan, with a capital of 1,500,000 lire. Six electric undertakings, two banks, and the Meridional Railway Co. are the foster parents of the concern.

Spain.—The Sociedad Hidro-Electrical Galle, of Madrid, has secured a concession to put down plant to utilise the water power of the river Tajo, at Acebache, to generate electrical energy for lighting and power purposes.

Sweden.—Among the new companies recently formed in Sweden in connection with the distribution of electricity for lighting and power purposes are the Utomhertens Elektriska Aktiebolag, of Ha, and the Elektriska B.S.H. Aktiebolag, formed at Lit.

Coventry.—Year's Working.—The annual accounts of the Corporation electricity undertaking show a profit for the year of £12,649, and an available surplus (including the amount brought forward) of £13,547. £5,000 is to be allocated to the relief of the rates, £8,280 applied in meeting various capital charges, and the balance carried forward. Last year's accounts showed £16,321 profit.

Crewe.—Year's Working.—There was a deficit of £727 on the working of the electricity department for the past year.

Price Revision.—The price of electricity is to be advanced by a further 20 per cent.

Crook (County Durham).—E.L. Scheme.—The Council has decided to consider the question of electrically lighting the town. It is also proposed to instal a refuse destructor with a view to its use in generating electricity.

Darlington.—Loan Application.—The Corporation is to apply to the L.G.B. for sanction to borrow £25,000 for new generating plant at the electricity works.

Douglas (I. of Man.)—E.L. Scheme.—The T.C. is to obtain expert advice in connection with the supply of electricity in the borough, and especially with regard to the powers sought by a newly-formed company.

Dover.—The electrical engineer states that the Colliery Co. is not able to supply additional power, as had been hoped, and he advises extensions to the plant. The T.C. has deferred the matter for six months.

Ferrybridge.—Deferred E.L. Scheme.—The proposed E.L. scheme submitted by the Yorkshire E.P. Co. is to remain in abeyance until the Government has dealt with the Bill now in Parliament.

Hatfield.—Proposed Mains Extensions.—The South Metropolitan E.L. Co. has informed the R.D.C. that the demand for energy would not justify it extending the mains to Hatfield. The Council has decided to persevere in the matter, and to circularise the district, including East Hyde.

Holmfirth.—Extensions.—The U.D.C. is to proceed with the extension of the electricity service to Spring Bank, Burnlee, at an estimated cost of £800.

Horwich.—E.L. Scheme.—The U.D.C. is to approach the Bolton Corporation and the Lancashire Electric Power Co. as to the supply of electricity for lighting and power purposes in Horwich, and ask for terms for supplying the Council in bulk.

Houghton-le-Spring. — Public Lighting. — At the request of the U.D.C. the E.L. Co. has agreed to prepare a provisional estimate for public lighting.

Low Moor (Bradford). — Mains Extensions. — The Bradford E.C. has authorised the extension of electricity mains at Carr Lane, Low Moor, including transformer chamber, at an estimated cost of £405.

Lytham.—Loan Application.—The D.C. is applying to the L.G.B. for sanction to borrow £35,500 for the purpose of electric lighting.

Manchester.—Year's Working.—The financial results of the past year's working were dealt with in our last issue. The annual report further states that during the year the average price paid for coal had risen 3s. 5d. per ton, and the average weight of coal consumed had fallen 0·09 lb. per kelvin sold. During the year 235,258,030 kelvins, against 236,463,740, were generated, and 181,675,199, against 195,582,784, were sold; private consumers taking 155,480,090 kelvins; public lighting 266,255 kelvins; and traction 28,923,845 kelvins. The total maximum demand was 65,050 kw., lighting and power 55,050 kw., and traction 10,000 kw. During the year the installation of two 80,000-lb. B. & W. water-tube boilers has been completed; the erection of the 25,000-kw. turbo-alternator has been commenced, and the contract for additional fan-driven cooling towers is near completion. Important extensions to four distributing stations are not yet complete, owing to non-delivery of plant by the makers. No material additions to the list of new supplies have been made, but on mains an addition of over 5 miles is recorded. The efficiency of the distributing system, as a whole, equalled 87·85 per cent.

Loan.—The T.C. has approved of the proposal to borrow £1,160,000 for the erection of the new generating station at Burton.

Morley.—Bulk Supply.—The T.C. has applied to the Leeds E.C. for a supply of electricity in bulk to supplement Morley's own supply, which is not sufficient to meet local demands.

Oldham.—Year's Working.—There was a profit of £8,322 on the past year's working of the Corporation electricity department, compared with £7,500 twelve months ago. Coal has cost £4,600 more, and the quantity used per unit sold was 3·40, against 3·45 lb. the previous year.

Portrush.— Time Extension.— The B. of T. has extended the Lighting Order for a year from August next, when the laying of the mains, cables, &c., was to have been begun. The L.G.B. also acknowledged the receipt of the Council's application for the sanction of a loan of £10,500 from the Belfast Banking Co. in connection with the lighting scheme of the town.

Rochdale.—An agreement with regard to a supply of electricity has been arrived at with the Lancashire Electric Power Co. One with the D.R. Cotton Mills is in process of completion.

South Staffordshire.—Water-Logged Mines.—As a result of the Federation of British Industries having taken up the question of the flooding of the Tipton and South Staffordshire coalfields, the Controller of Coal Mines has decided immediately to proceed with the installation of electrical pumping machinery.

Stockport.—Price Increase.—Electricity charges are to be increased by 10 per cent. to consumers who have not a special agreement.

Sunderland.—Year's Working.—The annual report on the Corporation's electricity undertaking for the year ended March 31st last, shows that there was a loss on the year's working of £3,880. The income totalled £103,636, of which £15,148 was received from the Corporation and £86,838 from private consumers. Expenses amounted to £75,363, leaving a balance to be carried to the net revenue account of £28,274. After paying interest on capital, &c., there was a balance for the appropriation account of £15,999, to which must be added a contribution of £3,880 from the rates to meet repayment of loans. There are now 1,785 consumers, and the number of kelvins sold last year amounted to over 18½ millions, the cost per kelvin sold being 1·10d. The total loans repaid to date amounted to £204,681, and loans outstanding were £217,010. Superseded plant repaid was put down at £82,919, leaving only £5,767 to be provided for this purpose.

Wigan.—L.G.B. Inquiry.—The L.G.B. has held an inquiry into the application of the Corporation for sanction to borrow £101,250 for extensions to plant at the electricity works. The details were:—5,000-kw. turbo-alternator, £25,000; surface condenser, £11,000; switchgear, £9,000; alterations to boiler house, £9,000; two boilers, 35,000 lb., mechanical stokers, economisers, £22,000; contingencies, £11,000. The present plant amounts to 4,820 kw., and there is a bulk supply from the Lancashire Power Co. of 1,500 kw. There is on order at the present time one 5,000-kw. turbo-alternator. Exclusive of traction there were demands for 8,864 kw.

Worcester.—Loan Application.—The C.C. has approved of the application for a loan of £15,350 for plant and cables. A firm which wishes to establish a factory will require about 100,000 or 150,000 units per annum.

TRAMWAY AND RAILWAY NOTES.

Ashton-under-Lyne. — Extensions. — The T.C. has decided to borrow £25,000 for tramway extensions.

Blackburn.—Year's Working.—The annual report on the tramway's undertaking for the year ended March 25th, 1919, shows that receipts totalled £94,992, against £80,361, and expenditure £69,021, against £53,232. After repayment of loans, £5,597, sinking fund, £10,612, interest on loans, £3,548, and other items, there was a profit of £6,650, against £6,971. Traffic records show the following increases:—Mileage, 28,373; passengers, 1,637,574; cash, £14,252; and parcels traffic receipts were £2,048. The following are the increases in the chief items of expenditure compared with the previous year:—Wages, £5,715; income-tax on profits, £1,291; permanent way repairs, £2,654; cars, £1,230, and electrical energy, £1,167. The amount spent on permanent way fell short of that which ought to have been expended by £3,000, and the amount required to bring it up to date is £8,000. Increases in wages and decreases in working hours, granted since the close of the financial year, are estimated to cost £7,000 per annum.

Continental.—France.—The comprehensive scheme for the electrification of French railways under contemplation was lately set out by M. Jules Cels, Under Secretary of State for Public Works and Transport, in the *Petit Parisien*:—3,000 km. on the Western network, 2,800 on that of the Midi, and 3,000 on the Paris-Lyons-Mediterranean network was what was contemplated. The outcome of the electrification would mean a saving of 3,000,000 tons of coal per year. The Western would be fed by 165,000 h.p. drawn from the river Dordogne, the Midi from works in the Pyrenees, and the P.L.M. from the Alps. The network to be electrified would be circumscribed by the Bordeaux-Bayonne on the side of the Atlantic, the Bayonne-Perpignan-Marseilles-Ventimiglia on the side of the Mediterranean; the Northern will close up on the system of the Bordeaux-Lyons-Modane. In total the scheme would embrace the whole of the Southern network.

Italy.— Idroelettrica Cisalpina S.A. per la Produzione di Energia Elettrica, with a capital of 2,000,000 lire (increasible to 20,000,000 lire), has been formed at Milan to supply electricity for tramway, railway or river traction, or to execute and work electrical plant for self or third parties. The Northern Railways Co. and six large electric companies are promoters of the undertaking.

The Paris transport strike ended on Monday morning last; a general strike of French coalminers, however, began officially on the same day.

Cork.—Strike Threat.—A strike of tramway employés last week was temporarily averted through the intervention of the Cork Conciliation Board—an influential citizens' committee formed for the arranging of local trade disputes. The men put in their claim on the lines of the National demand for a weekly wage of 50s. and a 44-hours' week. The notice expired on the 7th inst., but on the intervention of the Board, the men agreed to continue working, and to bring their case before the Board for adjustment. The Board awarded the men 4s. per week increase, with a reduction in working hours, and this finding has been tentatively ratified by the men.

Conductresses.—All the women employed on the Walthamstow tramways have now left. The Preston T.C. has approved of the decision to replace all conductresses, the women to be given time to find fresh employment. The Newcastle branch of the Amalgamated Association of Tramway and Vehicle Workers is pressing for the dismissal by July 1st of conductresses still employed. There are now 250 women employed out of the 400 working at the time of the Armistice and 100 pre-war male employés have yet to be demobilised.

Dundee. Price Revision.—The electricity convener is willing to reduce the tramway electricity charges to 1½d. per unit if the repair of the equipment is taken over, and it is expected the Corporation will approve of the arrangement.

Holmfirth.—Proposed Extensions.—The U.D.C. has referred to a Committee a suggestion for the extension of the Huddersfield tramcar service to the district.

Ilford.—The Council tramways manager has been asked to report on the question of running motor-omnibus services.

London.—Fires.—The first fire which has yet occurred on an electric train of the L. & S.W. Railway, took place on Friday last week. As a train was approaching Clapham Junction, a fire, believed to have been started by sparks from a steam engine, broke out on the roof of one of the centre coaches. The train was stopped, and passengers got out and walked to the station. The fire was extinguished, and the train was soon afterwards put back into service.

A fully-laden L.C.C. tramcar took fire on Tuesday, last week, in Peckham Road. No one was injured.

Canada.—Strike.—The local tramway employés at Toronto, at a mass meeting, voted to strike on Monday last. At the request of the executive officers of the Union, a decision was reached to delay the strike for one week, but the meeting declined to name a representative for the Government Board of Conciliation.

Malvern.—The U.D.C. has decided to dissent from the application to revive the powers granted by the Funicular Light Railway Order, 1911, to enable it, if necessary, to appear at any inquiry into the matter.

New Zealand.—The ratepayers of Auckland have ratified the City Council's proposal to purchase the tramways, at a cost of £1,180,000.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Telephones.—An automatic telephone system came into operation at Huddersfield on Saturday. The telephone exchange for the town and district has been transferred to the new post office buildings.

Cable Censorship Restrictions.—The Government is to be asked to receive a deputation from the London Chamber of Commerce, when the desirability of a considerable relaxation in the present cable censorship will be urged. The removal of restrictions on the use of private cable codes on account of the "serious effect of such restrictions upon British trade, particularly with the Dominions," will also be asked for.

Protests against cable delays to South Africa have been made in the House of Assembly.

Telephone (In.) Efficiency.—Our esteemed, if frivolous, contemporary, Mr. Punch, makes a subtle thrust at the deficiencies of the telephone system by a neat adaptation of the old classical tag, "*Nulla dies sine lineâ,*" into "*Nulla linea sine die,*" which is, being interpreted, "No line till further notice," which it is regrettable to state is the fate of many a hapless Briton to-day.

United States.—A Bill for the construction of a submarine cable, at a cost of £1,600,000, stretching from the Pacific Coast to Manila, in the Philippines, and to some Asiatic ports, by the United States Government, has been introduced in the Senate.

A message from Copenhagen refers to reports of plans for a new direct cable between either Sweden or Norway and the United States.

The first steps towards a settlement of the widespread strike of telegraphists were taken on June 13th, when the Commercial Telegraphers' Union of America submitted to the Postal Telegraph Co. conditions upon which an agreement might be based. These were that the company should agree to certain wage adjustments immediately after full control of the telegraphs had been restored by the Government.

A message from Washington states that the strike is not likely to delay telegraphic traffic, and reports from telegraph companies everywhere indicate that the strike thus far has been a failure.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* Electrical Review *in which the "Official Notice" appeared.*)

OPEN.

Australia.—Sydney.—June 23rd. Municipal Council. One 60-ton electrically-driven overhead travelling crane. Electric Lighting Department, Town Hall, Sydney.*

Newcastle.—July 14th. T.C. Single-phase watt-hour meters if different sizes, and single and three-phase transformers. Electrical Engineer and Manager, Corporation Electricity Works, Newcastle, N.S.W.

Atherton.—U.D.C. Two 45-k.v.a. air-cooled transformers, 2,400 to 240 volts. (See this issue.)

Bedford.—July 14th. Electricity Committee. One 1,500-kw. 1-phase turbo-alternator and condensing plant, boilers, superheaters, mechanical stokers and induced draught plant, e.h.t. switchgear, water softener, feed-water heater and storage tanks, water-measuring apparatus, feed pumps. (See this issue.)

Birkenhead.—July 28th. B. of G. Installation of internal telephones. (June 6th.)

Colne.—July 4th. Electricity Department. Supply, drawing-in and jointing of approximately 2,200 yd. ·05 sq. in., 3,300-volt, 3-core cable. (See this issue.)

Darlington.—July 11th. Electricity Department. Rotary converter, cooling tower, water-tube boiler, economiser, and induced draught fan. (See this issue.)

Eccles.—June 23rd. Electricity Committee. Supply and laying of three-way underground ducts; supply and drawing-in 2,733 yds. of ·20 sq. in., e.h.t., three-core cable. (May 30th.)

Gravesend.—July 12th. Electricity Department. One 2,000-kw. turbine with 6,000/6,600-volt 3-phase alternator, condenser with motor-driven air and circulating pumps. (See this issue.)

London.—June 25th. Metropolitan Water Board. Three, six or eight months' supply of electric lamps, electric wire and accessories. Chief Engineer, 2, South Place, Finsbury, E.C. 2.

Paris.—July 10th. Administration des Postes et Télégraphes. Supply of multiple commutator switchboards. Particulars from Direction de l'Exploitation Téléphonique, 4, Bureau, 103, Rue de Grenelle, Paris.

Portsmouth.—July 3rd. Electricity Department. Water-tube boiler, steam capacity 20,000 lbs. per hour (See this issue.)

South Shields.—June 25th. Tramways Committee. Five or 10 double-deck, top-covered cars. Mr. J. C. Whiteley, General Manager and Engineer, Dean Road, South Shields.

Tasmania.—Launceston.—July 28th. City Council. Sub-station equipment, battery, reversible booster, switchgear, &c. City Electrical Engineer.

West Ham.—July 1st. T.C. 20 single-truck electric tramcar bodies, with roof covers. Mr. L. Slattery, General Manager, Greengate Street, Plaistow, E. 13.

CLOSED.

Australia.—Commonwealth. Department of Works and Railways:—

250 projector fittings for peace celebrations, £806.—British General Electric Co., Ltd.—*Tenders.*

Bishop's Castle.—B. of G. Electric bell installation. Mr. Winman.

Holmfirth.—The contract for the electrical work in connection with the Council's housing scheme in Newmill Road, has been let to Mr. C. R. Tolson.

London.—Islington.—Lighting Committee. Recommended:—

One 5,000-kw. turbine, coupled to two-phase Vickers alternator, with condensing plant, &c., £46,979.—Richardsons, Westgarth & Co., Ltd.

Malvern.—U.D.C. Electric meters. The Electrical Apparatus Co.

Sunderland.—T.C. Accepted:—

Steel joists.—Redpath, Brown & Co., Ltd.
Switchgear.—Ferguson, Pailin & Co.
Cable.—B.I. & Helsby Cables, Ltd.
Wood capping.—Joseph Thompson & Co.

Watford.—U.D.C.:—

Ljungström turbo-alternator.—Brush Electrical Engineering Co., Ltd., £13,420.
Motors.—Parkinson & Co., £300.

FORTHCOMING EVENTS.

Incorporated Municipal Electrical Association.—Friday, June 20th. At 10 a.m. Annual convention. At the Spa Pavilion, Felixstowe. Annual general meeting.

Society of Technical Engineers (Woolwich Branch).—Friday, June 20th. At 6 p.m. At the Shakespeare Hotel, Powis Street, Woolwich. Discussion on "The Third Party Policy."

Institution of Mining Engineers.—Friday, June 20th. Visit to the Docks and Warehouses of the Port of London Authority.

Industrial Reconstruction Council.—Wednesday, June 25th. At 4.30 p.m. At the Saddlers' Hall, Cheapside, E.C. Lecture on "Some Industrial Problems," by the Rt. Hon. C. W. Bowerman, M.P.

Institution of Electrical Engineers.—Wednesday, June 25th. From 8 p.m. to 11.30 p.m. At the Natural History Museum, Cromwell Road, S.W. Conversazione.

Thursday, June 26th. At p.m A the Connaught Rooms, Gt. Queen Street, W.C. Reception, 7.3 p.m Annual dinner

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*A copy can be seen at the Inquiry Office of the Department of Overseas Trade (Development & Intelligence), London.

NOTES.

Birmingham Electrical Golfing Society.—The first post-war meeting will be held at Moseley on Monday, June 23rd. There will be two handsome cups and other prizes up for competition. The annual subscription has been increased to 7s. 6d. Applications for membership can only be considered from those in the electrical engineering or manufacturing occupations. Applications for membership should be addressed to the honorary secretary, Mr. W. A. Miflinger, 9, Livery Street, Birmingham.

Government Motor Sales.—The Disposal Board of the Ministry of Munitions last week continued its sales of surplus motor vehicles at the Agricultural Hall, Islington.

The Electrical Training of Demobilised Officers.—At a meeting of the Hull Corporation Electricity Committee a letter was read from the Ministry of Labour, Appointments Department, asking if the Committee would allow demobilised officers to be trained as electrical engineers. The electrical engineer explained that they had not previously taken apprentices, as they required the finished product. In this case they would not pay anything, as the Ministry assisted the officers whilst they were undergoing training. Councillor Mell thought the "men" as well as officers should have an equal chance. Eventually the matter was left to the chairman and deputy chairman to report to the next meeting.

Electrical Engineers' Memorial Service at Westminster Abbey.—On Wednesday at noon at Westminster Abbey a service in memory of members of the engineering profession who have fallen in the war was held. We shall refer to the matter in our next issue.

Diesel Engine Users' Association.—At the May meeting of the Association the subject of insurance of Diesel and semi-Diesel engines against breakdown was discussed. The Association proposes to take action in regard to carrying out research work with a view to obtaining more definite information as to the suitability of various classes of liquid fuels, and it was decided to make application for a Government grant in aid of this work. A discussion took place on the report made at the previous meeting by Mr. G. W. F. Horner on the breakdown which had occurred on a Diesel engine at Weymouth. At the next meeting of the Association, Mr. G. E. Windeler will explain a method of checking the alignment of shafts, and a means of proving whether a shaft is bedding in its bearings.

Help for Apprentices.—The *Times* states that considerable progress has been made with the scheme for assisting young men whose apprenticeship has been interrupted by service in the Forces. Schemes have been prepared by national joint industrial Councils and other bodies representative of employers and work-people, and approved by the Minister of Labour, in the engineering, shipbuilding, ironfounding, electrical contracting, building, and many other trades.

The schemes all provide that an apprentice on reaching the age of 21 shall, for the first year, receive not less than three-fourths of the journeyman's rate (including war bonus), and for the second year not less than five-sixths. Towards this payment the State makes a grant of one-third of the journeyman's rate (including war bonus). Provision is also made for training in a technical institution. Full information and application forms may be obtained at any Employment Exchange.

Costs of Management in Small Undertakings.—Walsall Corporation has prepared the following comparative statement of the cost of remuneration of the staffs of 10 electricity supply undertakings (Walsall being No. 10):—

Undertaking.	Units sold last completed year.	Technical staff including manager and all positions covered by E.P.E.A. award.		Accounting and clerical staff including store-keepers and meter readers.		Total staff excluding sales department.		Sales dept. staff.
		£ per ann.	Per unit sold.	£ per ann.	Per unit sold.	£ per ann.	Per unit sold.	£ per ann.
1	10.000.000	6,351	·153	3,909	·094	10,260	·246	516
2	9.554.210	4.516	·113	2,157	·051	6,673	·168	—
3	9,880,000	3,557	·086	1,670	·041	5,227	·127	571
4	10,217,551	3,161	·075	1,812½	·043	5,006	·120	319
5	6,118.788	3,016	·118	1.909	·075	4,925	·193	—
6	3.500,000	2,532	·171	1 621	·110	4,153	·285	—
7	4.080.069	2.194	·129	1,596	·094	3,790	·222	—
8	7,000.000	2,632	·090	926	·032	3,558	·122	—
9	10,833,341	2,137	·047	989	·022	3,126	·069	—
10	6,286,428	2.536	·097	1,574	·060	4,110	·157	237

Soldering Aluminium.—The *Revue générale de l'Electricité* discusses the uniting of pieces of aluminium by soldering or brazing. For soldering, the surfaces must be rubbed with emery paper with a small quantity of vaseline. The flux may be made up of lithium chloride, 15 per cent.; potassium chloride, 45 per cent.; sodium chloride, 30 per cent.; potassium fluoride, 7 per cent.; bisulphate of soda, 3 per cent. The joint should be carefully brushed and washed in hot water to remove all traces of the flux. For brazing, metals such as tin, bismuth and cadmium may be used. The process should, however, be used only in exceptional cases.

Institution and Lecture Notes.—Institution of Electrical Engineers.—The annual general meeting of the North Midland Centre was held at the Hotel Metropole, Leeds, on Tuesday, May 27th. Mr. R. H. Campion presided, and there was a good attendance. The statement of accounts was adopted, and the following officers were appointed for the ensuing session:—Chairman, Mr. W. M. Selvey; vice-chairmen, Messrs. W. E. Burnand and C. J. Jewell; committee, Messrs. C. N. Hefford, W. M. Rogerson, S. Simpson, W. B. Woodhouse, W. H. Brown, J. C. B. Ingleby, T. B. Johnson, T. Roles, J. H. Shaw, S. P. Barclay, S. E. Fedden; hon. sec., Mr. J. D. Bailie.

With regard to the time allowed to members for payment of subscriptions and the ceasing of giving notices of meetings, the following resolution was carried:—"That at the end of three months the local secretary should be first communicated with before cutting off the supplies to any member, and that a member should not then be struck off the list for another period of three months."

A discussion took place in reference to the desirability of increasing the number of members on the Committee. It was pointed out that Sheffield had been made a Sub-Centre of the North Midland Centre, and while they had a good representation on it, they would like power to increase the number on the Committee. More members on the Committee might make it of more interest to the general body of members.

Mr. Lang pointed out that Yorkshire was a very scattered area, and was different from a large industrial centre like Newcastle or Manchester, where the members were grouped very closely together. In his opinion, the North Midland Centre would be well advised to have a larger Committee.

Mr. Chaytor moved—"That this general meeting of the members of the North Midland Centre, in view of the creation of the Sheffield Sub-Centre, authorises the Committee, if they should think it desirable, to increase the numbers on the Committee, but not to exceed three more members." This was seconded by Mr. Blackburn (Huddersfield) and carried.

Gas *v.* Electricity.—The relative cost of gas and electricity in lighting and heating in relation to housing schemes was discussed by the British Association of Gas Managers, at a conference in Edinburgh last week. Mr. F. W. Goodenough, chairman of the Executive Committee, said there were three questions prominently before the public and in the Government programme to-day—housing, transport, and coal conservation. The public had very generally been led to believe, as the result of certain one-sided reports on coal conservation, that the panacea for all, or most, of the difficulties in regard to each of the three questions named was to be found in the general use of electricity. The most efficient generating station of to-day showed a loss of 88 per cent. The best result anticipated for the suggested super stations was an efficiency of only 18 per cent. Out of every 100 heat units in the coal carbonised at the "good practice" gasworks of to-day 77·5 were delivered to the community, and only 22·5 were lost. In the gasworks of the future it was possible that coal would be as completely as possible gasified, and that 75 heat units out of every 100 in the coal treated would be available for distribution as gas, against only 18 if the distribution was in the form of electrical energy. To use electricity as a fuel on any scale was, therefore, clearly out of the question from the point of view of the conservation of coal and its chemical constituents, as it was also from the point of view of cost. The facts were indisputable; but they had been unknown, overlooked, or ignored by those who, in the name of coal conservation, advocated the use of electricity for heating and cooking in connection with the great housing problem. In the fields of lighting and power electricity contended with gas on grounds unconnected with coal conservation, as its relatively high efficiency of conversion in those cases largely counterbalanced its relatively and positively high waste in generation. Under some conditions electricity would be preferred to gas for light or power, but where heat was required there could be no doubt that gas was preferable.

Mr. A. Masterton, engineer and manager, Edinburgh and Leith Corporations' Gas Commissioners, in a paper on Gas Equipment in Relation to Housing Schemes, said that, compared with electricity, gas was cheaper, more reliable, and cheaper in installation, when all the needs were considered from the first in the construction of the house.

The British Science Guild.—The annual meeting of the Guild was held on Tuesday last at the Goldsmiths' Hall, when the report of the year's work was submitted. An address on "Science and Labour" was delivered by the president, Lord Sydenham, G.C.S.I., and addresses were also given by Major-General Seely, Sir J. J. Thomson, and Sir Robert Hadfield.

The E.P.E.A.—A successful meeting was held at Dunfermline on Saturday last, with the view of forming a new Section to embrace Fife, Kinross, and Clackmannan, and to be called the Fife Section, with Dunfermline as centre. The following office bearers were appointed:—Chairman, Mr. R. K. Robertson, Cowdenbeath; vice-chairman, Mr. G. B. Jones, Dunfermline; secretary, Mr. D. Macdairmid, 166, Townhill Road, Dunfermline; treasurer, Mr. A. Webster, 6, Rose Crescent, Dunfermline.

Electrically-Operated Valve-Gear.—Mr. W. P. Durtnall writes with reference to a recent American patent for electrically-operated valves for internal-combustion engines, pointing out that this type of valve-gear was invented by him in 1909, and described in a paper read before the Institute of Marine Engineers in September, 1910, on the "Paragon" engine.

The Mind of Rathenau.—Dr. Walter Rathenau, "Jewish financial magnate," as the *Times* describes him, head of the A.E.G., as we know him, advocate of the most thorough preparations for another war which Germany must not start a year too soon, is now pouring abuse upon the political leaders who were not so quick as he to see that the German game was up, and that peace was the only card to play. The glib talkers who now advocate refusing to sign the Peace Treaty because it is still possible to resist, are told by him in *Die Zukunft* (as quoted by the *Times*) that this last illusion is the most stupid of all their wrong beliefs. He advises negotiation to the last moment, and signature if amelioration were obtained. Alternatively—what then? The German National Assembly dissolved, the president and all the German Ministers resigned, the enemies of Germany would take over the complete sovereign rights of Germany together with the responsibility of the Peace, the Government, and all the affairs of Germany. The progress of Rathenau during these years of war has been very interesting. It was in January, 1917, that he wrote in the *Lokal Anzeiger*, "We began the war a year too soon. . . . We must begin at once a reorganisation upon a broader and firmer basis than ever before"—we must calculate in advance—see what the country lacks, secure immense reserves of raw material to remain unused until a day in the future. . . . Every damned thing and every damned body must be ready next time upon the second day following a new declaration of war—these were the things that Rathenau was saying, perhaps in other words (see Elec. Rev., Dec. 27th, 1918, p. 633), even when he knew that a mistake had been made in beginning the war "a year too soon." What did he say in December, 1918? The great "Jewish financial magnate," head of the A.E.G., was "crying for mercy." Germany was "innocent" of wrong intentions! Well, the way to hell is paved with good ones, and there has been hell enough these years, Heaven knows! If the Entente Powers were to kill Germany in the name of justice, "we will bear our lot and perish upon the earth." That is precisely what we wanted to effect, to kill the Germany that longed for war, and if Dr. Walther Rathenau still believes in that Germany, and has lurking in his breast desires for preparing more thoroughly than ever before, the best thing that can happen to him is that he should, as he foretells, "perish upon the earth." The only other thought that we will give expression to here—and it always presents itself whenever we read the changing views of Rathenau—is this: Will the industrial organisation that he represents be permitted to win its way again into British Home and Colonial markets. How many British lives have been sacrificed through the materials, organisation, and efforts of Rathenau, and the productions of the A.E.G works? How many innocent women and children have been bombed in British homes by aeroplanes made at their Berlin factories, or sunk by submarines equipped with apparatus therefrom? Everybody knows of these things, of course, but the truth must be said again and again, "Lest we Forget!"

Plight of the Russian Railways.—The Russian railway system, according to an article in the *D.A.Z.* (May 6th), threatens to collapse, owing to the fact that no repairs have been effected since the Revolution. The station buildings are for the most part deserted, the warehouses falling in, and the central switches and signalling apparatus no longer work, owing to the lack of spares with which to replace the worn-out parts. No modern electric or automatic signalling and loading apparatus exists on the Russian railways. The railway workshops were obliged to hand over important parts of their machinery to the munition workshops. This absence of necessary machinery and instruments is especially felt in the locomotive shops. The number of railway engines out of repair amounted in March, 1916, to 17·3 per cent.; March, 1917, 23 per cent.: March, 1918, 35·3 per cent.; March, 1919, 52·4 per cent.

The railway bridges and railway lines are also in a state of decay and have in some cases been badly damaged as a result of civil war. Little is heard in the Press of the numerous accidents that take place in consequence of trains running off the lines. The work of repair is often hindered by the passive resistance of railway workers antagonistic to the Soviet régime. For lack of raw material, the number of engines built in 1918 was considerably reduced. Since the taking of the Urals by Koltchak's Army, the production of pig-iron for rails has entirely ceased as far as the requirements of Soviet Russia are concerned and few new lines can be built.

The measures taken by the Soviet Government are too late to prevent the ruin of the Russian railway system. It is hoped, however, that the difficulty of transport will be lessened with the approach of the warmer weather, when the waterways will become available.

Inquiries.—Makers of electric immersion heaters are asked for.

Fatality.—At Hobart, Tasmania, in April, a boy aged 13 years, met his death through receiving a shock from overhead electric light wires. He and his companions were playing ball in the street, and the ball lodged in the wires of the transformer pole carrying a 3,000-v. cable. The boy climbed the pole to the platform near the top, and in trying to get the ball, he evidently caught hold of the wire and received a shock. One hand was severely burned.

The Association Scheme of the Society of Engineers (Inc.).—Recognising that association and co-operation are the order of the day, the Council of this Society has prepared a scheme for the Association of Engineering Societies.

We have received a copy of the printed regulations governing such Association. Any Engineering Society in the British Empire consisting wholly or in part of professional members may, at the discretion of the Council of the Society of Engineers, be admitted to association with the Society.

The Society will not be responsible for any acts which may be done, or for expenses or liabilities which may be incurred, by any Associated Society.

The Society has power to admit to membership, corporate or non-corporate, any duly-qualified member of any Associated Society, and shall in each year contribute to the Associated Society not more than one-fifth of the annual subscription paid to the Society by each member thereof, who at the date of his election to the Society is also a member of such Associated Society, for so long as he remains a member of the latter, provided always that, if any member of the Society at the date of his election thereto is a member of more than one Associated Society, the contribution shall be equally divided between the Associated Societies of which he is a member. All members of Associated Societies will be entitled to the following privileges:—(*a*) To attend the ordinary meetings, visits, and social functions of the Society; (*b*) to make use of the library and reading room of the Society; (*c*) to make use of the appointments and employment registers of the Society; (*d*) to compete for such premiums as may be awarded by the Society in open competition. Any member of an Associated Society on payment of 5s. per annum to the secretary of his Society, who shall transmit the same to the Society, shall be entitled to receive, post free, a copy of each issue of the *Journal* and *Transactions* of the Society as published.

Further particulars may be obtained from the Secretary at 17, Victoria Street, S.W.

Appointments Vacant.—Electrician-wireman, electrician armature winder, and gas engine attendant, for the Sheffield Corporation Water Department; overhead line foreman (90s.), for the Hull Corporation Tramways; repairs superintendent (£300 + 20 per cent. + £90), for the L.C.C. Tramways Generating Station; lecturer in practical mathematics (£150 to £240 + £39), for the Goldsmiths' College; resident electrical engineer (£300), and chief assistant engineer, for the Horsham U.D.C. Electricity Works; charge engineer (£305), for the Borough of Swansea Electricity Department; shift engineer (82s. 7d.), for the Eccles Corporation Electricity Works; second assistant mains engineer (350 taels per month, tael = 3s. average), assistant secretary, for the Electricity Department (400 taels per month), for the Shanghai Municipal Council. See our advertisement pages to-day.

Scott Transformer Connection.—According to Mr. E. Baticle, in the *Revue Générale de l'Electricité* of April 26th, the two transformers of a Scott connection operate under very different conditions. From the point of view of heating, it is therefore not permissible to load the system up to twice the rated load of each transformer. In fact, the load should not exceed three-quarters of this value. Furthermore, if the two-phase load is balanced, the heating of the two transformers will differ. Lastly, if the two-phase loads are unbalanced, the three-phase currents will be unbalanced also, and automatic cut-outs may not afford equal protection to each transformer.

Electric Furnaces in the States.—The production of electric steel castings in the U.S. rose from 8,551 gross tons in 1914 to about 92,000 tons in 1918. In the same period the output of electric steel ingots increased from 15,458 tons to about 325,000 tons. During the year 1918 nearly a hundred new electric furnaces were installed in the United States, increasing the total number in operation by 41.5 per cent. Nearly all these furnaces were designed for the production of either electric steel ingots or castings, there being only about 27 so-called special furnaces in the U.S. and in Canada at the end of the year. But it is to these special fields that attention will be turned now that the abnormal stimulus of the war has ceased. Considering the problem as a whole, the future technical development of the electric furnace may be expected to follow new and original lines, which will take it into virgin fields rather than further along paths marked out by war conditions.—*Iron Trades Review*.

Electrically-heated Boilers.—Under certain special circumstances the electrical heating of boilers is justifiable. The Allgemeine Elektricitäts Gesellschaft has developed special boilers, in which the heating is effected by the passage of electric currents through the water. For this purpose, narrow tubes of insulating material are provided. These contain water, and are vertically arranged so as to communicate with the interior of the boiler at the upper and lower ends of the tubes. Current is sent through the water columns contained in the tubes, and, as the resistance is great, considerable voltages are required. Alternating current must be used, and, in the case of three-phase currents, the tubes are connected in groups of three. The strength of the current is regulated by moving the electrodes in the tubes. The efficiency of the boilers is 95 per cent. and over, and 1 unit of electricity produces about 1.25 kg. of steam at 6 to 8 atmospheres. Up to the present electric steam generators have been built up to capacities of 1,500 KW. and at voltages up to 10,000 volts.—*Schweizerische Elektrotechnische Zeitschrift*, April 12th.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station and Tramway Officials.—The Darlington T.C. has advanced the salary of the tramway traffic superintendent, Mr. Fraser, from £180 to £200 a year, with a war bonus of £70.

Mr. D. J. Gadsby, assistant electrical engineer at the Hove Corporation Electricity Works, has resigned his position.

Swinton, Pendlebury, U.D.C. has increased the salary of the electrical engineer, Mr. H. C. Busbridge, to £330 a year.

The Keighley Tramways and Electricity Committee recommends the appointment of Mr. David E. Bell, of Pontefract, as assistant borough tramways and electrical engineer, at £286 per annum, rising to £300 after six months' satisfactory service.

Mr. H. R. Harper, chief electrical engineer of the Melbourne City Council, has been appointed by the Victorian Electricity Commissioners chief engineer in connection with the development of Morwell brown coal deposits for the generation of electricity. The Commissioners have also appointed Mr. A. G. M. Mitchell, M.C.E., to act as consulting hydraulic engineer and to obtain for the Commission data regarding water power possibilities. Mr. Harper's appointment is a permanent one, and the Commissioners expect that work will be commenced by the engineers immediately, as they have in view the preparation of a definite scheme for the establishment of a scheme for supplying electricity in bulk at an early date.

A breezy discussion took place at Sunderland Town Council last week on the Electricity Committee's report that they accepted with regret the resignation of the chief clerk, Mr. J. M. Donkin. The acting chairman, Councillor R. J. Wilson, said that no reason had been given for the resignation, but Councillor R. Baxter asserted that there was a very powerful reason. He said Mr. Donkin had had no opportunity of being heard by the committee, and that it was a remarkable fact that with the departure of Mr. Donkin there was not now left a single member of the original staff. They had all been hounded out of the place. There was something wrong at the top, and the sooner there was an investigation the better. He moved that the committee's report be referred back. This was seconded, and after discussion carried by a large majority.

General.—The Appointments Department, Ministry of Labour, Norfolk Street, Strand, have recently appointed Major Gordon Kennard, M.C.R.E., O.C. Signals (in the Expeditionary Force), to the 56th Loudon Division to be their engineering investigation officer. Major Kennard was before the war for a number of years with the British Westinghouse Co., Ltd., and the Westinghouse Cooper Hewitt Co., Ltd.

It is stated in *Tenders* that Mr. R. Creswell, of the chief mechanical engineers' branch, N.S.W. railways and tramway department, and Mr. W. S. Corner, of the chief electrical engineer's branch, are visiting America to investigate technical matters connected with the department, including the installation of electric furnaces for the production of electric steel.

Major S. Utting, who recently returned from France, where he has been with the B.E.F. since September, 1914, has moved his offices to 82, Victoria Street, Westminster, S.W.1, where he will be interested in the Prat induced draught system.

Mr. T. Wallwork, a member of the staff of the Blackburn electrical engineer, has been appointed on the Executive Council of the National Association of Local Government Officers.

Mr. E. E. Sharp and Mr. H. H. Holmes, whose resignations from Chamberlain & Hookham, Ltd., and St. Marylebone Electricity Department respectively, we recently mentioned, are now joint managing directors of the Tok Manufacturing Co., Ltd., who are making rotary switches, as notified elsewhere in this issue.

Mr. E. Scott Rivett, late assistant electrical engineer with the Rio Tinto Co., Spain, is now in England preparatory to taking up an agency for British firms in Spain. Mr. Scott Rivett, who has been acting for some little time as our correspondent in Spain, has a special knowledge of the present situation in that country.

Mr. A. H. Human has resigned his position as chief technical adviser to the Electric Power Supply Department of the Ministry of Munitions, and is rejoining the firm of Merz & McLellan, consulting engineers, 32, Victoria Street, Westminster, to establish in conjunction with Mr. Robert Nelson (late H.M. Electrical Inspector of Mines) a new section of the firm to advise on the applications of electricity to manufacturing and engineering works and in mines.

Mr. M. L. Cohen, for many years with Messrs. Dorman & Smith, Ltd., Salford, has joined the staff of Mr. T. A. Nunwick, 4, Carr Street, Blackfriars, Manchester, as assistant representative.

Roll of Honour.—Trooper H. Stott, Duke of Lancaster's Own Yeomanry, has died in France from injuries received in a railway acident whilst ou his way home from Italy. He was previously employed in the office of Messrs. J. P. Hall & Co., Ltd., electrical engineers, Oldham.

Private (Acting Regimental Quartermaster-Sergeant) A. E. Allison, Labour Corps, who has been awarded the Meritorious Service Medal, was formerly in business as an electrical engineer at Doncaster as a member of the firm of Fisher & Allison.

Birthday Honours.—Company S/M S. G. Meadows, who was in the King's Birthday Honours List, receiving the award of the Meritorious Service Medal for service in Egypt, is on the staff of Callender's Cable and Construction Co., Ltd. He is shortly coming home.

Obituary.—Signor Pirelli.—We regret to read in Press dispatches from Milan that while laying telegraph cables in the Straits of Messina on Monday the cable steamer *Citta di Milano* foundered with the loss of 26 lives. Amongst those whose bodies have been recovered are Signor Pirelli, of Pirelli & Co., Milan, and Signor Brunelli, chief inspector of Italian Telegraphs.

Mr. W. McGeoch.—Mr. William McGeoch, head of the firm of Messrs. William McGeoch & Sons, Ltd., wholesale ironmongers and electrical engineers, 28, West Campbell Street, Glasgow, died at Helensburgh on Thursday evening last week in his 78th year. Mr. McGeoch, who had been in indifferent health for some years, practically retired from active business over five years ago. Mr. and Mrs. McGeoch celebrated their golden wedding last year.

Will.—The late Dr. Henry Wilde left £9,154.

NEW COMPANIES REGISTERED.

"Radiation."—Big Gas Stove Combine.—Radiation, Ltd., has been registered as a public company with a nominal capital of £2,750,000 in 1,350,000 prelerred and 1,400,000 ordinary shares of £1 each. The preferred shares are entitled to a fixed cumulative preferential dividend at 6 per cent. per annum, and take priority in a winding up, both for arrears of dividend and return of capital, but carry no further rights in profits or assets. The principal objects are to acquire by purchase or otherwise all or any of the shares of John Wright & Eagle Range, Ltd., the Ridimond Gas Stove & Meter Co., Ltd., the Davis Gas Stove, Ltd., and any similar companies, and to carry on the business of manufacturers of and dealers in gas cooking and heating appliances, stoves, furnaces, and other apparatus employing gas, electricity, coal, coke, oil, or nther fuels, manufacturers of and dealers in gas and electric appliances of all kinds, miners of fireclay and similar materials, &c. The papers are presented for filing by Mayo, Elder & Co., solicitors, 10, Drapers Gardens, E.C.2. The registered office is at 18, Bennett's Hill, Birmingham. The file number is 155,708.

South of Ireland Electric (Arc) Welding Co., Ltd. (4,717).—Private company. Registered in Ireland May 29th. Capital £2,000 in £1 shares. To carry on business as indicated by the title. The subscribers (each with one share) are: A. W. Spencer, 107, Cork Street, Dublin, engineer and contractor; P. Fay, 44, Surrey Street, Belfast, boiler maker and electric welder; R. D. Whyte, Sally Park, Clandalkin, Co. Dublin, director Irish Paper Mills. First directors: A. W. Spence, P. Fay, and R. D. Whyte. Registered office: 26, Upper Abbey Street, Dublin.

Halwains, Ltd. (155,794).—Private company. Registered June 5th. Capital £5,000 in £1 shares. Electric and steam engineers and contractors, manufacturers of tramway and other apparatus. The subscribers (each with one share) are: T. Halstead, Bent Gate House, Haslingden, cotton spinner; H. G. Wainscott, 9, Rochdale Road, Edenfield, near Manchester, electrical engineer; and Mrs. N. Wainscott. Directors: T. Halstead and H. G. Wainscott. Registered office: 44a, Bolton Street, Bury.

Engineering Industry, Ltd. (155,810).—Private company. Registered June 5th. Capital £5,000 in £1 shares. To acquire the periodical hitherto produced and published by the Electrical Times, Ltd., as "El Ingeniero Industrial" (in Spanish), and as "L'Ingenieur Indusrtial" (in French), &c. The subscribers (each with one share) are: E. Slater, Weir Bank, E. Molesey, Surrey, engineer; J. May, 36, Victoria Street, S.W., consulting engineer; G. W. S. Hawes, 36, Victoria Street, S.W., consulting engineer; R. W. Hughman, Sardinia House, W.C. 2, journalist. The directors are to be appointed by the subscribers. Registered office: Sardinia House, Kingsway, W.C. 2.

W. Partington & Co., Ltd. (155,787)).—Private company. Registered June 5th. Capital £5,000 in £1 shares. To acquire the business carried on by W. W. Partington at Alpha Works, Taff's Well, Glamorgan, under similar style, and to carry on the business of electrical and mechanical engineers. The subscribers (each with 100 shares) are: H. O. King, 48, Park Place, Cardiff, shipowner; W. W. Partington, 180, Cathays Terrace, Cardiff, electrical engineer. The first directors are: H. O. Kine, W. W. Partington, and A. E. Davey. Registered office: Alpha Works, Taff's Well, Glamorgan.

W. E. Jackson & Co., Ltd. (155,860).—Private company. Registered June 6th. Capital £10,000 in 9,000 10 per cent. preference shares of £1 each and 20,000 deferred shares of 1s. Electrical and mechanical engineers, metal stampers, press tool makers, &c. The subscribers (each with one deferred share) are: H. H. Oxley, The Nest, King Edward Avenue, Dartford, mechanical engineer; W. E. Jackson, 48, Freer Road, Birchfields, Birmingham, press tool maker; W. R. Taylor, 59, Hampton Road, Birchfields, Birmingham, general engineer; G. C. Lawrence, 11, Brentgerd Street, Bury St. Edmunds, marine engineer. Directors: H. H. Oxley, W. E. Jackson, W. R. Taylor, G. C. Lawrence. Registered office: 60-1, Blackfriars Road, S.E. 1.

CITY NOTES.

Birmingham District Power & Traction Co., Ltd.

Mr. C. S. B. Hilton, speaking at the annual meeting on Monday, said that the net traffic receipts showed a fairly satisfactory increase. This would have been more marked but for the heavy increase in power and running expenses and repairs and maintenance. They had £66,000 to dispose of, as against £55,000 a year ago; the greater part of the increase was to be put to renewals and reserve. The conditions under which they were carrying on were exceedingly difficult. Before the war the highest rate paid to motormen was 7d. per hour, with no bonus. The standard week worked was 60 hours, and the motorman's wages averaged about 35s. per week. The top rate was now 9¼d., plus 6½d. bonus—a total of 15¾d. The weekly earning for a 48-hour week was, therefore, three guineas. This showed an increase of 125 per cent. in the hourly rate of pay, or an increase of 80 per cent. in the weekly wage earned, notwithstanding a 20 per cent. reduction in the working hours. On the assumption that the car hours worked in 1919 would be the same as those worked in 1918, and on the basis of the wages paid for the month of April, 1919 (the first period in which the shortened working week took effect), the wages bill for the year 1919 would exceed that for 1918 by £33,000. To this should be added the extra cost of materials, estimated at £17,000, so that the expenses for 1919 might be estimated at £50,000 in excess of those for 1918. This would give a total for expenses of £245,000, leaving a net result of £108,000, to compare with £142,000 for 1918, or £34,000 less, but £36,000 more than for 1914. The engineering, traffic, and clerical wages of the operating staff, excluding all reconstruction expenditure, amounted in 1914 to 2s. 0½d. per car hour. In 1918 they were 3s. 6d½., while in 1919 they had risen to 4s. 10½d. The cost of labour per car hour was, therefore, 37½ per cent. more this year than last year, or 139 per cent. more in 1919 than in 1914.

Siemens Bros & Co., Ltd.

The annual meeting was held on June 12th, at Winchester House, E.C., Mr. G. Mure Ritchie presiding. In proposing the adoption of the report, which is summarised below, the chairman referred first to the balance sheet, and said there was a new item, £830,000, being debentures issued and deposited with the Public Trustee as collateral security as part of the financial arrangements which they had made with that department. If not previously paid off, that item would be reduced to £500,000 in the next balance sheet. The item of £1,326,495, due to the Public Trustee, but subsequently reduced to £500,000, was also new, and included debts incurred for capital purposes to the former enemy holders of the company's shares. Of that £1,326,495, about £690,000 was owing by Siemens Bros. Dynamo Works, Ltd., and was assured by Siemens Bros. against the receipt of an equivalent amount of 4½ per cent. debenture stock of the Dynamo Co., which appeared on the credit side of the balance sheet. They, of course, had had no dealings with the former enemy shareholders, nor any responsibilities to them. They bought the business and its assets from the Public Trustee at a fair price in competition with other tenders, and had nothing to do with the disposal by him of the price. The general reserve fund stood at £45,000, and they recommended the appropriation of £15,000 from the year's profits, raising the fund to £60,000. Buildings reserve fund at £30,000 was up by £5,000, also appropriated from the year's profits. After making the various deductions, including depreciation, set forth in the profit and loss account, but excluding the proposed appropriation of £15,000 to reserves, the profit was £334,567, as against £269,890 in 1917. On the asset side of the balance sheet, the item of leasehold buildings at Woolwich had been augmented by £11,423. Materials, manufactured goods, and work in hand had, owing to still larger demands for munitions by the Government in 1918, gone up from £764,524 to £982,587; machinery, tools, and furniture had risen from £151,425 to £156,036, but the steamship *Faraday* remained as before at the very low figure of £18,000. The proposed disposal of the balance at the credit of profit and loss account—£334,567, was fully set out in the report, and after providing a dividend of 10 per cent., free of income tax on the £600,000 entitled to rank for 1918, they carried forward a balance of £244,567 to 1919, subject to excess profits duty. Though in 1918 the volume of the company's output had largely increased, and its value had increased by about 50 per cent., the net profit only increased by about 10 per cent., the additional gross profit having been absorbed chiefly in increased war bonuses, salaries, and wages. The new board took office on April 8th, 1918, and there were now 2,000 names on the share register; of debenture holders there were about 1,200. Having referred to the fact that in 1918 they distributed £11,700 in assisting the families of employés serving in the Army and the Navy, and stated that out of 1,154 men who joined the Forces they had had the pleasure of welcoming back so far 625, the chairman proceeded to refer at some length to the manufacturing work of the company during the past year. He said that at their works at Woolwich until the Armistice they continued to concentrate their operations almost entirely on special and urgent Government work. The apparatus and telephone factory was occupied almost entirely on producing war materials for the Government and electrical apparatus required in connection with the equipment of factories producing war work, such as the automatic telephone exchanges for factories. The requirements of the Air Board gave them a steady continuous production of aircraft magnetos. Repeat orders for Fullerphones and gun-aiming points kept shops employed on the same work with which workers and foremen had become acquainted during the former year. They made for the Ministry of Munitions large quantities of 120 cm. anti-aircraft searchlights, amplifiers for telegraph work, and Morse inkers. For the Admiralty and for shipyards under Government control they maintained a steady supply of torsion meters. As, however, the Government requirements for their apparatus and telephone department were almost wholly for articles to suit the special war conditions, and were quite different from their ordinary pre-war output and post-war requirements, the change-over to normal output could only be made with considerable difficulty, as suitable raw materials were not available in their stores, while many new foremen and workers had not yet got adequate experience of the work which they were now called upon to perform. An order for an automatic telephone exchange for Valparaiso was placed with them for execution as and when war conditions permitted. They much regretted that owing to the unrest of labour, which was more pronounced in 1918 than in former years, and owing to the restriction of output by the workers and their indifference, production in that department was greatly retarded. As very few orders were placed by the Post Office during the war for telephone exchanges, and as foreign administrations were unable to obtain supplies of telegraph instruments for nearly five years, large demands had to be filled, and they expected to get a good share of the work, to cope with the expected large volume of which adequate arrangements were now being made. During 1918 the battery department extensions were completed, affording the greatly increased facilities for production required by the Government, but on the armistice production was considerably curtailed. Throughout 1918 the india-rubber department was kept fully occupied on the production of field cables, effecting deliveries in continually increasing quantities to a maximum of 2,000 miles per week. That production of course had now ceased. Trench cable of the heavy armoured, four-core type was manufactured during 1918, the output constituting a continuous supply of 80 miles per week; a production likewise stopped soon after the armistice. The Government's demands for submarine cable, principally of the telephone type, coil loaded, necessitated continuous production during 1918. In that speciality they were now the largest and premier manufacturers. The wood work carried out was far in excess of any previous years, the demands emanating from the Ministry of Munitions, and the Office of Works, for military and office requirements. Ebonite was formerly a flourishing industry in this country, but partly because makers restricted themselves to the more profitable branches and partly because the workmen would not maintain an output equal to his Continental competitor, the industry here practically became extinct. Since the war, however, they had devoted particular attention to that production, and they were now manufacturing it in increasing quantities, and of a high quality, which compared favourably with the ebonite previously imported from Germany, from which most of the high-grade quality came. With regard to the s.s. *Faraday*, during part of 1918 she was chartered to the Western Union and the Direct United States Cable Co., and did much work under trying conditions. Since the end of last year the vessel had again been chartered, and at the present time she was doing cable repair work in the Atlantic. Having referred to the Dalston lamp works, where with their increased capacity for production he said they hoped to turn out lamps in greater volume at a substantial profit, the chairman referred to the dynamo works of Siemens Bros., about a mile south of Stafford station. Those works, he said, were not occupied to the same extent as Woolwich on work contracted directly to the Government, but during 1918, as in previous years, they concentrated on important contracts, practically all of which were directly or indirectly helpful to enable the nation to secure victory by providing other firms with plant. In the circumstances, the change-over from war to peace conditions had been more easily effected at Stafford, and he was pleased to say that those works were well employed, and had a large order book. Following on the armistice came extensive cancellations of Government contracts, and in regard to the settlement of those matters, though they had not got all that they thought they might fairly claim, yet, speaking broadly, there had been nothing about which they could complain. Whatever loss might be incurred during the period of transition they must cheerfully face, hoping by energy and enterprise to make up for it later. Before the war they were, under the conditions then existing, too insular in their policy; now, as a purely British industrial concern, they aspired to a substantial share of that worldwide expansion which great firms sought. With the approval of the British authorities, last year, they dispatched on a tour round the world two gentlemen of standing and experience—Messrs. Hopkins and Leonard, the latter being an old official of the company. They did not charge them to book orders, but they were instructed to make it plain, and they had done so, that the ownership of Siemens Bros., and of the Dynamo Co. had passed from the hands of a German company into those of a British company, and that while continuing to carry on the traditions of sound material and good workmanship long associated with Woolwich and Stafford, they were no longer under German influence or working for German interests. As to the prospects for the future, subject always to honest and sane government and a reasonable attitude on the part of the workmen, he considered, generally speaking, their prospects were good. There were, however, various dangers ahead, one of which he would mention. If in Britain we were to have not nationalisation of the mines, but appropriation for their own selfish aggrandisement by one powerful but limited class of workmen, to the detriment of the rest of the community, we should plunge into industrial suicide. If the mines were put under dual control, the ultimate result would not be very different, as it would mean industrial creeping paralysis, ending also in industrial death.

Did those things come about they could not but be seriously prejudiced, though in their particular lines of business the evil effect would be neither so early, nor so pronounced, as in other manufactures, such as iron and steel, for example, where fuel was consumed to a greater extent. However, he was not a pessimist. On the whole, he regarded the political economic future with hope, if not with confidence, believing that British common sense would sooner or later assert itself, and that there was sufficient sanity in the country to prevent their being plunged into industrial chaos, and that no section of workers, however highly organised, could indefinitely seize the community by the throat and hold it up to blackmail. Subject to those observations he preferred to close on a note of optimism—he hoped temperate and reasonable optimism—in regard to the expansion of the business; and thought that on the whole, year in and year out, they might expect that adequate profits would accrue.

Lord Queenborough seconded the motion, which was carried unanimously.

Subsequently an extraordinary meeting was held at which a resolution was passed dividing the existing £5 shares of the company into five shares of £1 each, so that the capital would henceforth be £1,500,000 divided into 1,500,000 shares of £1 each, of which 1,000,000 have been issued and fully paid; and the remaining 500,000 shares are unissued.

In the report for the year ended December 31st, 1918, the directors state that the company was called upon by the Government for an increased output of war materials from the beginning of the year, and had to make further extensions to its rubber and battery shops for the purpose. More work-people were employed, and manufacture was carried on at high pressure until the armistice when work eased down, and output on Government contracts was gradually reduced preparatory to the return to civil work, for which preparations were at once made. The company's steamer *Faraday*, under the direction of the Admiralty, was engaged during the year in repairing telegraph cables for two of the Atlantic cable companies, and although working in the danger zone, escaped mishap. The amount spent during the year in assisting the families of employés who had been called up for the Navy and Army was £6,616 by this company and £5,155 by Siemens Bros. Dynamo Works, Ltd. These payments had had the effect of strengthening the good relations between the company and the men, who as they are being demobilised are returning, thus securing to the company trained men for the future. The authorised share capital was increased in July, 1918, from £600,000 to £1,500,000. Of this increase £400,000 was issued in November, making the fully paid-up capital now £1,000,000. At the same time £500,000 4½ per cent. debenture stock was sold. Since the end of the year the proceeds of the shares and debentures issued had been applied in reduction of the capital sum owing to the Public Trustee, which now stands at £500,000. The profit for the year per profit and loss account is £229,647, plus £134,920 brought forward. The interim dividend of 5s. per share required £30,000 and 5s. per share, free of tax, on the £600,000 capital absorbs a further £30,000; there is written off the commission on the sale of shares £20,000; written off discount on the sale of debenture stock, reducing it to £62,500, £25,000; put to general reserve (bringing it up to £60,000) £15,000; there is carried forward to 1919 (subject to excess profits duty for 1918) £244,567.

Delhi Electric Tramways & Lighting Co., Ltd.

Mr. A. W. Tait, C.B.E., presided at the annual meeting on June 13th. He said that the results were satisfactory, considering the abnormal conditions. The progress of the past five years was decidedly encouraging, and he hoped it would continue. They were now able to recommend the full 6 per cent. upon the preferred shares for the first time in their history. The net revenue increase for the year was £2,890, and for the five years £11,800, or 190 per cent. The costs of operation and maintenance had been affected by the higher prices of material and labour, and by difficulties in securing spare parts from this country. The revenue continued to reflect the prosperity which had ruled in India for some time, but expansion of business was retarded by the necessity of shutting down on new consumers owing to inability to obtain cables and materials for connections. Now that the restrictions had been removed, orders had been placed for the necessary cables and materials. Rates to consumers had only been increased by a small percentage—considerably less than the actual increase in cost, but they kept the surcharge low in order to encourage the use of electricity. It might be necessary at some future date to issue further capital to a moderate extent to deal with extensions of the electricity undertaking and of the tramway system; for the latter they would supply cars of a new type, adapted to meet the requirements of the service. Mr. Griffin, the general manager, was at present home on leave. The electricity supply undertaking sold 1,970,000 units (increase 6 per cent), including the tramway requirements. Average revenue per unit sold (excluding the tramway supply) 4.70d., as against 4.24d. Units sold for other than tramway supply 1,465,000. Costs of generation .96d., against .92d. per unit, due to increased charges for coal and oil fuel. The new Sulzer engine coupled temporarily to an old dynamo gave a much needed increase of capacity of 150 KW. A new dynamo had been ordered which would give an additional 80 KW. The gross revenue from the tramways increased by 11 per cent., and the receipts per passenger from .43d. to .49d. Receipts per car mile were 8.5d., against 6.9d. Passengers carried 7,204,000, against 7,480,000. The travelling habit had become established with the native population, and if they could maintain an increased service the capital in the tramways would yield a proper return. In regard to the prospects for the current year, it was impossible to give reliable estimates, as oil fuel and stores and spares still showed an upward tendency. Provided nothing unforeseen occurred, the results for 1919 should show an improvement on those now submitted.

The General Electric Co. (U.S.A.).

The report of this company dated Schenectady, April 15th, 1919, states that the value of the orders received during 1918 was £46,826,807, against £49,355,698 in 1917. A considerable part consisted of contracts for the U.S. Navy Department. As the result of heavy expenditure incurred upon additional manufacturing facilities to meet war contracts, the rate of production had reached the highest point in the company's history when the armistice was signed in November. The cessation of hostilities led to the suspension and cancellation of orders for £6,000,000, leaving approximately £16,000,000 of unfilled orders at the end of the year. Sales billed £43,363,055, an increase of £3,977,791. Net result: profit £5,675,151, plus £921,263 income from other sources. Interest on debentures and notes payable £475,417. Federal income and excess profits taxes (estimated) £2,700,000; dividends £1,833,124, leaving £1,587,873 as surplus for the year. Expenditure for additional land, buildings, machinery, and other equipment aggregated £4,318,799. As a portion of these recent additions will be unused, and having regard to their high cost owing to the circumstances under which they were built, £3,041,832 has been written off the plant account, and £637,358 will be included in the cost of unfinished contracts. £383,740 was charged against the general plant reserve, leaving an increase of £1,020,348 in the book value of plant and equipment. The totals are thus: Gross book value, £15,998,157; general plant reserve, £7,180,127; net book value, £8,808,030. The book value of the manufacturing plants which in January 1893 was £791,705 was at December, 1918, £8,808,031, after £18,493,633 had been written off or carried to general plant reserve during the 26 years. The total factory floor space increased from 17,573,000 sq. ft. in 1917 to 19,581,000 at the end of 1918. In order to provide additional facilities for the manufacture of incandescent lamps the company has leased the Sandusky works of the Libbey Glass Co., with contract to purchase. The patent account is, as before, carried at a net value of one dollar, that proportion of the actual cost which represents the unexpired life of patents and franchises being offset by a reserve of like amount. The report mentions that at the close of the year, after careful consideration, the board decided that the interests of the company would best be served by segregating its investments and activities in foreign countries in manufacturing, selling, engineering, and utility enterprises, and transferring them to a separate company—the International General Electric Co., Inc., organised in January, 1919—which will at once take over the investments and conduct the activities above described in all foreign fields. Mr. C. Neave, of the G.E.C. legal staff, becomes chairman of the new company; Mr. G. Swope, formerly vice-president of the Western Electric Co., is president, and Mr. M. A. Oudin, for many years manager of the foreign department of the General Electric Co., is vice-president. The offices of the new company are at 120, Broadway, New York City. Of the 8,421 employés of the G.E. Co. who joined the Forces, 1,880 had returned and been reinstated when the report was issued.

Marconi International Marine Communication Co., Ltd.

During 1918 the business continued to show substantial expansion. Gross revenue £563,205, an increase of £92,547, again mainly derived from rentals of additional ships fitted. The restrictions on private messages from ships at sea had only been removed since May 1st, 1919. The net profit for 1918 is £186,342. Last year shareholders were advised that H.M. Government had decided to make the provision of wireless telegraph apparatus compulsory on merchant ships of 1,600 tons gross and over, and to require that two operators be carried on all these vessels. At the request of the Board of Trade, this company undertook to provide the necessary apparatus and the trained operators. It, therefore, became necessary to arrange facilities in all parts of the country for the simultaneous training at the company's expense of a very large number of operators. Thereby a large and extraordinary expenditure has been incurred during the year under review which will not recur, and it is responsible for a small reduction in the profits compared with the preceding year notwithstanding the substantial increase in the year's revenue. The losses sustained in consequence of attacks upon the mercantile marine during 1918 have been debited to profit and loss. The directors recommend a final dividend of 10 per cent. for 1918, making 15 per cent. for the year. The total number of public telegraph stations owned and worked by the company on the high seas increased from 2,265 to 2,549. The organisation of the company, together with that of its associated companies, with a total of over 1,000 mercantile vessels fitted with Marconi telegraph stations, has continued to render inestimable service. The Amalgamated Wireless (Australasia), Ltd., in which this company is interested, has paid a dividend of

5 per cent. for the year ended June 30th, 1918. The increase of the capital of the company to £1,500,000 was duly confirmed at the extraordinary general meeting, held on May 2nd, 1919, and 600,000 new shares were offered to the shareholders, at par, on May 10th. An official quotation on the London Stock Exchange was granted for the company's shares in April last. Further members of the company's telegraph staff have lost their lives in the services of their country. The directors record the death, on May 9th, of Mr. H. S. Saunders, who had been a director of the company since its incorporation. Mr. S. St. J. Steadman and Sir C. J. Stewart, K.B.E., have been appointed directors.

Marconi Wireless Telegraph Co., of Canada.—Shareholders of this company will be invited at the approaching general meeting to agree to the reduction of the nominal value of their shares from $5 to $2.50, and to the creation of 500,000 additional shares of $2.50 each. By this arrangement the total nominal capital of the company will be reduced to $3,750,000; the company will be entirely clear of its heavy liabilities; will be provided with substantial working capital, and enter into possession of a second high-power wireless station, which will enable it to open up additional telegraph service.

Mr. Arthur H. Morse has been appointed managing director of the company, and will proceed immediately to Canada to take up his duties.

Calcutta Electric Supply Corporation, Ltd.—The number of units sold to consumers during the four weeks ended April 25th amounted to 2,587,915, compared with 2,509,519 last year.

Stock Exchange Notices.—Applications have been made to the Committee to allow the following to be quoted in the Official List:—

Smith (S.) & Sons (Motor Accessories), Ltd.—150,000 ordinary shares of £1 each, fully-paid.

Vickers, Ltd.—1,844,351 ordinary shares of £1 each, fully-paid.

Barnsley & District Electric Traction Co., Ltd.—This company is about to change its name to the Barnsley and District Traction Co., Ltd., and to divide its £5 shares up into £1 shares. It will also alter the 6 per cent. cumulative preference to 7 per cent. non-cumulative shares, and 50,000 new shares of £1 each will be added to the capital.

Manila Electric Railroad & Lighting Corporation.—The directors announce a dividend of 1½ per cent. on the common capital stock for the quarter ending June 30th.

James Keith & Blackman Co., Ltd.—The report for the year ended March 31st, 1919, states that after providing for debenture interest, excess profits duty, and making sufficient allowance for depreciation and reserves against doubtful debts, the accounts show a net profit of £36,898. The balance brought forward is £13,266. Preference dividends paid, £2,112, leaving a balance of £48,052. Dividend on the ordinary shares at the rate of 10 per cent. and a bonus of 10 per cent., both free of income-tax, absorbing £16,000, transfer to reserve account £15,000, and carry forward £17,062.—*Financial Times.*

Vulcan Boiler & General Insurance Co., Ltd.—Interim dividend 9 per cent. (4s. 6d. per share), less income tax.

Mackay Companies.—Dividend of 1½ per cent., less income tax, on the common stock.

Mirrlees Bickerton & Day, Ltd.—Year ended March 31st, 1919, net profit, after providing for depreciation and excess profits duty, £33,177. £2,120 brought forward. Dividend 12½ per cent., free of income tax, on the ordinary shares; to reserve fund £5,000; carry forward £5,720.

United River Plate Telephone Co., Ltd.—The gross earnings during the year ended December, 1918, were £908,870, while the gross maintenance and other charges in Argentina and London were £616,370, leaving £292,500 profit, plus £17,308 brought forward. Debenture interest and preference dividend are paid and dividends (including 5 per cent. final) on the ordinary amount to a total of 8 per cent., free of tax. There is put to reserve £60,000, to reserve (war contingencies) £60,000, and £36,707 is to be carried forward. Sir John Gavey has found it necessary to resign the chairmanship, and Sir Frederick Green has been appointed in his place. Sir John has been elected as deputy chairman.

Cork Electric Tramways & Lighting Co., Ltd.—The report shows that, after paying the preference dividend, putting £6,500 to reserve for depreciation and renewals, £4,000 to maintenance reserve, and writing £396 off wiring consumers' premises, and including £3,776 brought forward there is a credit balance of £3,649, which is to be carried forward.

Ruston & Hornsby's, Ltd.—After paying dividend of 8 per cent. for the year, £40,697 is to be put to depreciation, £40,000 to reserve, and £41,000 is to be carried forward.

Yorkshire (Woollen District) Electric Tramways Co., Ltd.—The report for 1918 shows that the revenue was £102,562, an increase of £17,977. £19,800 is put to renewals. The dividend on the ordinary shares is to be 6 per cent. for the year. In addition a further £10,001 is to be applied to raising the dividend for the years from 1914-1918 from 5 per cent. to 6 per cent. average. £1,978 is to be carried forward.

Calcutta Tramways Co., Ltd.—Sir H. Kimber presided at the annual meeting on June 16th. He said that the traffic receipts showed an increase of £24,803, or about 10 per cent. This was comparing with the excellent figures of the previous year. The increase on mileage run was only 1 per cent. The other receipts were £14,962, chiefly a profit on exchange of £14,128. The total Indian working expenses were £8,062 more than in the previous year, and £5,637 of that amount represented a bonus of one month's salaries and wages paid to the Calcutta staff to meet increased cost of living, &c. There was a gross profit of £151,124 over all working expenses. The traffic receipts continued to show substantial improvement. During the past five months the traffic receipts increased by Rs. 2,55,172, and the mileage run by 25 per cent., while the rate of exchange still continued largely in their favour. They had ordered 15 new trams. They were now obtaining better deliveries of materials for repairs and renewals.

Petters, Ltd.—After paying the preference interest a dividend of 10 per cent. and a bonus of 2s. per share are to be paid on the ordinary shares, putting £50,000 to reserve, and carrying forward £16,993.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—Net receipts for 1918 from all sources £88,063. After deducting expenses and interest on loan, £20,000 is put to reserve, including sinking fund, 6 per cent. is to be paid on the ordinary shares, and £8,136 is to be carried forward. An issue of £150,000 cumulative preferrence shares (6 per cent.) will be made to discharge capital liabilities and to provide additional capital.

Nairobi Electric Power & Lighting Co., Ltd.—Final dividend at the rate of 2 per cent. for the year 1918, less tax.

STOCKS AND SHARES.

Tuesday Evening.

Now that the Victory Bonds are out the effect is not much greater upon Stock Exchange business than was produced by the anticipation of their advent. Certainly business in the investment markets is quiet, but, also certainly, this is a state of affairs which is not unusual in June. Brokers are being asked whether they find much selling of existing securities on behalf of people who want to apply for the new bonds, and the reply on the whole is in the negative. A good many prices have been marked down to the tune of a point or so amongst gilt-edged stocks, while in the markets for first class industrial debentures and preference descriptions there is an obvious slackening of demand. But prices on the whole are comparatively little influenced by the bonds, and it is regarded in the Stock Exchange as astonishing that a loan of such magnitude can be floated at the cost of so trifling a disturbance to other markets.

For the second week in succession there is no change to record in the price-list of London electric supply companies' shares. It may be that the month will go by and leave the list untouched. This is not to say, however, that there is no interest taken in the market. In point of fact, keen attention is being paid to the prospects of the industry as they open up under the Government Bill. We have already hinted that one of the effects of the Bill may easily be a prolongation of the companies' leases of life, and this impression becomes stronger amongst those who are in close touch with the workings of the business. At any rate, the Government Bill, instead of being regarded as a bear point, and one which justified the putting down of prices three weeks ago, is now held to carry germs of hopeful possibilities which may result in the position of proprietors being bettered instead of worsened.

Cable securities have given way in several cases, owing to the general wish to subscribe to the new bonds. Eastern Extensions are down 5s., Eastern Ordinary 2 points and Western Telegraphs 2s. 6d., while in the telephone shares, Orientals and United River Plates are both 1/16 lower. Globes fell back to 16. It is easy enough to understand that holders of these stocks should consider it patriotic to sell them in order to buy the new bonds, seeing that the return on the latter looks much about the same as that on the cable shares, although it is easy to forget that the dividends on the cable companies' shares are distributed free of tax, which makes a very considerable difference in these days of a 6s. in the £ impost. The same influence is at work amongst certain of the good foreign tramway bonds, and some which, until lately had been extremely difficult to buy, are now obtainable at more reasonable figures.

The Marconi market has developed renewed animation under the leadership of Canadians. Shareholders of the Canadian Marconi Company are asked to agree to the cutting in half of the nominal value of the shares—making them 2½ dollar, instead of 5 dollar shares—and to the creation of half a million additional shares of the new denomination. This is read as a clear sign of forthcoming bonus, and the price rose from 16s. to 18s. 9d. before a slight reaction took place. The Marconi International Marine Company's report shows a gross revenue for the year of £563,200, an increase of £92,500 over the previous twelvemonth, but large and extraordinary expenditure, of the non-recurring kind, was involved by the training of a "very large number of operators," and the net profits accordingly show a small reduction. A dividend of 10 per cent., making 15 per cent. for the year, is declared, the same as that for 1917. The price has remained steady at 3 9/16, while the parent shares are 6 3/16 and American Marconis a shade better at 30s.

Brazilian Tractions have fallen back to 60, and the foreign list as a whole is dull. The news that American troops have crossed the Mexican frontier, and that General Villa is again displaying unhealthy activity, has had the effect of making Mexicans weaker. Mexico Trams and Mexican Light and Power bonds have both eased off. Anglo-Argentine Tramways First Preference are also lower again. Bombay Electric Second Debentures at 86½ show a rise of 3, and the Preference shares hold their price at 11¾.

Underground Electric Income Bonds went back to 95½. Amongst this week's letters of a stockbroker was one from a client asking whether the latter could "convert" his Underground Electrics into the new Victory Bonds! The shilling shares have weakened to half-a-guinea, and Home Railway stocks are generally heavy.

British Westinghouse Preference have recovered all their dividend and a little more, the market being extremely hard. Babcock & Wilcox, after giving way to 3 13/16, recovered to 3 15/16, which still leaves them a little lower on the week. General Electric Ordinary have risen 10s. to 22. India Rubber shares have resumed their advance, and are now 17¾. Henleys hardened to 2½. English Electrics are dullish at 27s. 6d., and other shares in this group are quiet. The rubber market has been flat in consequence of a drop to 1s. 8¼d. per lb. in the price of the raw material, though a slight recovery in prices ensued upon a farthing rally in rubber. Iron, coal and steel shares are somewhat under the influence of what possibilities may be held in the forthcoming report of the Coal Commission. Industrials as a whole maintain their prices with a good deal of strength.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies

	Dividend		Price June 17,		Yield
	1917.	1918.	1919.	Rise or fall.	p.c.
Brompton Ordinary	10	8	6¾	—	£5 8 16
Charing Cross Ordinary	4	4	8¼	—	6 3 1
do. do. do. 4½ Pref...	4½	4½	8½	—	6 18 4
Chelsea	6	8	8⅝	—	4 2 9
City of London	8	8	11⅞	—	6 14 6
do. do. 6 per cent. Pref. ..	6	6	10	—	6 0 0
County of London	7	7	10⅛	—	6 18 8
do. do. 6 per cent. Pref.	6	6	10	—	6 0 0
Kensington Ordinary	7	8	6¼	—	6 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref...	6	6	8⅜	—	7 14 10
Metropolitan	4	5	8⅛	—	8 0 0
do. 4½ per cent. Pref. ..	4½	4½	8¼	—	6 18 6
St. James' and Pell Mell	9	10	7⅛	—	7 0 4
South London	6	5	2¾	—	7 5 6
South Metropolitan Pref.	7	7	20,6	—	6 16 7
Westminster Ordinary	9	6	6⅜	—	6 10 8

Telegraphs and Telephones.

	1917.	1918.	1919.	Rise or fall.	p.c.
Anglo-Am. Tel. Pref.	6	6	100	—	6 0 0
do. Def.	1½	33/6	22¼	—	7 8 0
Chile Telephone	8	6	7	—	6 14 4
Cuba Sub. Ord.	7	7	11	—	*6 4 5
Eastern Extension	6	8	16⅛	— ¼	*4 17 9
Eastern Tel. Ord.	8	8	164	—2	*4 17 8
Globe Tel. and T. Ord.	7	8	16	— ⅛	*5 0 0
do. do. Pref.	6	6	10⅝	—	5 13 0
Great Northern Tel.	22	22	82	—	6 17 6
Indo-European	18	18	55	—	6 18 2
Marconi	20	20	6 3/16	— ⅛	3 4 6
Oriental Telephone Ord.	10	15	2[illegible]	— 1/16	6 9 0
United R. Plate Tel.	8	8	8½	— 1/16	*4 18 6
West India and Panama	1/9	1/9	1[illegible]		*4 6 4
Western Telegraph	8	8	17	—⅛	*4 14 2

Home Rails.

	1917.	1918.	1919.	Rise or fall.	p.c.
Central London Ord. Assented ..	4	4	63½	—	6 6 0
Metropolitan	1	1¼	26	—	4 16 4
do. District	Nil	Nil	24½	—	Nil
Underground Electric Ordinary..	Nil	Nil	9½	—	Nil
do. do. "A" ..	Nil	Nil	10/6	—3d.	Nil
do. do. Income ..	4	6	95½	— ½	*5 4 9

Foreign Trams, &c.

	1917.	1918.	1919.	Rise or fall.	p.c.
Adelaide Sup. 6 per cent. Pref. ..	6	6	4⅝	—	6 11 4
Anglo-Arg. Trams. First Pref. ..	5½	Nil	3⅛	—⅛	—
do. do. 2nd Pref. ..	—	—	8¼	—	—
do. do. 6 Deb... ..	6	6	68½	—	7 8 5
Brazil Tractions	—	—	60	—1	—
Bombay Electric Pref.	6	6	11¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62½	—1	7 18 6
do. do. Preferred	Nil	2½	48½	+1	5 8 1
do. do. Deferred	Nil	Nil	44½	+1	Nil
do. do. Deb. ..	4½	4½	61½	— ½	6 17 10
Mexico Trams 5 per cent. Bonds..	Nil	Nil	62½	—	Nil
do. 6 per cent. Bonds..	Nil	Nil	50½	—1	Nil
Mexican Light Common	Nil	Nil	37	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds.. ..	Nil	Nil	67	—2	—

Manufacturing Companies.

	1917.	1918.	1919.	Rise or fall.	p.c.
Babcock & Wilcox	15	15	3 15/16	—[illegible]	8 16 0
British Aluminium Ord.	10	10	1 11/16	—	5 18 6
British Insulated Ord.	25	12½	2[illegible]	+ 1/16	5 11 1
British Westinghouse Pref. ..	7½	8	2⅞ xd.	+ 1/16	5 11 1
Callenders	25	25	10¼	—	6 3 0
do. 6½ Pref.	5	6½	5⅛	—	6 3 10
Castner-Kellner	25	20	8	—	6 13 4
Edison-Swan, "A"	—	—	1¼	—	6 0 0
do. do. 5 per cent. Deb. ..	4	5	75½	—	6 12 8
Electric Construction	10	10	1¼ xd.	—	8 0 0
Gen. Elec. Pref.	6	6½	10½	—	6 8 10
do. Ord.	10	10	22	+½	*4 11 0
Henley	25	25	2½	—	5 2 6
do. 4½ Pref..	4½	4½	8¾	—	6 0 0
India-Rubber	10	10	17¾	+⅛	*6 12 8
Siemens Ord...	—	10	6[illegible]	—	*7 4 0
Telegraph Con	20	20	25½	—	4 18 6

*Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Wednesday, June 18th.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Oxalic	per lb.	1/5	..
a	Ammeniac Sal	per ton	£80	..
a	Ammonia, Muriate (large crystal)	,,	£78	..
a	Bisulphide of Carbon	,,	..	..
a	Borax	,,	£39	..
a	Copper Sulphate	,,	£44	£1 inc.
a	Potash, Chlorate	per lb.	1/3	..
a	,, Perchlorate	,,	1/5	..
a	Shellac	per cwt.	£17	10/- inc.
a	Sulphate of Magnesia	per ton	£15	..
a	Sulphur, Sublimed Flowers ..	,,	£28	.
a	,, Lump	,,	£20	..
a	Soda, Chlorate	per lb.	9d.	1d. dec.
a	,, Crystals	per ton	170/-	..
a	Sodium Bichromate, casks ..	per lb.	..	..
	METALS, &c.			
c	Brass (rolled metal 2" to 12" basis)	per lb.	11⅜d.	..
c	,, Tubes (solid drawn) ..	,,	1/2¼ to 1/2½	.
c	,, Wire, basis	,,	1/-	..
c	Copper Tubes (solid drawn) ..	,,	1/3¾	..
g	,, Bars (best selected) ..	per ton	£117	£3 inc.
g	,, Sheet	,,	£117	£3 inc.
g	,, Rod	,,	£117	£3 inc.
d	,, (Electrolytic) Bars ..	,,	£88	£5 inc.
d	,, ,, Sheets ..	,,	£161	..
d	,, ,, Wire Rods	,,	£96	£5 inc.
d	,, ,, H.C. Wire	per lb.	1/0¾d.	¾d. inc.
f	Ebonite Rod	,,	3/-	..
	,, Sheet	,,	2/6	..
n	German Silver Wire	,,	2,6	..
h	Gutta-percha, fine	,,	11/-	..
h	India-rubber, Para fine	,,	2/5	½d. dec.
i	Iron Pig (Cleveland warrants) ..	per ton	Nom.	..
l	,, Wire, galv. No. 8, P.O. qual.	,,	£42	£2 inc.
g	Lead, English Pig	,,	£21	..
g	Mercury	per bot.	£18 10 to £19	..
e	Mica (in original cases) small ..	per lb.	8d. to 4/6	..
e	,, ,, ,, medium	,,	5/- to 10/-	..
e	,, ,, ,, large ..	,,	12/6 to 25/- & up	..
d	Silicium Bronze Wire	per lb.	1/5	1d. inc.
r	Steel, Magnet, in bars	per ton	..	..
g	Tin, Block (English)	,,	£239	£7 inc.
n	,, Wire, Nos. 1 to 16	per lb.	4/-	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
r W. F. Dennis & Co.

A New Splitdorf Magneto.—There are a number of interesting constructional innovations in this instrument. One of these is the use of a single square carbon brush. The new instrument shows a decided increase in sturdiness, the interrupter points, for instance, being noticeably heavier. Micarta gears are used and the distributor board is made of a new composition known as Americanite. The Mason principle of stationary windings and revolving poles is retained in the new instrument, which is unidirectional. Americanite is a new insulating material which the Splitdorf Company has discovered for use in electrical instruments, and which the company manufactures in its own plant. It is moulded similar to products of this nature, and in the case of the distributor block the contacts are moulded in with the Americanite. The Micarta not only is very quiet, but is long-lived as compared with metal.—*Aerial Age Weekly.*

Japanese Copper for Germany.—The Japanese Government Department for Commerce has given its consent to the resumption of the export of copper to Germany. Deliveries of Japanese copper will give immediate relief to the Rhenish-Westphalian and the Upper Silesian industries. But for the moment there is no shipping available.—*Zeitschrift für angewandte Chemie.*

Power Transmission by Magnetic Belts.—According to French Patent No. 487,380 of P. L. Weston, thin steel or iron belts are used on magnetised pulleys to transmit power. The magnetisation of the pulleys is effected by windings lying in helicoidal slots on the surface of the pulleys. The thickness of the belt should not exceed about 0.06 times the diameter of the smallest pulley. With a steel belt of ⅛ in. thickness making contact over an arc of 145 deg. on a pulley of 10-in. diameter running at 4,000 R.P.M., it is possible to transmit more than 200 H.P. per in. width of belt. With a pulley of 50-in. diameter running at 800 R.P.M., a belt of 1 in. width will transmit 1,000 H.P. Steel belts may be run at speeds of 18,000 ft. per min., so that this method of transmission is suitable for speed reduction with turbines.—*Revue générale de l'Electricité.*

TRADE STATISTICS OF NEW ZEALAND.

The following figures, showing the imports of electrical and allied goods into New Zealand in 1917, are taken from the official statistics which have recently reached this country. The figures for the previous year are given for purposes of comparison, and increases or decreases are noted. The country named is the country of origin of the goods.

	1916. £	1917. £		Inc. or dec. £
Leather belting.—				
From United Kingdom ...	4,000	3,000	–	1,000
,, United States ...	1,500	1,000	–	500
,, Other countries ...	2,500	6,000*	+	3,500
Total	8,000	10,000	+	2,000
* Australia £5,000.				
Belting, other than leather.—				
From United Kingdom ...	39,000	39,000		—
,, Australia	2,000	3,000	+	1,000
,, United States ...	3,000	6,000	+	3,000
Total	41,000	48,000	+	4,000
Engine packing.—				
From United Kingdom ...	13,000	10,000	–	3,000
,, Australia	3,000	3,000		—
,, United States ...	7,000	8,000	+	1,000
,, Other countries ...	1,000	—	–	1,000
Total	24,000	21,000	–	3,000
Scientific instruments.—				
From United Kingdom ...	4,000	2,000	–	2,000
,, United States ...	2,000	4,000	+	2,000
,, Other countries ...	1,000	1,000		—
Total	7,000	7,000		
Telegraph and telephone wires, iron.—				
From United Kingdom ...	1,000	—	–	1,000
,, United States ...	1,000	1,000		—
,, Other countries ...	—	8,000*	+	8,000
Total	2,000	9,000	+	7,000
* Canada.				
Generators, motors, and transformers.—				
From United Kingdom ...	46,000	35,000	–	11,000
,, United States ...	38,000	29,000	–	9,000
,, Other countries ...	2,000	2,000		—
Total	86,000	66,000	–	20,000
Electric batteries and cells.—				
From United Kingdom ...	10,000	1,000	–	9,000
,, United States ...	7,000	15,000	+	8,000
,, Other countries ...	2,000	2,000		—
Total	19,000	18,000	–	1,000
Carbons and insulating material.—				
From United Kingdom ...	7,000	2,000	–	5,000
,, United States ...	3,000	5,000	+	2,000
,, Other countries ...	1,000	1,000		—
Total	11,000	8,000	–	3,000
Other electrical material.—				
From United Kingdom ...	78,000	55,000	–	23,000
,, United States ...	52,000	36,000	–	16,000
,, Australia	2,000	2,000		—
,, Sweden	1,000	1,000		—
,, Other countries ...	7,000	5,000	–	2,000
Total	140,000	99,000	–	41,000
Telephones and accessories.—				
From United Kingdom ...	13,000	8,000	–	5,000
,, United States ...	11,000	20,000	+	9,000
,, Other countries ...	1,000	10,000	+	9,000
Total	25,000	38,000	+	13,000
Meters, electricity.—				
From United Kingdom	12,000	5,000		7,000
,, Other countries	2,000*	2,000		
Total	14,000	7,000		7,000
* United States £2,000.				
Lamps, electrical.—				
From United Kingdom ...	29,000	22,000	–	7,000
,, Holland	9,000	9,000		—
,, United States ...	8,000	17,000	+	9,000
,, Other countries ...	—	1,000	+	1,000
Total	46,000	49,000	+	3,000
Steam engines.—				
From United Kingdom	41,000	31,000	–	10,000
,, United States	2,000	1,000	–	1,000
Total ...	13,000	8,000		5,000
Gas and oil engines (except for motor cars).—				
From United Kingdom ...	11,000	7,000		4,000
,, United States ...	21,000	23,000	+	2,000
,, Other countries ...	6,000	4,000		2,000
Total	68,000	58,000	–	10,000
Boilers.—				
From United Kingdom ...	10,000	6,000	–	4,000
Insulated cable and wire.—				
From United Kingdom ...	156,000	58,000		98,000
,, United States ...	6,000	7,000	+	1,000
,, Other countries ...	10,000*	12,000	+	2,000
Total	172,000	77,000	–	95,000
* Japan £9,000.				
Mining machinery.—				
From United Kingdom ...	11,000	7,000	–	4,000
,, Australia	3,000	2,000	–	1,000
,, United States ...	6,000	4,000	–	2,000
,, Other countries ...	2,000	—	–	2,000
Total	22,000	13,000	–	9,000
Railway and tramway plant.—				
From United Kingdom ...	73,000	8,000	–	65,000
,, Australia	10,000	4,000	–	6,000
,, Other countries ...	11,000	—	–	11,000
Total	94,000	12,000	–	82,000

German Wireless Development.—According to *E.T.Z.* of March 13th, great improvements have been made in wireless communication during the war. It was found possible to keep up communications in both directions between Germany and the Colonies for at least six hours in the day, the best times being 6 to 11 a.m., and the best wave-length 5,500 m. With 100 KW. it was at times possible to reach Windhuk. The Goldschmidt machine at Eilvese gave much trouble and failed for long periods, nevertheless towards the end of the war it became much more reliable. Its capacity was increased to 800 KW.

The Nauen station, also with 800 KW. capacity, was most satisfactory in its operation. The relays were improved so as to enable 50 to 80 words to be transmitted per minute. One method of sending consists in taking two frequencies out of the same machine and causing these to interfere so as to give a note. This system is also in use, as an alternative, at the Pola station. Variations of the note are counteracted by a very sensitive speed regulator. The Nauen station has been greatly extended. The antenna has been raised by a second tower 260 m. high. Methods of double sending by two senders acting on one antenna tuned simultaneously to two wave-lengths have the advantage of attaining a greater degree of selectivity by the combination of the wave-lengths. New types of cathode-tube amplifiers rendered communication possible between firing trenches with very light apparatus. Blocking stations were used to interrupt the wireless communications of enemy aircraft. Directive stations were very successful in aiding Zeppelins to cruise over England, and it was even possible to guide a Zeppelin over Paris through a thick fog. Various improvements are referred to in arc transmitters, tube transmitters, high-frequency coils, receivers, relays, and antennæ.

Copper Scarcity.—Since Russia fell out of the war, stocks of copper in Japan have accumulated. This is a matter affecting in some degree the markets of the world, for the Russian demand having ceased, Japanese present prices do not admit of competition in other countries. Before the war, Japanese exports of copper amounted in value to Yen 25 million. With rapidly rising prices, this value increased to Yen 60 million in 1917. Of this quantity England took 25,000 tons against 14,000 tons in the previous year, while the Russian demand dropped to one half.

The shortage of copper, from which all Norway, but especially the electrical works of that country, has suffered through war conditions, no longer exists. America is now in a position to deliver the whole of the metal purchased long ago on Norwegian account. In consequence of this, the electrical works at Christiania have forbidden the continued use of zinc and iron as electrical materials. From July 1st, 1919, only copper is to be used for electrical purposes. The imports from America will include large quantities of line wire.—*Metall und Erz.*

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

ANNUAL CONVENTION.

ON Wednesday the Annual Convention of the Association was to open at Ipswich; it was to continue on Thursday at Felixstowe, and will close to-day. As the exigencies of printing and distribution compel this journal to go to press on Wednesday, we are obviously unable to report the proceedings, but from the programme which we have already published it will be seen that in addition to the usual technical and commercial transactions, the social amenities which in pre-war days contributed so largely to the success of these conventions have now been restored; ladies are welcomed to the convention, and visits to works and other places of interest—notably Harwich Harbour, where surrendered German warships were to be inspected yesterday, and the Felixstowe Air (Sea-plane) Station to-day—have been arranged. We have no doubt that, given fine weather, the 1919 Convention will rank with any of its forerunners in point of interest and recreation, while the fact that it is the first peace-time reunion of municipal electrical engineers will go far to ensure a large attendance and a most enjoyable renewal of old friendships.

Mr. Ayton, whose various duties comprise, besides his functions as electrical engineer and tramways manager to the County Borough of Ipswich, those of President of the Association, chairman *and* hon. secretary of the Electric Vehicle Committee of Great Britain, is also acting as hon. secretary for the Convention; apparently, therefore, the 44-hour week does not appeal to him, and he loves work for its own sake—certainly during the past weeks he must have practised intensive production assiduously, and we trust that his efforts will be crowned with the unblemished success that they deserve. In his Presidential address, of which a slightly condensed report is given below, he blesses the Electricity Supply Bill—provided that it is amended to suit the wishes of the Association—and lays stress on the point to which we first drew attention when the Coal Conservation Committee's Report was about to be published[*]—namely, that while public bodies and Committees were pouring out proposals "to the end that an abundant supply of electricity shall be available for all classes of consumer," not a stroke was being done to develop the demand, without which such a supply would be a drug in the market. Central-station engineers may well be trusted to provide that abundant supply; but to build up the demand will not be the work of a day, and we cordially endorse Mr. Ayton's exhortations to them as managers and salesmen to set about preparing the market in good time.

It is true that the war provided an immense stimulus to the sale of electrical energy—for war purposes; but, as the President points out, the Armistice brought with it a heavy drop in the output. That, no doubt, will be partly made good as industry settles down to its normal lines, but in many places it will be a long time before the demand overtakes the facilities for supply already available. "Dora" no longer controls the situation. But "Eda" comes to the rescue—somewhat belated, for we have advocated her creation and invoked her assistance these ten years past—and in the Electrical Development Association we see, with Mr. Ayton, the instrument by which prosperity may be assured to the supply industry, provided that the industry gives its wholehearted support and co-operation to the new organisation. The first essential to success is financial resources; the operations of the E.D.A. will be nation-wide, and it is but fair that all who benefit thereby shall bear a fair share of the cost. If, under existing powers, municipal undertakings find it difficult (though *not impossible*) to shoulder the burden, now is the time, when the Bill is going through Parliament, to take steps to ensure that the obstacles shall be removed, and that the authorities charged with the duty of supplying electricity shall be placed in a position to develop their undertakings *on commercial lines.* Mr. Ayton draws attention to the absurd restrictions imposed by some municipalities which own both gas and electricity undertakings upon the respective managers, restraining them from competitive efforts to develop their undertakings; could anything be more foolish or short-sighted? Competition is of the greatest value not only in fostering demand, but also in encouraging the pursuit of economies in working and organisation, and wilfully to discard this most potent factor of efficiency is a policy which calls for the severest censure.

Not only to the commercial side of the subject must station managers devote attention—there is also the sociological aspect to consider, a matter which has rightfully assumed a position of constantly increasing importance. This forms the subject of the paper by Alderman W. Walker, A.M.I.E.E., of which we give an abstract commencing on the next page.

Yesterday a discussion on "Electric Transmission Considerations," to be opened by Mr. S. L. Pearce, M.Sc., O.B.E., was to take place, and a paper by Bailie W. B. Smith, O.B.E., on "Valuing and Assessing Electrical Undertakings" was to be read and discussed. To-day the Annual General Meeting will be held, followed by a Special General Meeting to alter the Articles of Association. We see no reference in the programme to the Report of the Electric Vehicle Committee, which is usually submitted at the Convention, but presumably it will be presented to-day.

Mr. Ayton, in announcing Mr. H. Faraday Proctor's retirement from the position of hon. secretary, paid him a tribute of appreciation of the valuable services which he had rendered to the Association over so many years. We gladly seize the opportunity of associating ourselves with Mr. Ayton's remarks. Naturally the technical Press has been more or less continually in communication with Mr. Proctor, and while we have not always seen eye to eye with the Association, we have always met with the most kindly courtesy and consideration at the hands of the hon. secretary, who has shown every disposition to co-operate with us in promoting the welfare of the electricity supply industry. We feel that that industry, particularly but not solely on the municipal side, owes a debt of gratitude to Mr. Proctor for his untiring efforts and invaluable services. At the same time we tender our congratulations to Mr. A. C. Cramb on his appointment to the very honourable—and onerous—post vacated by Mr. Proctor.

Presidential Address.

BY MR. FRANK AYTON,
Chief Electrical Engineer, Ipswich. (*Abstract.*)

THE fact that this is the first post-war Convention planned on the lines of pre-war days gives an added importance to the occasion, but still greater importance is attached to it by reason of the momentous changes that are on the eve of being made in the organisation of the electricity supply industry. Whatever may have been the effects of the war in other directions, posterity will concede that, as concerned the electrical industry, the war did good by bringing the nation to recognise, first, the importance of electricity supply, and, second, the general inefficiency and the drawbacks of the present methods of electrical generation and distribution, and to take active steps towards improvement.

During the war the majority of electric supply undertakings have carried on under difficult conditions, among which may be mentioned depletion of staffs, impossibility of always effecting repairs as needed, the ever-increasing demand, poor quality of fuel, shortage of plant, &c. The lot of the central-station engineer, especially in the case of those responsible for catering for industrial demands, has not been an altogether happy or enviable one, and the easing off in the output that followed the signing of the armistice came, therefore, in some ways as a rather welcome relief. While that memorable event released us from some of our war-time difficulties, it brought upon us at least one new one of a serious character, and that was the considerable falling-off in the industrial demand and the consequent declension in revenue. This is, of course, but a temporary condition which will right itself so soon as our industries can be re-established upon a normal peace footing, labour difficulties be composed, and the galling restrictions on export trade removed. Nevertheless, the reduction in revenue which has resulted, and which it was, of course, impossible to foresee when our estimates for the year were framed, has placed a number of undertakings, whose output was largely for industrial power, in a somewhat serious financial position. The incidence of the Fuel and Lighting Order has also been responsible for a not inconsiderable reduction in revenue from private residence and other consumers coming within the purview of its restrictions.

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[*] ELECTRICAL REVIEW, December 28th, 1917.

So much has already been said and written about the Williamson Committee's report and the Government Electricity Supply Bill, which, generally speaking, follows closely the main lines of the report, that it would be needlessly taking up time to make any detailed reference to the measure now before Parliament. The Association has put forward its criticisms of certain clauses and its recommendations for alteration and amendment, and it remains to be seen how far those recommendations will be adopted. If the Bill is altered as we desire it altered—and our suggestions for alteration are rather in matters of detail—and the important principle of public control is adhered to and safeguarded—then, in my opinion, there is little doubt that the carrying-out of its provisions will be of immense benefit to the nation, and in particular to the electricity supply industry.

The ultimate success of the measure will largely depend upon the choice of the Electricity Commissioners and the constitution of the District Boards. It is to be hoped that political influence will not be allowed to play any part in the appointment of the Commissioners, and that the latter will be chosen solely upon their technical and business qualifications and their suitability for the positions.

If the spirit of real business management and commercial enterprise can be breathed into the new organisation and maintained; if all that is done under the new regime has for its aim the national interest; if it can be kept free from the baneful effects of political wirepulling and exploitation, from a change in policy coincident with every change in the Government; then I have confidence that the placing of the Bill upon the Statute Book will be of immense advantage to the country. As for the electricity supply industry, it, at last, will have secured its Magna Charta, and have been freed from those legislative shackles which have for so many years impeded its free development in this country.

The need for the reorganisation and the co-ordination of electric supply has been abundantly proved. The electricity supply industry is now, as it were, part and parcel of the manufacturing organisation of the country; its future and its prosperity are indissolubly linked up with that of the nation's industries. To secure that the products of the latter may compete in the markets of the world, a cheap and abundant supply of electrical power is clearly one of the main necessities.

It was claimed by a speaker at a previous meeting of this Association that the actual cost of electric power to the industrial consumer represents but a small percentage of the whole cost of production in the factory, and that consequently the question of low price for power was not of so much real importance to the manufacturer as had been made out. That observation may be true in regard to certain industries, but as a general statement it is far from being correct. There is, for example, a wide difference in this respect between a clothing factory and an electrochemical works, between a printing works and a rolling mill.

In preparing to meet the demands of the future, a bold policy and the long and statesmanlike view are needed. We shall find ourselves sadly in error, and we shall seriously hamper industrial progress in those supply areas for which we are responsible, if we do not clearly visualise the altered conditions under which manufacturing operations will need to be carried on in the new era which is opening before us. These conditions will compel the use by the manufacturer of a considerably greater amount of machinery, and therefore power, per employé than has been the case in the past. Everything points to an enormous increase in the demand for electric power, which has proved to be far and away the most economical, convenient, and efficient means of driving machinery in the factory and the workshop, while the employment of electricity in other important industrial operations has become well established. The wonderful expansion in the use of electricity during the four and a half years of war is surely an index of what we may expect to have to meet in the way of increased demand in the future. The electric supply interests will be inexcusably lacking in foresight if they do not in good time prepare for this demand by the provision of ample generating plant.

While the conditions under which electrical energy is generated may be improved by the reorganisation of electricity supply upon national lines, the maximum of benefit will not accrue if we fail to recognise that the development of consumption is as important to the cheapening of electricity as the building of super-stations, linking-up, and the elimination of inefficient plants. The one is surely the obvious corollary to the other. The "business-getting" side of electric supply must be developed to a far greater extent than in the pre-war days.

In the great expansion in the use of electricity during the four and a half years of war, in all the eulogies upon its efficiency, convenience, and economy for industrial and other purposes that have come from authentic and official sources during that time, we have a great and valuable heritage to make use of in the intensive publicity campaign which, as the result of the formation of the Electrical Development Association, we have reason to hope may soon be inaugurated. One looks for great things from that association, and it must be a source of satisfaction to us that a well-known member of the I.M.E.A., Mr. J. W. Beauchamp, should have been chosen as its director. His appointment is, in itself, an augury of the successful results which may be expected.

I understand that an appeal is to be made by the Electrical Development Association, through the I.M.E.A., to all electric supply authorities for financial support, and one may express the hope that electric supply committees will respond to such appeal in a broad-minded and generous spirit. It ought surely to be the aim of every electric supply committee that the product of its undertaking should bring advantage and benefit to the greatest possible number of the inhabitants in the area. How, one may ask, can such aim be achieved otherwise than by keeping constantly before each prospective user, by means of appropriate publicity and propagandist effort, the merits and many uses of electricity? If we are to be in a position to supply electrical energy at the lowest possible price compatible with the business being conducted, as it should be, on sound commercial lines, we must secure outlets for its sale in every possible direction, its use for every purpose for which it offers advantages. The uses are innumerable, the advantages, financially and otherwise, of proved and unquestionable value. They require but to be made widely known to result in an enormous expansion in demand.

In the report of the Coal Conservation Sub-Committee of the Reconstruction Committee, dated April 17th, 1917, a most unjust aspersion was cast upon municipal electrical undertakings in the statement to the effect that more enterprise and progressiveness was manifest in the management of company-owned undertakings than in the case of those which are municipally owned. While there have been instances among municipally-controlled electric supply undertakings of apparent apathy in this matter of adopting what is generally recognised in commercial circles as a necessity to prosperity and progress in business, namely, "publicity," the underlying reason in these cases has seldom, if ever, been the indifference of the engineer responsible for the management of the particular undertaking, but the extraordinarily mistaken view which the ratepayers' representatives have taken where both electricity and gas are controlled by the same authority. There can be no greater error than to suppose that the interests of the municipality are best served by the arrangement which prohibits either undertaking from adopting every appropriate and possible means of publicity for the purpose of expanding its business. Competition should be permitted and encouraged to the fullest possible extent.

Whilst we must admit that there are those instances where modern propagandist methods have been taboo, there are not a few company undertakings against which the same reproach may be levelled, and where there is not the excuse for the management that has been mentioned above.

This Association can, I venture to think, point with some pride to its record of propagandist effort in the past. We may instance our offspring, the Electric Vehicle Committee, as so far the only successful co-operative effort in developing a particular use of electricity, and while one must acknowledge the great value of the services rendered by the representatives of the other constituent bodies upon that Committee, the fact remains that the credit for the inception of the movement, which is now having so marked a degree of success, belongs to the I.M.E.A., which, be it remembered, had also taken the initiative in the formation of an Electric Development Committee a short while prior to the outbreak of war. With Lieut.-Col. Vignoles as its hon. secretary that Committee, which was constituted upon the same co-operative lines as the Electric Vehicle Committee, gave promise of doing much good work, and no doubt would have done it but for the war, which brought its cause to an end in its inchoate stage.

There can, I think, be no question that the 12 months terminating with this Convention will rank in the annals of the Association as the busiest, most strenuous, and most important year in its existence. Members may gain from a perusal of the annual report some idea of the many important matters that have claimed the attention of your Council, in frequent instances calling for prompt decisions. One needs to be on the Council, however, to realise to the full extent the magnitude of the work accomplished, and in particular to understand how much the Association owes to its hon. secretary, Mr. H. Faraday Proctor, for his splendid services so ungrudgingly given, for his assiduous guarding of municipal electric supply interests, and for the valuable advice he has always been willing to place at the disposal of any member or local authority.

We must all feel regret that Mr. Proctor finds it necessary to relinquish the hon. secretaryship. Fortunately, the Council has been able to secure Mr. Proctor's consent to nomination as the hon. treasurer, so that his large experience in the affairs of the Association will still be at its disposal. I also think the Association is fortunate in having secured the acquiescence of Mr. Cramb to our nominating him as hon. secretary for the ensuing year.

The Whitley Report and the Electricity Supply Industry.

By. ALD. W. WALKER, A.M.I.E.E.

(*Abstract.*)

Labour discontent was acute at the time of the outbreak of the war, but there were differences between, or, rather, additions to the demands then being made and those which usually had been put forward. In addition to increased wages there were requests to be given a share in the control of the industry concerned, and a claim to be consulted regarding the working conditions within the industry. For a long time those demands, which may be looked upon as a natural result of extended education, had been growing more articulate and more insistent. The ideas concerning the extent of the control to be exercised ranged from the complete taking-over of all industries for and by the workers—through joint consultative committees of management—to the simple right of approaching the employer as and when some definite workshop grievance arose. The outbreak of war caused a temporary cessation of negotiations on the foregoing lines, all the demands centred on increased remuneration to meet the increased cost of living, and wages jumped to a hitherto unheard of height. At the same time, the Government was compelled by national necessities to take over some industries, to regulate others, and to control the supply of raw materials to all. To work these schemes the Government called representatives both of employers and employed to its aid, thus to a greater or less extent admitting the principle of joint control.

Plans to meet the conditions which would arise at the coming of peace were being considered by the Reconstruction Committee of the Cabinet, a sub-committee of which was dealing with the important subject of "The relations between employers and employed." This sub-committee was constituted of representative employers and trade unionists, and, after hearing much evidence, issued in March, 1917, an interim report, which immediately became a subject of great interest, much discussion, innumerable newspaper articles, and some criticism.

The principal recommendations of the Committee were:—

"1. The formation of National Joint Standing Industrial Councils in the several industries, composed of representatives of employers and employed, regard being paid to the various sections of the industry and the various classes of labour engaged."

"2. That District Councils, representative of the Trade Unions and of the Employers' Associations in the industry, should be created or developed out of existing machinery for negotiation in the various trades."

"3. That Works' Committees, representative of the management and of the workers employed, should be instituted in particular works to act in close co-operation with the district and national machinery."

The report contains definite suggestions as to the constitution and functions of the Joint Standing Industrial Councils. The *existing* Trade Unions and Employers' Associations are taken as the basis, but paragraph A3 says that new organisations should be admitted with the approval of the particular side of the Council of which the organisation would form a part.

The importance of the deliberations and the value to be given to the decisions of the Councils are clearly indicated in paragraph 21:—

"It appears to us that it may be desirable at some later stage for the State to give the sanction of law to agreements made by the Councils, but the initiative in this direction should come from the Councils themselves."

More important than any reconstruction of management machinery, more important even that the remedying of specific grievances, is the establishing of some degree of ordinary human touch and sympathy between management and men.

To post an order altering, say, the day for paying wages, find that it is resented, and must be withdrawn if a strike is to be avoided, is not nearly so good a method as that of consulting the Shop Committee, explaining the reasons for the alteration, and after getting the approval of the workers' representatives leave a short time for the latter to carry the explanation through the works before posting the formal notice. Delay in negotiating produces irritation, irritation causes bad temper, bad temper makes bad work.

Workshop Committees would not have powers to negotiate standard rates of pay, &c.; these would be fixed for the entire district by agreement between the Trade Unions and Employers' Association, or, when formed, by the National Councils.

This question of the relationship between employers and employed is a fundamental one. Many workers feel the burdens of their conditions, and are determined to satisfy their deeper needs, which education has both created and enabled them to explain; they wish to take an intelligent share in their work; they wish to know something of the ultimate outcome of their efforts; they desire to feel responsibility, to know why and wherefore, to receive such confidence as can be fairly given them, and, above all, to be consulted on those matters which most nearly touch them day by day.

The question of the effect on public undertakings of the acceptance of the recommendations made in the Whitley Report was a very important one, and local authorities had to consider the alternative methods for putting the proposals into practice which suggested themselves. It had to be decided whether to constitute a National Joint Council:—

1. For all municipalities and inclusive of all departments of each municipality.

2. For each separate department of all municipalities.

3. For some separate departments (gas, electricity, tramways, &c.), and some grouped (paving, cleansing, sewage, &c.)

4. For industries as industries inclusive of all undertakings whether municipal or company owned.

Those who studied the problem from the point of view of the industry with which the Convention is concerned, unanimously decided that the right solution was to establish a National Joint Council for the Electricity Supply Industry to include *all* authorised undertakings. Eventually, under the auspices of the Ministry of Labour, a conference of representatives of the employers and trade unions was held in Manchester on June 19th, 1918, Mr. Bridgeman, M.P., being in the chair. After a long discussion, a committee consisting of seven members from each side was appointed to draft a constitution for and to define the functions of a Joint Industrial Council. This Drafting Committee met several times at the Ministry of Labour, and unanimously decided to recommend the following draft constitution to its constituent organisations:—

JOINT INDUSTRIAL COUNCIL FOR THE ELECTRICITY SUPPLY INDUSTRY.

Draft Constitution.

To be submitted to the Constituent Associations.

Preface.

In a letter sent out by the Minister of Labour to the chief Associations of Employers and Workpeople on October 20th, 1917, the Minister announced that "the Government desire it to be understood that the Councils will be recognised as the official standing Consultative Committees to the Government on all future questions affecting the industries which they represent, and that they will be the normal channel through which the opinion and experience of an industry will be sought on all questions with which the industry is concerned."

In order to consider this suggestion with reference to the electricity supply industry, a conference was held between the employers' associations and the workpeople's associations concerned in the industry, at which it was decided that a joint committee be appointed to draft a scheme for an Industrial Council for the industry. Subsequently a meeting of representatives of the following workpeople's associations: Amalgamated Society of General Toolmakers, Engineers and Machinists; Electrical Trades Union; National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen, and Electrical Workers; Amalgamated Society of Gas, Municipal, and General Workers; National Amalgamated Union of Labour; National Union of General Workers; Workers' Union; Dock, Wharf, Riverside and General Workers' Union of Great Britain and Ireland; Steam Engine Makers' Society; United Machine Workers' Association, appointed seven representatives to the Committee. The following employers' associations: Incorporated Municipal Electrical Association; Incorporated Association of Electric Power Companies; Conference of the Chief Officials of the London Electric Supply Companies; Provincial Electric Supply Committee of the United Kingdom, also appointed seven representatives to the Committee.

The representatives appointed to the Drafting Committee were as follows:—

Employers' Associations.

Incorporated Municipal Electrical Association. Messrs. F. Ayton, H. Faraday Proctor, and Ald. Walker.

Incorporated Association of Electric Power Companies.—Messrs. E. T. R. Murray and W. B. Woodhouse.

Conference of the Chief Officials of the London Electric Supply Companies.—Mr. C. P. Sparks.

Provincial Electric Supply Committee of the United Kingdom.—Mr. C. J. Wigham.

Workpeople's Associations.

Amalgamated Society of Gas, Municipal & General Workers.—Mr. E. Hallas.

Amalgamated Society of General Toolmakers, Engineers and Machinists.—Mr. G. Wilkinson.

Electrical Trades Union.—Mr. J. Rowan.

National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen and Electrical Workers.—Mr. George Parker.

Steam Engine Makers' Society.—Mr. W. F. Dawtry.

United Machine Workers' Association.—Mr. R. H. Coates.

Workers' Union.—Mr. W. T. Kelly.

This Joint Drafting Committee has met, and now submits the following scheme for your acceptance or otherwise:

DRAFT CONSTITUTION AND FUNCTIONS.

I.—Functions.

General Objects.—To secure the largest possible measure of joint action between employers and employés for the development of the industry as a part of national life and for the improvement of the conditions of all engaged in that industry.

It will be open to the Council to take any action that falls within the scope of this general definition. Among its more specific objects will be the following:—

1. The establishment of District Councils and Works Committees, and to define the functions and scope of such Councils and Works Committees, having regard in each case to any such organisations as may already be in existence.

2. The consideration of wages, hours and working conditions in the industry.

3. The consideration of measures for regularising employment.

4. The consideration of the existing machinery for the settlement of differences in the industry, and the establishment of machinery for this purpose where it does not already exist.

5. The consideration of measures for securing the inclusion of all classes of employers and employés in their respective associations.

6. The collection of statistics and information as and when agreed on matters appertaining to the industry.

7. Inquiries into special problems of the industry, including the comparative study of the organisation and methods of the industry in this and other countries, and, where, desirable, the publication of reports.

8. The encouragement of the study of processes and design and of research, with a view to perfecting the industry.

9. The provision of facilities for the full consideration and utilisation of inventions and any improvement in machinery or method, and for the adequate safeguarding of the rights of the designers of such improvement, and to secure that such improvement in method or invention shall give to each party an equitable share of the benefits financially or otherwise arising therefrom.

10. The improvement of the social and health conditions obtaining in the industry, and provision of special treatment where necessary for workers in the industry.

11. The supervision of entry into, and training for, the industry, and co-operation with the educational authorities in arranging education in all its branches for the industry.

12. The arrangement of lectures and conferences on subjects of general interest to the industry.

13. The issue to the Press of authoritative statements upon matters affecting the industry of general interest to the community.

14. Representation of the needs and opinions of the industry to the Government, Government Departments, and other authorities.

15. Co-operation with the Joint Industrial Councils for other industries to deal with problems of common interest.

16. The consideration of any other matters that may be referred to it by the Government or any Government Department.

II.—Constitution.

1. *Membership.*—The Council shall consist of 24 members, one-half appointed by Associations of Employers and the other half by Trade Unions.

Associations of Employers.	*No. of Representatives.*
Incorporated Municipal Electrical Association	6
Incorporated Association of Electric Power Companies	2
Conference of the Chief Officials of the London Electric Supply Companies	2
Provincial Electric Supply Committee of the United Kingdom	2
Total	12

Trade Unions.	*No. of Representatives.*
Amalgamated Society of Gas, Municipal and General Workers	1
Amalgamated Society of General Toolmakers, Engineers and Machinists	1
Dock, Wharf, Riverside and General Workers' Union of Great Britain and Ireland ...	1
Electrical Trades Union	2
National Amalgamated Union of Enginemen, Firemen, Mechanics, Motormen and Electrical Workers	1
National Amalgamated Union of Labour .	1
National Union of General Workers .	1
Steam Engine Makers' Society ..	1
United Machine Workers' Association	1
Workers' Union	1
Twelfth place to be left vacant for the present	1
Total	12

and such other organisations as may be added from time to time.

2. *Re-appointment.*—The representatives of the said Associations and Unions shall retire annually, and shall be eligible for re-appointment by their respective Associations or Unions. Each organisation shall have power to remove any of its own representatives at its discretion and to appoint another member to fill the vacancy. Casual vacancies shall be filled by the organisations concerned.

3. *Committees.*—The Council may delegate special powers to any Committee it appoints.

The Council may appoint Standing or Sectional Committees as may be necessary. It shall also have power to appoint other Committees for special purposes. The reports of all Committees shall be submitted to the Council for confirmation.

4. *Co-opted Members.*—The Council shall have the power of appointing on Committees or allowing Committees to co-opt such persons of special knowledge, not being members of the Council, as may serve the special purposes of the Council, provided that any appointed or co-opted members shall serve only in a consultative capacity.

5. *Officers.*—The officers shall consist of a Chairman and a Vice-Chairman, selected from the members of the Council, one from each side of the Council, and two Secretaries, one from each side of the Council, one of whom shall act as Treasurer.

6. *Meetings of the Council.*—The ordinary meetings of the Council shall be held as often as necessary, and not less than once a quarter. The meeting in the month of May shall be the annual meeting. A special meeting of the Council shall be called within seven days of the receipt of a requisition from either side. The matters to be discussed at such meetings shall be stated upon the notice summoning the meeting.

7. *Voting.*—The voting, both in Council and in Committees, shall be by show of hands or otherwise as the Council may determine. No resolution shall be regarded as carried unless it has been approved by a majority of the members present on each side separately of the Council.

8. *Quorum.*—The quorum shall be one half of the number of members on each side of the Council, inclusive of the secretaries.

9. *Finance.*—The administrative expenses of the Council shall be met in equal proportions by the Employers' Associations and Trade Unions represented.

10. *Amendment of Constitution.*—The Council shall have power from time to time to amend or add to the above constitution in such way as it may think fit, subject to confirmation by the constituent associations of the respective parties.

W. Walker, *Chairman.*

At this date, March 22nd, 1919, the whole of the employers and all except one of the Trade Unions have notified their acceptance; the reply of the other is awaited.

It will be seen that this constitution is for the National Council only, leaving to such a Council, when formed, the work of creating or co-ordinating the duties of the District and the Workshop Committees. The necessity for a central authority for the industry cannot be questioned. The existing state of affairs is chaotic, and it would be advantageous to have regular joint meetings for the discussion of matters concerning the industry from a national instead of a sectional point of view. It is not proposed in this paper to go into all the details of the agreed constitution, but rather to leave them for the discussion. *One of the most important outstanding questions is that of whether or not plenary powers should be granted to the representatives on the National Industrial Council.*

District Councils.

The functions of the District Committees are not very clearly defined in the report. A letter circulated by the Rt. Hon. G. H. Roberts, M.P., Minister of Labour, in October, 1917, said:—

"In industries which are largely based on District Organisations it will probably be found desirable to assign more important functions to the District Councils than would be the case in trades which are more completely centralised in national bodies."

As the electricity supply industry came under the latter description, it appeared that the District Councils would not be of such importance as in some other industries. In addition to some of the functions enumerated in the draft constitution of the Joint Industrial Council, the District Councils would have to arrange to put into operation the findings of the National Councils, and also, presumably, would have the right to refer matters to that body. It would be advisable for them to arrange for close working with the education authorities of the district and to co-operate with the local District Industrial Councils of other industries when combined action was desirable in matters of common interest.

The Works Committee.

The third recommendation of the Whitley Committee is the one possessing the greatest interest for the average member of an Electricity Committee because it is possible immediately to adopt it for any undertaking. It also has a more direct and immediate effect upon a department than either the District or National Councils. Workshop Committees have long been established in the engineering industry in the Manchester district, such firms as Messrs. Hans Renold, the British Westinghouse Electric & Manufacturing Co., and Messrs. Mather & Platt, &c., having had much experience of the working and of the good results arising from their establishment.

(To be continued.)

Electric Welding.—Welding experiments carried out by Mr N Czako, on several types of alloy steels were recently described in *E T Z* A new kind of welding powder was used which contained neither borax nor iron filings, and the results of the experiments showed that the weldability of the types of iron and steel investigated was independent of their chemical composition, provided welding was carried out with a suitable welding composition which permitted of the union of pure metallic welding surfaces. By the use of a new welding powder of this type, it has been possible to make genuine welds in the ordinary forge with irons and steels which are generally recognised to be difficult to weld.

THE SOUTH AMERICAN MARKET.

[U.S. Commissioner's Review of the Position.]

It would appear that United States exporters have been overestimating to some extent the potential consumption of South American markets in electrical goods. In order to place the matter in proper perspective, the United States Trade Commissioner has reviewed the relative purchasing power of the principal consuming countries there. In summarising their physical characteristics, he points out that Argentina, Brazil, Uruguay, and Paraguay, being largely non-mountainous, are specially suited to cattle-raising and agricultural pursuits of various kinds.

Argentina and Brazil are, however, also making rapid advances industrially. All the west-coast countries are mountainous, containing the high peaks of the Andes, and abounding in mines, small and large, and in various stages of development. Some of the largest and most productive copper mines in the world are located in Chile, Bolivia, and Peru; hence much of the heavy machinery imported is for this group. On the north coast, Colombia and Venezuela have been making surprising progress in the last few years, and are now taking considerable quantities of insulated wire, lamps, and motors.

Of the three Guianas, British Guiana is the only one that consumes electrical goods, and that only in small quantities.

Trend of Trade During the War.

In 1913, the best year previous to the war, the total imports of electrical goods into South America amounted to approximately £1,150,000, and of this sum the share of the United States was £920,000, these figures having been taken from the statistics of the several foreign Governments. It is interesting, in passing, to make a comparison of the American share with the shares of England and Germany, the two other principal competitors, during the same period. They were, respectively, £1,080,000 and £2,000,000. On account of the world crisis, since that date, the relative positions of the exporting nations have undergone a radical change, and the United States is now the leader, with exports, according to statistics compiled by the Department of Commerce, of £1,956,000 for the year ended June 30th, 1918. This represents a decided increase in percentage of total imports.

The following table gives the electrical-goods imports of the principal South American countries, showing the amounts furnished by England, Germany, and the United States for the calendar year 1913, and the latest normal year, and the amounts sent from the United States to each country of South America for the year ended June 30th, 1918:—

Countries.	South American imports of electrical goods in 1913.				Exports of electrical goods from U.S in 1917-18.
	Total.	From United Kingdom.	From Germany.	From United States.	
	£	£	£	£	£
Argentina ...	1,951.247	671,743	978.508	115,426	525.233
Bolivia ...	122.405	40,069	59,493	1.185	6,705
Brazil ...	1,700,904	284,192	595,498	647,913	636,604
Chile ...	457,659	69,249	327,243	38,967	432.578
Peru ...	44,792	1.847	14,823	25,247	129,459
Uruguay ...	46,142	6,149	9,969	9,887	87,623
Venezuela ...	41,500	5.000	1,172	27,587	47,745

Measure of Purchasing Power.

The mistake is often made of taking it for granted that the average consuming capacity per capita is the same in South America as in North America. This is not true. Peru as a market for electrical goods is no better than an American purchasing public of 100,000 people. This includes both the people as a whole and the foreign mining interests, whose annual business is a large proportion of the total. This is one of the extreme cases, but the same sort of allowances must be made for all countries. The countries having the best purchasing power are, generally speaking, those on the east coast—Brazil, Argentina, Uruguay, and Paraguay.

Great Possibilities in Brazil.

The consumption of electrical goods in Brazil is steadily growing, and before many years it will surpass that of any other South American country. With a population of approximately 25,000,000, and resources of a very varied character, Brazil will have a more diversified demand than it has at present. Mines will be developed, numerous industries have been established already, and steam railroads will be electrified.

An indication of the extent to which electric power is used in the industrial life of Rio de Janeiro and Sao Paulo will be had from the statistics of the central stations, which show that in Sao Paulo there is over 50,000 H.P. in electric motors connected to the circuits, and in Rio de Janeiro there is over 100,000 H.P. connected. The normal yearly increase may be taken at not less than 5,000 H.P.

Already there are a number of mines in operation, and indications are that in the near future active work will be begun in the great iron ore district in the State of Minas Geraes. Judging by the size of the known deposits, and the importance of the companies owning them, it is evident that when this development takes place there will be required a large amount of modern mining and power machinery.

The railway that will tap this iron ore district, known as the Victoria-Minas Railroad, will be electrified for a length of several hundred kilometres. Plans have been completed already for electrifying a large portion of the Paulista Railroad in the State of Sao Paulo, and other roads are expected to follow this example.

The power for all these enterprises will be furnished by waterfalls, which are abundant in this particular section of Brazil.

There are a number of telephone companies, some of which are provided now with modern equipment, although most of the smaller ones will be needing new material to take care of their natural expansion. The more important companies are located in Rio de Janeiro and Sao Paulo, and are owned by the Brazilian Traction, Light & Power Co. They have about 40,000 subscribers, their yearly increase being approximately 10,000 instruments.

There are street-railway systems in Manaos, Para, Ceara, Bahia, Rio de Janeiro, Nictheroy, Sao Paulo, Santos, Porto Alegre, Pelotas, and Rio Grande. With the exception of the last, which is a very small company, they all use English or American equipment exclusively.

The small household devices used for heating and cooking are being introduced energetically, and will enjoy an increasing popularity with dealers in electrical goods. In all the cities the dealers are very progressive, and both they and the central stations are engaged in active propaganda for the wider use of electrical material of all kinds.

Argentine's Needs for the Immediate Future.

At the present time, and perhaps for the immediate future, Argentina offers the best market in South America for electrical goods, owing to the fact that it is capable of easy development and produces articles of such prime necessity throughout the world as grain, wool, and beef. It is expected that its progress will be more rapid than that of other countries that have more difficult transportation and production problems, and its point of maximum ability to absorb electrical goods will be reached while Brazil is still in the early stages of its development.

Argentina is handicapped in not having available for development any large amount of water power. Several of the interior cities, such as Tucuman and Cordoba, have hydro-electric plants, but these are furnishing practically all the power of which they are capable. The only large waterfall is the Iguassu, half of which may be ceded to Argentina, since it is on the boundary between that country and Brazil. As was pointed out, however, this is too far away to be of any use in the industrial development of either country.

A large number of small telephone companies operate in the various towns and cities, and have a total of approximately 50,000 subscribers.

Street-railway companies in Buenos Aires and other cities have an aggregate of 2,500 motor cars, equipped almost exclusively with English and German motors and controllers. Many extensions are contemplated, and the repair and supply business is one of considerable volume.

One of the steam roads has electrified one of its suburban lines for a distance of 30 kilometres, and contemplates further electrification in the near future. Two other railways have made some progress toward electrification, one of them having installed its power plant and third rail. All these are English-owned companies, and employ a firm of English consulting engineers to take charge of this work.

The retail dealers in electrical goods are progressive and handle all kinds of miscellaneous devices, as well as standard lines of wire and wiring supplies. These two items are the principal lines in the electrical trade, but with the assistance of the central stations there is being created a demand for heating and cooking devices, and the more modern forms of lighting equipment.

There is little of interest in Uruguay outside the city of Monte Video, since the central stations in the interior are of very small capacity, and many of them operate only during the night time, which practically excludes all household devices and motors. There are no waterfalls, as the country is comparatively flat.

Telephones and Lighting in Uruguay.

The telephone companies, of which there are approximately 20, are now owned privately, but the Government intends to take them over, under its policy of declaring all public utilities to be State monopolies. There are approximately 18,000 instruments in use, of which 10,000 belong to the two companies operating in Monte Video.

There are two street-railway companies, with 400 motor cars. The Government has bought a mule-car line, and intends to electrify it in the near future.

Monte Video is one of the few cities still lighted by arc lamps, of which there are now approximately 2,000 in service. It is expected that these will be replaced by a system of incandescent lighting before very long.

Growing Importance of Chilean Market.

Chile, although one of the smaller countries, offers one of the best three markets for electrical goods. It has large and active mining enterprises, and quantities of electrical material are employed in its nitrate fields. Many industries have been established under the stimulation of the abnormal conditions of the last few years, and everything possible is being done to extend them.

In the section from Coquimbo to Valdivia there is an abundance of water power, and the Government has created a commission to study the possibility of constructing a longitudinal artery for the transmission of power throughout this stretch. If this can be done successfully, it will make available a large amount of cheap power, which, in turn, will greatly encourage the establishment of more industries. The two larger central stations are in Santiago and Valparaiso

There are several smaller independent telephone companies, but most of the more important places are controlled by the Chile Telephone Co. It is preparing to replace much of the older equipment with more modern material.

The Chilean Government has taken steps already looking toward the electrification of three sections of its railway system, and if the entire programme is carried out it will mean the installation of a large quantity of generating and power apparatus.

Minor Openings.

The only users of electrical material in quantity in Bolivia are the mining companies, and as these have been enjoying several years of prosperity they will probably purchase more heavily than ever in the near future. Each has its own generating plant, operated by water-power or petroleum engines. The number of motors installed is being increased constantly. Personal representation is necessary to obtain this business.

For domestic purposes, electric devices are confined to three or four towns, since the greater portion of the population consists of Indians and half-breeds, who will never become users of this material. Under present conditions, there is little opportunity for the sale of anything but lamps and wiring material.

Electric power is used in the large and small mines of Peru, the oil fields, and the sugar plantations, all of which are following a programme of expansion as fast as conditions will permit. In or near Lima a number of small industries also use electric power, and the central station is quite active in securing new customers.

The street-railway system in Lima and Arequipa, and the telephone company in Lima use American material exclusively. The Central Railroad has been making studies of the electrification of its line, but apparently has not found that conditions warrant such a movement.

A great majority of the inhabitants are Indians and half-breeds, living in the high inland plateau, so that the consumers of household and miscellaneous devices are confined to not more than 15 per cent. of the population.

In Ecuador there are some 20 central stations, and outside of Guayaquil, where there are a few small industries using power, the electrical goods that can be sold are confined entirely to lamps and wire and wiring devices. The purchasing population is extremely small.

THE SALVAGE OF LECLANCHÉ CELLS.

By W. J. THORROWGOOD.

(*Abstract of paper read before the* Institution of Railway Signal Engineers (Incorporated).

The author describes a process which he has introduced on the London and South-Western Railway, and which has given satisfactory results so far.

Generally, before the war, manufacturers were unwilling to allow a rebate on returned porous pots and their contents, or spent dry cells that had been put out of service. They can obtain new carbon plates, pyrolusite and carbon granules at less cost than would be incurred in collecting and recovering the useful material from porous pots.

In view of the increased cost of new porous pots and dry cells since 1914, and the difficulty of obtaining them of the same quality and to the same specification (pyrolusite was for a short period unobtainable), it seemed to the author that it might be economical to treat the old porous pots which had been put out of service, by washing, either as they were, or by unsealing the top and washing the porous pot and the contents separately and then reassembling. Neither method gave very satisfactory results, and the second was costly owing to the labour charges.

Analysis of the contents of porous pots supplied before the war, that had been in use, showed that the volume of carbon and pyrolusite, 50 per cent. of each, remained the same and the quality of pyrolusite (85 to 90 per cent. of manganese) was practically unaltered, but the damp mixture had an alkaline reaction.

Six discarded porous pots, taken at random, were treated according to the following process:—

A solution of commercial hydrochloric acid one part and water five parts is placed in six glass jars, so that when a porous pot stands in the jar the solution comes nearly up to the black rim at the top of pot. The porous pot remains in the solution for 24 hours. It is then washed and soaked in clean water for 48 hours, the water being changed after 24 hours' immersion. The cell is then ready for use in the ordinary way. The acid solution can be used three or four times.

Each of the six cells was joined up to repeaters, having 300 ohms resistance, and tested against a new cell, of standard quality, for seven weeks. The cells were then left standing for five and a half months, when the voltages of the cells were taken and recorded.

The six chemically treated cells were then joined in series with two new ones of standard quality to form a battery of eight cells, which was put in service on April 25th, 1917, on an electric fouling-bar circuit at Gunnersbury. This circuit consists normally of an indicator, 3,000 ohms resistance, and a Syx D.A. lock 30 ohms; the latter was brought into use every time the lever was operated. The circuit was a heavily worked one, and the battery remained in service until October 30th, 1917, when the current in the electric lock circuit was 400 m.a., the minimum current allowed for lifting the lock. The battery was then put out of service.

The cells were again chemically treated on January 16th, 1918; the voltage of the two new cells that were used for comparison had fallen to 1.3 volts. One of the treated cells on testing gave 1.3 volts, but the voltage of the other five treated cells had fallen to from .9 to 1 volt. The zinc rods used in the cells containing the chemically treated porous pots remained freer from crystallised salts and were generally cleaner than the zincs in the new cells.

This method has been extended, and up to March, 1919, 3,653 porous pots were treated, and 2,650 had been put into service, so far with satisfactory results. At one or two large depots vessels have been provided, in which from 30 to 40 spent porous pots can be treated at one time.

It is, of course, not to be expected that every porous pot can be renovated, as in some cases it is found that the carbon plate is broken, or the terminals of the carbon plate may be loose. An effective method of overcoming this difficulty is to drill a hole through the lead and carbon plate and fill the hole with solder.

Good results have been obtained by treating the porous pots with the chemical solution before they are useless and when the voltage of the cell on open circuit has fallen to 1.2 or 1.1 volts.

By using the interiors of spent dry cells as porous pots, very successful results have been obtained. The Dania Dry Cell C.S. size is largely used. The general practice is to use these cells on important circuits until they give on testing 1 to 2 amperes momentarily, and then to use them on unimportant circuits until entirely spent; at this point the whole is discarded.

To render the sac interiors of these spent cells suitable for use in place of porous pots, the zinc case is removed and the jelly washed away, leaving the interior to dry. A little of the pitch recovered from the old dry cell is heated and placed on the top of the sac and around the carbon rod, or the top of the sac and carbon rod when dry are varnished with an insulated varnish or paraffin wax to prevent the salts from creeping. The sac is then ready for use as a porous pot with the ordinary zinc rod and salammoniac solution in a glass jar, to form a Leclanché cell. If a spent interior after being washed does not give satisfactory results on testing, it is submitted to the hydrochloric acid process similarly to a spent porous pot, but for a shorter period.

A battery of Leclanché cells in which the interiors of 12 spent dry cells, treated as above described, were used as porous pots was installed on a busy telephone circuit from Exmouth Junction to Exeter, on which were 10 telephone instruments, on September 21st, 1917. Each of the cells was tested after three months' work on December 21st, 1917, and again after a further three months' use. All the cells, except No. 10, were then in good working order; the fault was subsequently found to be due to a broken carbon. Another cell was put in to replace No. 10 and the battery is still in service.

Up to March 31st, 1919, 4,165 interiors of spent dry cells were treated as above described; 2,821 were in use replacing porous pots in Leclanché cells on various kinds of circuits, so far satisfactorily.

Circuits may be divided into important and unimportant circuits, and the treated porous pots can generally be used on the latter. Approximately 95 per cent. of the spent dry cells can be made useful. Loose lead terminals and broken carbon plates account for the remaining 5 per cent.

It is found that one quart of hydrochloric acid is sufficient to treat 36 porous pots. The average total cost of material and labour (including war wage) of treating one porous pot is twopence.

Spent interiors of dry cells cost 2.5d. each to render useful, owing to more labour in cleansing being required. When treating porous pots in bulk, say, about 40 at a time, the cost works out at 1.5d. each. It is estimated that the value of a treated porous pot or a treated interior of a spent dry cell is approximately from 50 per cent. to 66 per cent. that of a new porous pot. Before the war the price of No. 1

porous pots was 5.16 pence; of No. 2 porous pots 3.99 pence each. At present the cost of No. 1 is 14.2 pence, and No. 2 is 8.2 pence. Therefore there is an ample margin between the price of new cells and the cost of renovating porous pots or interiors of spent dry cells, even in peace times, to justify the use of this process or a similar one.

Details of the test results are given in the paper.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

13,884. "Electric power generating sets." H. R. Ricardo. June 2nd.

13,909. "Device for electrical illumination for theatrical and stage effects, &c." T. H. Rochford. June 2nd.

13,919/20. "Sparking plugs." H. R. Wilks. June 2nd.)

13,954. "Automatic telephone systems." W. C. Davey & Sterling Telephone & Electric Co., Ltd. June 2nd.

13,965. "Apparatus for transforming alternating current into continuous current for charging accumulators." N. Samssonow. June 2nd.

13,968. "Electric signal devices for railways." S. H. Childs. June 2nd.

13,986. "Secondary dry battery." F. A. van Hooydonk. June 2nd.

13,997. "Electric lamp fittings." G. P. Fairless. June 2nd.

13,998. "Covers for electric switches, bell pushes, &c." J. A Bowie. June 2nd.

14,029. "Electric turbine." D. Suchostawer. June 4th.

14,033. "Impregnation of electric cables, transformers, &c., and fibrous material used therein with insulating medium." British Insulated & Helsby Cables, Ltd., and J. Lewis. June 4th.

14,062. "Electrical ironing, cooking, heating, &c., apparatus." P. P. Meunier. June 4th. (France, June 4th, 1918.)

14,068. "Electric relays and relay circuits." L. B. Turner. June 4th.

14,071. "Brush holder for electric machines." W. S. Bulfitt & W. J. Denholm. June 4th.

14,087. "Vacuum tube for use as detector, amplifier, or generator of wireless waves, &c." J. Scott-Taggart. June 4th.

14,110. "Electric switches." A P. Rutherford. June 4th.

14,111. "Preparing aluminium or its alloys for electro-plating." H. D. Cunningham. June 4th.

14,163. "Fittings for metallic electric conduits." F. S. Rippingille. June 4th.

14,167. "Electric fuse-holders." Ironclad Switchgear Co. & E. W. Morgan. June 4th.

14,168. "Electric switches." Ironclad Switchgear Co. & E. W. Morgan. June 4th.

14,191. "Telephone receivers." R. L. Murray & Telephone Manufacturing Co. June 4th.

14,192. "Electrical furnaces." E. P. Barfield & L. W. Wild. June 4th.

14,205. "Electric selective signalling, &c., systems." F. R. Baldock & International Electric Co. June 4th.

14,213. "Means for securing permanent magnets of electrical measuring instruments of the moving coil type." Elliott Bros. & W. Phillips. June 4th.

14,224. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. June 4th. (U.S.A., September 5th, 1918.)

14,225. "Automatic or semi-automatic telephone systems." Automatic Telephone Manufacturing Co. June 4th. (U.S.A., October 23rd, 1918.)

14,251. "Wireless telegraphy systems of the arc gap type." L. T. Barkers. June 5th.

14,305. "Direct current dynamo-electric machines." B. J. Shillito. June 5th.

14,309. "Wireless signalling systems." British Thomson-Houston Co. (General Electric Co., U.S.A.) June 5th.

14,315. "Electric heating apparatus." C. G. Norris & M. J. Railing. June 5th.

14,316. "Cable splices." N. K. Bowman. June 5th.

14,318. "Electric starters for internal combustion engines." A. H. Midgley & C. A. Vandervell & Co. June 5th.

14,325. "Insulators for conductor rails, &c." F. H. Meyrick. June 5th.

14,348. "Secondary batteries." T. D. Greeley & Vickers, Ltd. June 5th.

14,350. "Electric transformers." F. R. Baerlocher & Vickers, Ltd. June 5th.

14,351. "Means for directing fire of ground batteries from aircraft." H. J. Finer. June 5th.

14,354. "Electrical system for generating intermittent high-tension current impulses for ignition purposes, with or without low-tension current for battery charging, lighting, &c." C. H. Tower. June 5th.

14,358. "Apparatus for practising clock code or co-ordinate signalling between aircraft and ground batteries on electrically controlled counter battery schemes, &c." H. J. Finer. June 5th.

14,365. "Dynamo machines." F. Shaw. June 6th.

14,367. "Sparking-plugs for internal combustion engines." F. A. Jennings. June 6th.

14,374. "Insulating and anchoring device for electric lampholders, &c." B. Deakin. June 6th.

14,392. "Sparking-plugs for internal combustion engines." A. Farrington & G. M. Nicklin. June 6th.

14,409. "Mixed manual and machine switching telephone exchange systems." G. Deakin & Western Electric Co. June 6th.

14,417. "Sparking-plug for internal combustion engines." G. H. Negus. June 6th.

14,422. "Electric condensers." R. W. Winn. June 6th.

14,427. "Electric railways." British Westinghouse Electric and Manufacturing Co. June 6th.

14,428. "Device for electrically lighting cycles, &c." W. A. Hymas. June 6th.

14,432. "Method of springing overhead arm of tramcars, &c." H. L. Reilly. June 6th.

14,462. "Negative plate for electric batteries." A. Pouchain. June 6th.

14,463. "Negative plate for electric accumulators." A. Pouchain. June 6th.

14,464. "Incandescent lampholder." J. P. Johansson. June 6th.

14,471. "Control of electric installations." H. Crochat. June 6th.

14,477. "Manufacture of electric heaters." W. O. Miller. June 6th (Switzerland March 26th.)

14,525. "Insulated wire stripper." S. A. Goss. June 7th.

14,545. "Attachment for electric holders in motor lamps, &c." O. T. Banks. June 7th.

14,559. "Method of electrically and mechanically connecting electric accumulator cells, storage and primary battery cells, electrolytic cells, &c." R. C. Houston. June 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

3,250. Submarine sound signalling apparatus and the like. H. L. De Skipwith and T. F. Wall. March 3rd, 1916. (Complete accepted March 12th, 1917. Patent sealed March 12th, 1917.) (126,654.)

15,072. Vacuum tubes of the audion type. M. Peri & J. Biguet. October 23rd, 1915. (126,658.)

1917.

1,636. Electrolytic production of metallic tubes with a closed end. S. O. Cowper-Coles. February 1st, 1917. (126,667.)

1,802. Manufacture of carbons for electric arc lamps. W. Heape and H. B. Grylls. February 5th, 1917. (126,673.)

2,011. Safety spark gaps for magneto-electric machines. British Thomson-Houston Co. & A. P. Young. February 9th, 1917. (126,681.)

2,280. Manufacture of electric signalling and other lamps. O. Lucas, G. S. Hague and G. E. F. Goold-Adams. February 15th, 1917. (126,695.)

2,294. Electrical signalling apparatus. Sir S. T. Dawson and Sir G. T. Buckham. February 15th, 1917. (126,696.)

2,779. Electric heater or heaters for use with internal combustion engines. C. G. Nobbs and Falkirk Iron Co. February 26th, 1917. (126,719.)

16,677. Electrical transformers for regulating or varying the voltage of the current supplied therefrom. F. E. Berry. November 13th, 1917. (126,744.)

18,533. Headgear for telephone and other acoustic receivers. H. W. Metcalfe. December 13th, 1917. (126,746.)

1918.

2,685. Electric selective switching systems and apparatus. International Electric Co. and F. R. Baldock. February 14th, 1918. (126,755.)

2,745. Electric distribution systems. British Thomson-Houson Co. and J. Whitcher. February 15th, 1918. (126,757.)

4,689. Electric cells or batteries. E. Baur and W. D. Treadwell. March 16th, 1918. (126,766.)

7,974. Sound amplifying device for telegraph relays. C. F. Hilton, May 13th, 1918. (126,779.)

8,002. Electric motor control systems. L. Miller & British Westinghouse Electric & Manufacturing Co. May 13th, 1918. (126,781.)

8,038. Electric water heaters. L. O. Meyer. May 14th, 1918. (126,783.)

8,129. Electric battery cells. H. R. Pearson. (May 15th, 1918. (126,790.)

8,169. Electric switches. H. Garde & C. G. Bennett. May 15th, 1918. (126,794.)

8,176. Charging boards for electric accumulators. H. Leitner & W. H. Exley. May 15th, 1918. (126,795.)

8,226. Electrically operated hoisting machinery. G. Ellison and J. Anderson. May 16th, 1918. (126,800.)

8,293. Electric heating stoves. H. A. Cope (Soc. Anon Hecla). May 17th, 1918. (126,806.)

8,324. Electric engraving pencils. A. M. Robinson and R.I. Electrical Instrument Co. May 17th, 1918. (126,808.)

8,607. Electric hand lamps. J. Bein. May 24th, 1918. (126,820.)

8,793. Trolley heads of electrically propelled vehicles. C. W. Collins. May 28th, 1918. (126,826.)

9,579. Appliance for facilitating the re-energisation of luminous paint surfaces by means of an electric torch. A. B. Gibbons and Efandem Co. June 11th, 1918. (126,838.)

9,740. Ignition systems for internal combustion engines. A. H. Midgley and C. A. Vandervell & Co. June 13th, 1918. (126,840.)

10,160. Electrical switches. Ferguson, Pailin & Co., S. Ferguson & G. Pailin. June 20th, 1918. (126,847.)

10,673. Sparking plugs for internal combustion engines. B. Hopps, A. M. Lodge & Lodge Sparking Plug Co. June 28th, 1918. (126,852.)

11,485. Leading-in conductors for incandescent electric lamps and other vacuum tubes. K. Ohtani. July 12th, 1918. (126,859.)

12,042. Starters for electric motors. A. H. Railing, C. C. Garrard, P. H. Jackson and C. Bonner. July 24th, 1918. (126,864.)

16,911. Electric starting motors for internal combustion engines. H. Lucas, C. L. Breeden and H. N. Urquhart. October 16th, 1918. (126,898.)

17,513 High frequency alternators. Soc. Française Radio-Electrique October 26th, 1917. (Addition to 102,738.) (120,888.)

1919.

2,393. Electrical condensers and mountings therefor Bosch Magneto Co. February 11th, 1918. (123,308.)

2,847. Device for varying the point of ignition in electrical ignition apparatus. Akt. Ges. Brown, Boveri et Cie. February 5th, 1918. (Addition to 9,959/18). (123,021.)

New Method of Smelting Iron Ores.—An article in *Canadian Machinery*, of April 3rd, deals with the smelting of many kinds of iron ores, especially prevalent in Canada, which do not admit of economical reduction in the blast furnace. The ore is first reduced to a sponge, which is then transferred to an electric furnace and melted down and finished. The process is particularly applicable to iron, steel, and ferro-alloys. The author shows that iron ore of 65 per cent. or more metal content is increasingly difficult to obtain from the larger fields, and advises the exploitation of the numerous small deposits along the Great Lakes by means of electric furnaces driven by hydro-electric plant. In conclusion, details are given with regard to the commercial possibilities of iron ore treated in the manner described, the points which should be embodied in the design of suitable furnaces, and the method and process claims included in the author's patents on the treatment of ores in this way.

THE
ELECTRICAL REVIEW.

Vol. LXXXIV. JUNE 27, 1919. No. 2,170.

ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

Published every FRIDAY, Price 4d.

The Oldest Weekly Electrical Paper. Established 1872.

TO BE OBTAINED BY ORDER FROM ANY NEWSAGENT IN TOWN OR COUNTRY.

OFFICE 1—4, LUDGATE HILL, LONDON, E.C. 4.

Telegraphic Address: "AGEEKAY, CENT., LONDON." Code, A B C.
Telephone Nos.: City 997; Central 4425 (Editorial only).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

Subscription Rates.—Per annum, postage inclusive, in Great Britain, £1 1s. 8d.; Canada, £1 8s. 10d. ($5.80). To all other countries, £1 10s.

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The "Electrical Review" Table of Pre-war and Present Prices of Electrical Energy for Lighting, Power, Heating and Cooking, and Traction, and Cost of Coal, in 240 British Electricity Supply Undertakings, is now ready.

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RAILWAY ELECTRIFICATION AND SIGNALLING.

MAIN-line electrification will no doubt bring about a considerable modification in British signalling practice, and it would seem that the modification will be towards the adoption of American methods. Formerly British signalling was considered the best in the world; to-day it is outclassed by American. The main difference between British and American signalling is that the former is based on manual operation and human control, the latter on power operation and electrical control.

That British signalling has not progressed to the same extent as American, is partly due to the following reason. On most British railways the function of signalling—one of the most important in railway operation—is actually divided between two separate and distinct departments, to one being assigned what is regarded as mechanical, and to the other what is considered as electrical signalling. Sometimes the heads of these departments may be responsible directly to the general manager, sometimes to the civil engineer, sometimes one to the civil and one to the mechanical engineer. The result is not fortunate. The tendency has grown to regard a Government department as the principal authority on railway signalling, and "not to do electrically what can be done mechanically," is a principle one often hears laid down during discussions on signalling matters. With the advent of electrification, it may be expected that signalling will be regarded as signalling without any qualification, and that the engineer responsible for it will be required to be electrical.

One change in signalling methods which will be inevitable with electrification is in the character of the track circuits. There is already a number of these in operation on main lines, and it is understood that an extended use of them is regarded as part of any electrification scheme, quite apart from the demand for these appliances brought about by labour conditions. These track circuits are at present almost all of the direct-current type. With electrification they will require to be operated by alternating current. This, in turn, will probably mean the use of impedance bonds for carrying the propulsion current across the rail joints at the ends of the track circuits, and for limiting the flow of the alternating current of track-circuit frequency across from rail to rail. The value of the impedance of these bonds to the track-circuit current may be well under 1 ohm. In America, from which country alternating-current track-circuit apparatus and experience usually comes, such low-impedance bonds are probably quite satisfactory, as the impedance may be considerably higher than the rail-to-rail resistance through the axles of the heavy cars used there. In this country, however, the problem is not quite the same, the resistance from rail to rail through the axles of some of the light vehicles used here being under some conditions high enough to have little effect on the oint resistance of the permanent shunt, due to the ballast leakage and the bond impedance. The matter is one which will require to be carefully examined.

There would not appear to be any difficulty in retaining the present manual block signalling system under electrification. But electrification would certainly offer the opportunity for making extensive installations of automatic signalling. Time was when the manual block system (under which the signalmen working with a code of rules, and assisted with reminders in the shape of electrical indicators, keep the trains properly spaced) sufficed, but it has been necessary so to augment the rules, and add such a number of controls to the reminder indicators, that the manual block system is becoming extremely complicated, and the time is ripe for a change to the simpler and more direct methods of the automatic block.

In large centres, with power available, as it will be with electrification, power interlocking—that is, the electrical control and operation of points and signals—should generally replace the present mechanical plant. It seems little short of an anachronism that in these days men of the intelligence necessary to supervise train movements should be required to exercise such supervision, and at the same time make the continuous physical effort demanded by the manual operation of points and signals.

The electrification of main-line "signalling" seems a necessity, apart altogether from the general question of electrification.

Electric Transmission. The question which has so long been in dispute—whether it is cheaper to carry coal or to transmit energy in the form of electricity—seems to have given place to a secondary problem, namely, whether the electricity should go overhead or underground. But the former should not be altogether shelved: the weight of opinion at present clearly fixes the ultimate economical limit of electrical transmission under English conditions at 30 or 40 miles, but Scottish conditions—so far as relates to the water-power proposals which have lately been under consideration—may favour 100 miles, and Irish conditions, when a satisfactory method is found of turning the peat bogs to account, may also call for long-distance transmission. We are far from attaining finality in methods of transmission, and some day directive wireless transmission may be developed to a degree as yet undreamt of.

In the meantime, it is right that attention should be directed to the question which constituted the technical subject of the I.M.E.A. Convention—the relative merits of overhead lines and underground cables—for this is a matter that will shortly assume an aspect of the first importance. Mr. Pearce, in his admirable exposition of the subject, held the balance evenly between the rival methods, and left his hearers to draw their own conclusions from the abundant data that he provided; it was interesting to observe, however, that his paper was generally regarded as stating the case for the cable, and for some time it appeared as though no one had a good word to say for aerial lines. We cannot help feeling that this was regrettable, and we were pleased to hear Mr. Wordingham challenge the tendency to regard the overhead system as down and out, while Mr. Burr opportunely quoted his satisfactory experience with it in South Wales.

The fact appears to be that British practice, since the early days, has always favoured the cable; it is one of the many consequences of the parochial system of supply that was forced upon the country by Parliament some 30 years ago, confining generation and distribution mainly within narrow boundaries in populous areas, where obviously the cable was the right thing to use. Few of the members of the Association have had extended experience—we might almost say any experience—with overhead lines, and the case for the latter was never adequately stated.

Frankly, we regard the discussion as one-sided and unintentionally misleading. There is a great deal to be said for overhead transmission; it was not said. In the case of distribution in sparsely populated areas, the arguments are almost entirely in favour of aerial lines, but we admit that this case did not fall within the scope of the discussion.

Mr. Pearce's confidence in the 66,000-volt cable came as a surprise even to Mr. Fedden, and still more to those who had not recently studied the subject. We would point out that this cable is not yet on the market, whereas overhead transmission at 66,000, and up to 150,000, volts is well established practice; comparisons, therefore, should be made rather between 66,000 volts and upwards with overhead mains, and 33,000 volts as a present maximum underground. If this is done, Mr. Pearce's data show a marked advantage on the side of overhead transmission so far as costs are concerned.

Whitley Councils. The relations of the Whitley Report to the electricity supply industry formed a prominent feature of the proceedings at the Annual Convention of the I.M.E.A. last week, and the members were fortunate in having the constitution and functions of the Joint Industrial Council expounded to them by no less an authority than the chairman of that Council. Alderman Walker certainly scored a triumph on that occasion; his paper was rightly regarded as a classic on this important subject, and his explanations and suggestions were admirably conceived and ably placed before the meeting. Moreover, not only has he made a close study of the matter, but also he has acquired experience of the actual working of the principles embodied in the Report, Works Committees having been formed in the Manchester Corporation Electricity Department a year ago. We are glad to learn that after six months' trial of the scheme, the employés expressed satisfaction with the results obtained, and decided to carry it on throughout the current year. The scheme evolved at Manchester is so complete and well thought out that we have judged it advisable to reproduce the details *in extenso*, for the benefit of other undertakings; modifications can easily be introduced to suit local conditions.

The sense of the meeting was strongly in favour of the Whitley system, and we were particularly interested in the views expressed by several working-man Councillors, whose contributions to the discussion were both illuminating and instructive.

The Joint Industrial Council as yet is in the throes of organisation; the District Councils cannot come into existence until the districts are outlined; but the Workshop Committees can, and should, be formed without delay and got into working order. As we have frequently pointed out, small differences and difficulties, if tackled at once with mutual goodwill, can often be smoothed away by a friendly discussion, whereas, if they are allowed to fester unchecked, they may grow into serious grievances and eventually involve a large area in turmoil. Apart from this, the Committees and Councils are not intended merely to settle disputes, but to anticipate their development and to institute reforms and improvements in working conditions in all kinds of ways. "*Human sympathy*" should be the key-note of their conduct, and harmonious co-operation for the common good their aim. The worker has demonstrated his right to be regarded as a man and a brother, a right which in the past has too often, but not always, been ignored; we are glad that, having won the greatest war in history, he is in a fair way to share in the blessings of peace.

ELECTRICITY SUPPLY AT SHANGHAI.

In view of the development of electricity supply undertakings in this country during the war period, a review of the recent activities of the Shanghai Municipal Council's electricity department, for which we are indebted to Mr. T. H. U. Aldridge, M.I.E.E., &c., engineer-in-chief and manager, may be of interest.

Early in 1916, contracts were placed for 25,000 KW. of turbo-generator plant with the following firms:—One 10,000-KW. turbo-generator and condensing plant to the General Electric Co., of New York; one 10,0000-KW. turbo-generator and condensing plant to Messrs. Parsons and Co., of Newcastle-on-Tyne; and one 5,000-KW. set to Messrs. Fraser & Chalmers—Vickers. The G.E.C. machine was delivered in 1917, and was put into commission in August of that year. The Fraser & Chalmers machine only arrived in the latter part of 1918, and was put into commission in January of this year. The Parsons machine has not yet been shipped from England. When this particular machine was practically completed in 1917 the Government commandeered it, as it was required for the Sheffield Corporation electricity works. Messrs. Parsons were given a licence to build another machine for Shanghai, but it is interesting to note that, with the exception of the rotor of the generator, the first machine has never been delivered to Sheffield. It is hoped that the second machine may be shipped from Newcastle this year.

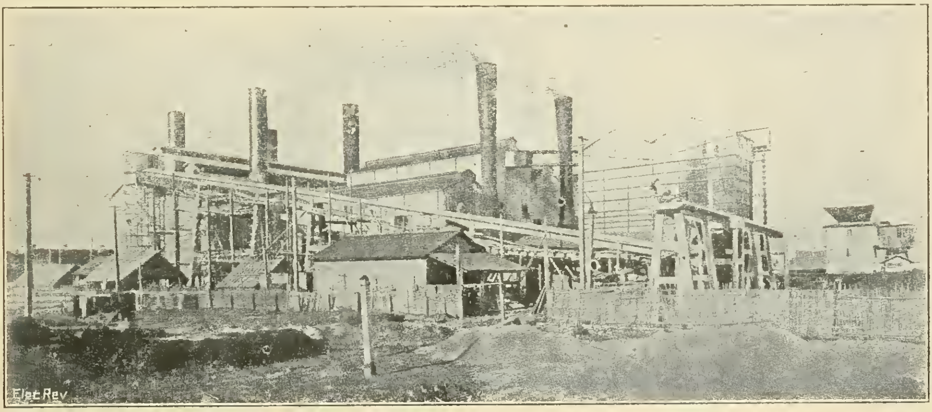

Fig. 1.—Riverside Power Station, Shanghai.

At the same time that these turbines were ordered, a contract was placed with Messrs. Babcock & Wilcox for eight marine-type water-tube boilers, each having an evaporative capacity of 40,000 to 50,000 lb. of water per hour. Six of these are fitted with B. & W. chain-grate stokers, and two of them with the Taylor stoker made by the American Engineering Co. of Philadelphia. The last two stokers have only just recently been delivered, and are now being erected, consequently there has been no opportunity of testing them against the chain-grate stoker with the coals which are locally obtained from Japan and China. The boiler plant was all delivered in 1917, with the exception of some of the pipework which was lost at sea.

The steelwork for the turbine room and boiler house, bunkers, &c., was supplied by the United States Steel Products Corporation, the tender being £2,000 lower than any of the British tenders.

The 22,000-volt switchgear for the main Riverside Power Station, and for the Fearon Road sub-station (this is the original generating station, which is being gradually converted from a generating station to a main sub-station and distributing centre), and also 6,600-volt switchgear for the Fearon Road station, was all placed with the British Thomson-Houston Co., Ltd., of Rugby. Four trunk cables, each five miles in length, consisting of 22,000-volt, split-conductor, lead-covered and armoured cable laid direct in the ground, were supplied by the British Insulated and Helsby Cables, Ltd. These cables were all laid and completed during 1917.

Two motor-driven circulating water pumps of 20,000 gals. per minute capacity each, by Messrs. Mather & Platt, were provided.

In spite of the war, the demands for electricity have increased very satisfactorily during the past few years, and in 1917 it became necessary to consider further extensions. It was decided to call for tenders for a 15,000 or 20,000-KW. turbo-generator, and also additional 22,000-volt split-conductor cables, pumping plant, and 22,000-volt switchgear. For the purpose of obtaining this material, Mr. Aldridge went to the United States in the autumn of 1917, and issued specifications in New York for the material required. At the same time tenders were called for in England for a 15,000-KW. turbo-generator, and tenders were received from the General Electric Co., of New York, and the Westinghouse Electric Export Co., of Pittsburg. The British tenders were for a 15,000-KW. set, and the American tenders for an 18,000-KW. set, this being their nearest standard size adapted for 50-cycle operation, the usual frequencies in the States being 60 and 25 cycles. The British tenders were lower than the American, but, unfortunately, the Ministry of Munitions was not able to give any guarantee that a licence would be issued to build the machine, nor could any undertaking be given as regarded delivery. As it was becoming increasingly urgent to obtain additional plant for Shanghai, it was necessary to place the order in America, and the tender of the General Electric Co. for an 18,000-KW. machine with its most efficient load at 16,000 KW., and with a capacity of continuous operation at 20,000 KW., with a somewhat higher steam consumption, was accepted. The guaranteed steam consumption of this machine with a 29-in. vacuum is as follows:—10·95 lb., 13,500 KW.; 10·95 lb., 16,000 KW.; 11·1 lb., 18,000 KW.; 11·35 lb., 20,000 KW.

A contract was also placed with the Worthington Pump and Machinery Corporation for an electrically-driven vertical centrifugal pump to provide the circulating water for the big turbine. This motor is constructed for operating at the power house generating pressure of 6,600 volts.

For the equipment of a large sub-station designed for handling a 25,000-KW. load in a growing industrial district the General Electric Co. received the contract for 22,000-volt switchgear. A 6,500-K.V.A. synchronous condenser was also ordered from the same firm, the function of this machine being to raise the power factor at this large sub-station, which is situated about 10 miles from the Riverside power station. The load in the district served from this sub-station is almost entirely industrial, the bulk of the supply being given to cotton-spinning and weaving mills, flour mills, and oil mills; in addition, power is supplied for various other purposes, amongst which is a jute mill, and also an incandescent electric lamp factory owned and operated by the General Electric Co., of New York. It is to be noted that the last two enterprises inaugurate new industries upon a commercial scale in Shanghai. To connect the Fearon Road sub-station with the 25,000-kw. sub-station just referred to, two trunk cables, each approximately five miles in length, consisting of 22,000-volt, split-conductor, lead-covered and armoured cable, were also ordered from the General Electric Co., British manufacturers not being in a position to supply this cable owing to Government restrictions.

For the Fearon Road station, from which at the present time the Shanghai Tramway Co. is supplied with direct current by Belliss-Peebles steam-driven generators, a motor-generator-synchronous-condenser set has been supplied by the Westinghouse Electric Co. This machine is designed to give an output of 600 kw. d.c. for traction purposes, whilst the synchronous condenser is rated at 3,250 k.v.a., its purpose being to improve the power factor on the system between the main power station at Riverside and Fearon Road.

Fig. 2.—Riverside Station Pump House, Shanghai.

When Mr. Aldridge returned from the States he found that, owing to the uncertainty of getting the Parsons machine and, moreover, to the absolute unreliability of the A.E.G. turbo-alternators (two 2,000-kw. and two 5,000-kw.), 9,000 kw. of which has been out of commission since last autumn owing to very serious breakdowns in the generator end, it was necessary that in order to safeguard the undertaking by the provision of a sufficiency of plant a second 18,000-kw. machine should be ordered. The reasons given for placing an exact duplicate machine with the General Electric Co. are referred to later: although both the Electricity Committee and the engineer-in-chief would naturally have preferred a British machine, the uncertainties were such that it was decided that the best interests of the undertaking would be served by having a duplicate G.E.C. set. A strong factor influencing the recommendation of this second machine was that the General Electric Co. was in a position to give quick delivery, and, furthermore, as the machine would be a duplicate of the first one, the original drawings were applicable; consequently, all the foundation work is being carried out from these drawings, and a considerable saving of time thereby effected. If tenders had been called for in England it would have been several months before drawings could have been obtained, and valuable time would have been lost.

These explanations are put forward because it may appear strange that a British engineer responsible for an undertaking of this size should favour American machinery, but it should be borne in mind that it was practically impossible to get this plant with any degree of certainty in England, whereas the Americans have been able to fulfil their contracts within very reasonable time. Moreover, the conditions at Shanghai were such that in order to meet the growing demands for electricity it was very necessary to obtain plant with the utmost dispatch. Owing to the serious breakdowns of the German machinery on various occasions the undertaking was very seriously handicapped in the winter of 1917, and not only was it run without any spare plant, but for several weeks it had to curtail the supply to industrial users between the hours of 4 p.m. and 10 p.m. daily. The scale of further extensions outlined below may appear at first sight somewhat extravagant, but in this connection it should be pointed out that 14,000 kw. of A.E.G. plant is to be scrapped, and also the Fearon Road station containing about 5,000 kw. of steam plant is scheduled to be closed down in favour of the more efficient turbine plant at the Riverside Power Station: thus it will be seen that whilst two large units are being installed, at the same time about 19,000 kw. of less efficient plant is being removed.

Turning to the financial results of the year 1918, the return on capital outlay was 7·03 per cent., as against 9·42 per cent. in 1917. This was partly due to the heavy capital expenditure on new plant which at the time was non-productive, but principally to the enormous increase in the price of coal, which rose from 1917 to 1918 by about 80 per cent., and the price paid for coal during 1918 was about 170 per cent. above that paid in 1916; in spite of this, however, the price of energy for light and power was only raised about 40 per cent.

The future of Shanghai depends on industrial development, which, in turn, is dependent on electric power supply. China cannot expect much development of water power for the production of electric power; she is dependent upon coal for her industries, and is content to import it, although, as the following figures show, she is one of the three countries most richly endowed with coal resources:—

	Short tons.
United States, including Alaska ...	4,231,352,000,000
Canada	1,360,535,000,000
China	1,097,436,000,000
Germany	466,665,000,000
Great Britain and Ireland, &c. ...	208,922,000,000

When one pauses to consider the coal wealth of China, the cheap labour, the wonderful facilities afforded by the waterways, and to a lesser, but improving, degree by railways for transportation, a feeling, not so much of pity as disgust, comes over one at the thought of all this valuable coal lying buried for want of initiative to work it. The coal question is of vital importance to the electricity department, as it is also to those industries dependent on it for cheap electric power. The price paid by the department has risen since 1914 from Tls. 5·70 per ton to Tls. 16·30 last year.

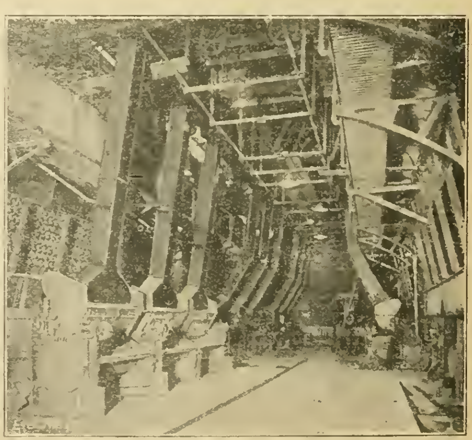

Fig. 3.—No. 2 Boiler House, Containing Eight B. & W. 50,000-lb. Boilers.

China has a very long way to go before she can begin to approach the commercial and industrial activities of European countries, but she possesses two of the principal minerals—coal and iron—with which to build up her State. Whether foreign capital would be necessary for development upon a scale commensurate with the position which her

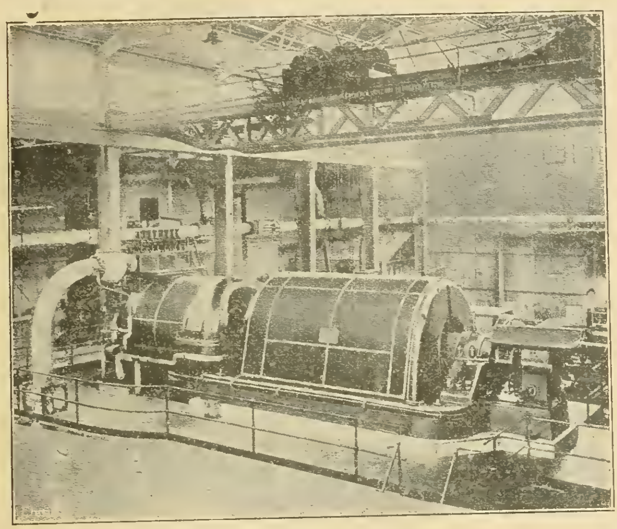

Fig. 4.—10,000-kw. G.E.C. (N.Y.) Turbo-Generator.

buried wealth should enable her to attain, is outside the province of this report, but that she will need foreign assistance—nay, supervision—in such development is patent to all; such assistance, however, need not and should not mean foreign domination, but rather mutual co-operation in the fullest sense of the words. If, as indications certainly suggest, Shanghai is to become increasingly important as a manufacturing centre, it must have cheap electric power, and it cannot have that without cheap coal. Last year a suggestion was made in the local Press that the Municipal Council should purchase mining rights and operate the coal mine acquired as a municipal co-operative business to meet the requirements of Shanghai. It may be doubted whether this form of municipal socialism is the best solution of the coal problem. The suggestion is offered that a local company formed by both foreign and Chinese residents, both having representation on the board, would be best fitted to undertake the supply of coal to Shanghai. The scheme, to be a success, should be organised on a co-operative basis, and it is suggested that part of the capital should be found by large users of coal who would have a direct interest in the efficient operation of the mine to the extent of securing a sufficient supply of cheap coal for Shanghai. The question requires a good deal of serious consideration, but once the initial difficulties were overcome the prospects of successful enterprise might be regarded as assured. It is rumoured that within five or six years Japan will not be able to export much of her own coal. Perhaps, also, the chance that China will open up her coal fields on scientific and commercial lines within a reasonable time is too optimistic. The more pressing does it therefore become for Shanghai to take the matter in hand itself. The proposal outlined is offered in all seriousness by the engineer-in-chief in his annual report, because he believes that unless steps are soon taken to ensure a continuous supply of cheap coal, Shanghai may be compelled to pay exorbitant prices for this all-important commodity, which will seriously react upon its commercial future in the Far East.

Since the Armistice there have been signs of renewed activities, which clearly show that an era of industrial expansion may be confidently looked for in the next year or two. The textile trade is, so far, the largest user of electric power, after which comes flour milling. It is significant that practically all the new mills and factories which have been established during the past five years operate by electric power purchased from the electricity department rather than from individual steam-power plant of their own. In the older mills, which are driven by steam power, the conversion from steam to electricity is gradually, but surely, taking place.

In former reports the various uses to which electric power is put in Shanghai have been written about. Suggestions are now offered to indicate further uses to which it may be applied in Shanghai on lines following its application in Europe and America since the outbreak of war called for the greatest production efforts.

Shanghai, with cheap electric power, may yet develop into a steel-producing centre. The city is better equipped and organised for manufacturing processes than any other city in China. Generally speaking, it is true that the prosperity of a city depends not only upon the magnitude of any one particular industry, but upon the diversity of industries, and on the recognition of this axiom and its practical application the future of Shanghai, as the first city of China, to no small extent depends.

With regard to building and structural work designed to this department's requirements by the Public Works Department, and executed under its supervision, it is commonly believed that the electricity undertaking being municipally owned, services of the nature referred to are rendered free by the Public Works Department; but this is a misconception. Upon all constructional work, whether undertaken by Public Works Department labour or by contract, a fee of 7 per cent. is paid on the cost of the work to the Public Works Department by the electricity department. This explanation is made because there still persists an idea that the electricity undertaking, being a municipal concern, enjoys certain advantages, which it would not possess if it were a public company.

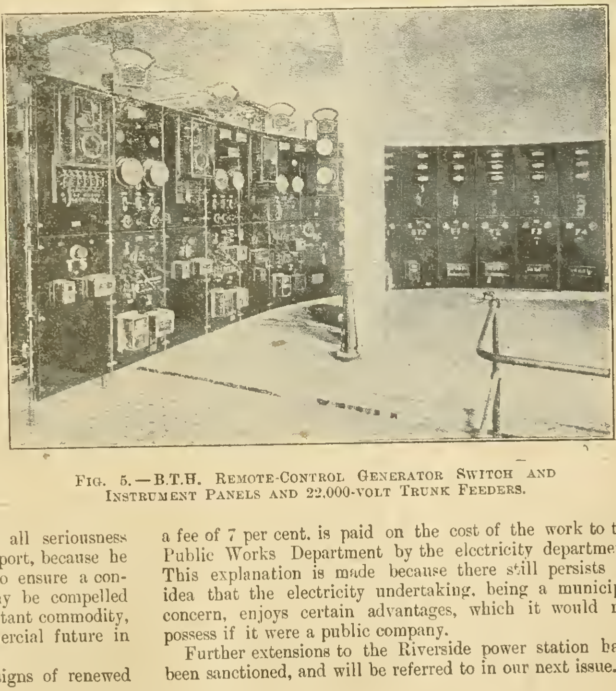

Fig. 5.—B.T.H. Remote-Control Generator Switch and Instrument Panels and 22,000-volt Trunk Feeders.

Further extensions to the Riverside power station have been sanctioned, and will be referred to in our next issue.

THE ELECTRICITY SUPPLY BILL.

(*Continued from page* 720.)

Bradford's views, as voiced by Mr. T. Roles, city electrical engineer, are similar to those of other municipalities: the Bill is welcomed as making for the good of the nation, but the terms of purchase are not acceptable, and as the Ministry of Ways and Communications will only use 20 per cent. of the output, it should not be entrusted with the powers of the Bill. An important point is raised by Mr. Roles—namely, that if the mains are extended to unprofitable areas, such extensions should be made at the cost of the nation, and not charged on existing industries.

At Birmingham, the chairman of the Electricity Supply Committee, in submitting the annual report of the undertaking, said that the Committee generally approved of the Bill, but objected to the "standard price." He made the assumption that Birmingham would become the centre of a District with a radius of 20 miles, and we notice that at other industrial centres the same idea has found expression; but here, we think, a grave error is made. The Districts will have to be far larger than that.

In the discussion in the House of Commons on the second reading of the Bill, Sir A. Williamson, chairman of the Board of Trade Committee, on whose report the Bill was drafted, pointed out that it was essential that the Boards should be small and the Districts large, and suggested that the whole of Lancashire, for instance, should be one District. To confine the Districts to 20-mile radii round big centres would be a fatal mistake.

At Stoke-on-Trent the Electricity Supply Committee recommended the Council to urge the Government to make the area within a 10-mile radius of Stoke Town Hall the District for North Staffordshire!

The feeling of the Provincial Companies was expressed by Mr. H. B. Renwick at the annual meeting of the General Committee; he took the same line as Mr. Braithwaite and Mr. Tuckett with regard to the breach of faith in changing the terms of purchase, and pointed out that if the companies were supplied with energy in bulk, and at the same time their prices were controlled by the Electricity Commissioners, they would be "tied at both ends." It is clear from his speech that the purchase terms, and certain other details, will be strenuously opposed by the companies. At the same meeting Mr. George Balfour, M.P., dealt with the subject on the basis of the public welfare; he held that the appointment of Commissioners was a sound policy, but that the District Board part of the scheme was contrary to the public interest, and should be opposed by the whole industry.

The Provincial Electric Supply Committee of the United Kingdom, representing 122 companies, has issued a memorandum to Members of the House of Commons, in which the Bill in its present form is declared to be not in the public interest; the proposed machinery of the District Boards is considered cumbersome, ineffective and expensive, and it is urged that the appointment of Electricity Commissioners alone would suffice to ensure a cheap and abundant supply of electricity. The proposed terms of compulsory purchase are described as inequitable and as constituting a breach of the Parliamentary bargain upon which the industry has been built up—a contention already advanced by metropolitan company representatives.

In Dublin the city electrical engineer, Mr. L. J. Kettle, has taken up an attitude of determined opposition to the inclusion of Ireland in the scheme. He points out, in a letter to the Corporation, that the investigation on which the Bill was based was confined to Great Britain, and that the conditions in Ireland, where there are no compact industrial areas, blast furnaces, or coke ovens, and very few power stations, are totally different. No advantage could be gained by dividing the country into areas under District Boards and controlling the supply industry from London, and if in the future a reorganisation of the industry is necessary, it will be far better done by an Irish authority. The Corporation decided to circulate the letter and hold a special meeting to consider the question.

BRADFORD.

The Bradford Corporation Electricity Committee welcomes the reform proposed by the Electricity Supply Bill. At the same time certain amendments are suggested by the committee. A special advisory sub-committee went very carefully through the Bill, and Mr Roles received a representative of the *Yorkshire Observer*, and indicated to him the attitude of the committee.

"We regard the Bill generally with favour," he said, "as it is quite realised by the Electricity Committee that there should be greater co-operation between the supply authorities. The committee is doubtful whether any district board under the new Bill will be able, for some time to come at any rate, to give a cheaper supply in Bradford than has been provided by the Bradford Corporation." The Electricity Commissioners are given very wide powers, and this should be all to the good provided that, as it is hoped, the right men are appointed to the positions. The Electricity Commissioners should be experts on the subject of electricity supply, and therefore we look to them to frame such regulations as will interfere with the industry as little as possible. "We think there should be a clause making it clear that if it is necessary to extend the mains at a large capital expenditure to thinly populated areas for agricultural and other purposes these extensions should be made at the national expense, and not be a charge on existing industries."

MR. H. B. RENWICK'S VIEWS.

Presiding at the second annual general meeting of the Committee of the Provincial Electric Supply Committee of the United Kingdom, on May 27th, Mr. Renwick said:—

The Bill affects the fortunes of the companies vitally. In the first place it violates the Parliamentary bargain entered into under the Electric Lighting Act, 1888, and the Bill, as drafted, contains clauses which constitute a distinct breach of faith, particularly in respect of the terms of purchase and the period of the tenure or concession.

The terms of purchase of the generating stations are not the same as those in the Act of 1888, on the strength of which so much money has been raised. It was on the strength of that Parliamentary bargain that the public invested its savings, and it was on the strength of that bargain, too, that we pioneers persevered in the face of the greatest difficulties and tremendous obstacles in developing the industry to its present state of efficiency. In any case, the terms of purchase should be not less favourable than those of 1888, and if we are to accept the conditions set out in the Bill they should certainly be a good deal better than the 1888 terms.

Again, when our stations are taken over we have to take bulk supply from the body set up under the Bill. The question is what price are we to pay for that bulk supply? The wording of the clause dealing with the matter is not satisfactory in its present form and must be amended. Further, the Electricity Commissioners take power to regulate the rates we are to charge our consumers. We are thus tied at both ends. We must have a proper margin in order to carry on our business successfully, and this is essential, not only in the interests of our shareholders, but also in the interests of the public.

Then, again, there is the question of the ultimate purchase of the remaining part of our undertakings, over which it is proposed that we should give a standing option of purchase, and meanwhile we are to submit—most unfairly, I suggest—to competition in our areas from the District Boards. It is true that the competition in question is subject to certain limits and conditions, but in any case the principle is a vicious one.

On all these points and on others we shall press for amendments. We are not averse to progressive change. On the contrary we welcome it, but it must be on equitable lines, and proper regard must be had to the fact that we have been the pioneers in an industry which to-day is admitted to be a key industry. We shall demand full, fair, and equitable compensation for any sacrifices we are called upon to make under this Bill, which we are assured is not intended to impose any hardship upon the existing undertakers.

Whatever ground there may be for nationalisation of railways, there is no ground whatever for nationalisation of electric supply, but while we object to nationalisation of our industry, we raise no objection to official control, so long as that control is on proper lines for the purposes of regulating, co-ordinating, and reorganising the electric supply industry.

We are closely in touch with the other associations in the industry so as to work together in all matters we have in common, for we realise that in this matter a united front is essential to success.

MR. GEORGE BALFOUR'S VIEWS.

At the same meeting, Mr. George Balfour, M.P., said:—

I would press on you all to keep in view, first of all, sound public policy. If you do that you will not go far wrong so far as the protection of the industry is concerned. Therefore, I would ask you to first come to a definite conclusion on the question: "Is the Bill right or wrong for the public at large?" and having come to a conclusion, start your attack from that point of view. Personally, I am convinced that the Bill is directly in opposition to the public interests, and the two main provisions of the Bill must be looked at from totally different standpoints. So far as Electricity Commissioners are concerned it is, broadly speaking, quite sound, and in the interests of the people, provided the Bill is suitably amended. So far as the District Boards, that is the distributing part, are concerned, I think we are all agreed that it is inequitable. I think the line we should adopt, if you agree with that view, should be to state in plain language first of all that the Bill is wrong, and then if you have any observations as to how it should be amended, make that the secondary item, but make quite clear, if your view is in harmony with mine, that you are absolutely opposed to District Boards as set out in the Bill. I suggest that you should press the view that I pressed in the House of Commons, that the Electricity Commissioners can very readily bring in the District Boards once they, the Commissioners themselves, are organised and the machinery set up by them is working smoothly. It cannot be done quickly, and the Commissioners will have ample work to occupy their attention for twelve months.

The Provincial Electric Supply Committee.

The avowed object of the Bill is to ensure a cheap and abundant supply of electricity. In the opinion of the Provincial Electric Supply Committee this object will not be attained by the Bill in its present form.

The machinery of control is far too cumbersome to operate efficiently. Delay and confusion are certain to result, when every electrical development over a wide area has to be considered and approved by a heterogeneous body of unwieldy dimensions. Members of District Electricity Boards are to be paid for their services; and the Boards are to be empowered to employ secretaries, engineers and other officials. The cost of these additional services, which are supplementary to the functions of the Electricity Commissioners and of the staff of existing individual undertakings, must eventually be borne by the consumer of electricity, thus leading to increased rates for supply. For these reasons alone the Provincial Electric Supply Committee holds that the District Electricity Boards will not tend towards a cheap and abundant supply of electricity. Further, the District Boards must inevitably lead to excessive organisation and in the opinion of the Provincial Electric Supply Committee are unworkable for the purpose of carrying on a commercial undertaking.

The appointment of Electricity Commissioners is considered by the Provincial Electric Supply Committee to be, by itself, sufficient to guarantee the purposes of the Bill, provided (1) that the Commissioners are chosen for their long and wide commercial experience and business standing, and/or for their knowledge of the electric supply industry, and (2) that they are granted power to remove the present obstacles to the extension and cheapening of the supply of electricity and to authorise the co-ordination and reorganisation of supply whenever necessary. The Commissioners should give full time and hold permanent appointments.

The Bill should not go beyond the appointment of expert Electricity Commissioners who would be free, under the Board of Trade or the Ministry of Ways and Communications to deal equitably with electricity supply in the various districts as they consider best in the public interest.

For the co-ordination and unification of electric supply it may be necessary for the Commissioners to arrange for the compulsory purchase of generating stations owned by authorised undertakers. Under the Electric Lighting Act, 1888, a definite tenure was guaranteed in respect of the whole of the undertaking, and at the expiration of the concession the undertaking as a whole was purchasable at the "then value." If a portion only was purchased allowance for severance was provided for.

The "standard price" or terms of compulsory purchase of generating stations proposed under the Bill are the costs of construction less depreciation. No provision is made for severance under the Bill, although a portion only of the undertaking may be purchased, nor is any allowance provided for loss suffered through the premature purchase of a partially developed undertaking, where the capital expended has not had sufficient time to become remunerative.

The Provincial Electric Supply Committee regards the terms of purchase as set forth in the Bill as a violation of the Parliamentary bargain upon the strength of which so many millions of capital have been invested by the public in electricity supply undertakings. The new terms of compulsory purchase under the Bill should be, at least, not less favourable than those laid down in the Act of 1888, *plus* reasonable compensation for anticipating the date of purchase.

Irish Conditions.

Mr. P. J. Kettle, city electrical engineer, Dublin, holds that the Bill should not be applied to Ireland, as it is not at all applicable or desirable. The conditions are essentially different in Great Britain and in Ireland.

"The main reasons I would advance," said Mr. Kettle to a *Freeman* representative, "for the non-applicability of the Bill to Ireland are: (1) The working conditions are essentially different. Ireland has no densely populated industrial areas supplied with electricity in scraps from a heterogenous collection of works, she has no blast furnaces, no coke ovens, and consequently no waste gases. What will suit Great Britain will not necessarily suit Ireland. The whole scheme will naturally be run in the interests of Great Britain. (2) Running and administering Irish electricity supply from London cannot benefit Irish interests. Her interests will be inevitably overlooked and neglected. This work should be done in Ireland by Irishmen, who not only know the conditions and know what they are doing, but who have a direct interest in developing Irish industries. English interests lie in the opposite direction. (3) The report upon which the Bill was based refers to Great Britain only, not to Ireland. Ireland is dragged in as an afterthought. (4) Centralisation cannot be carried out to any profitable extent—there is practically nothing to centralise. (5) The effect of the Bill will be not to reduce but to increase the cost of electricity.

"Standardisation, the development of Irish water power, the exploitation of the Irish peat bogs, the provision in time of a national supply of cheap power, the consequent encouragement and development of Irish industries, are all desirable and very desirable objectives, but they are not going to he achieved by a board in London. They can be and will be achieved only by an Irish authority to whom Irish interests will be paramount."

The electricity nationalisation scheme has created a great deal of interest in Irish industrial circles, especially in and around Dublin, but fears are expressed that it may not materialise in relation to reconstruction in that country. Mr. John O'Neill, chairman of the All-Ireland Munitions Committee, told an interviewer that he shared these fears, which were based on the Government's general attitude towards questions of Irish development. If the proposals were carried out, however, and electrical generating plant centralised in each big district—as in Dublin and its suburbs—it should enable electricity to be supplied very much cheaper than at present, and it would also effect most valuable and important economies.

A prominent Dublin electrical engineer said at present the percentage of electrical power used per manual worker in Ireland was less than that in any other country—except, perhaps, some of the out-of-the-way colonies. It was absurd that in Dublin there should be seven generating stations, and more absurd still that the Dublin Tramways Co., which was in a position to provide cheaper power than any of the other stations, should be prevented by legislation from doing so.

Mr. G. F. Pilditch, electrical engineer to the Rathmines Urban District Council, said that if the idea was to merely take over the control of the small stations it would not help matters much, but he understood the idea was to allow existing small stations to carry on as distributing stations, and that would be a great saving, and it would also mean that no new small generating plants would be allowed.

Mr. S. L. Price, resident engineer, Pembroke (Co. Dublin) Urban District Council, observed that the Irish electrical engineering representatives on the Committee dealing with the matter were opposed to putting the whole of the scheme under the control of the Minister of Ways and Communications, and advocated that it should be worked under the Board of Trade.

In the opinion of Mr. F. J. Allan, secretary, Dublin Corporation Electricity Committee, Government control never worked satisfactorily, and he objected to the Corporation being robbed of the fruits of its enterprise through the lean years, and of the prospects of substantial profits. In Dublin, he said, there were over 700 small power consumers—all of them working some little industry. These enterprises had to be nursed to a certain extent, and it was only municipalities with a patriotic motive towards industrial work that could do that.

Mr. L. Sherlock, chairman of the Dublin Electricity Committee, said there was, and should be, strong objection to having Irish generating stations controlled by an English Board, but if popular prejudice on that matter could be overcome it would undoubtedly be for the general benefit to have for Dublin and the district around it one large generating station, which would produce electricity not only for industrial and domestic use, but also for tramways. If they could secure a central Board for Dublin, which would be free from English interference, and which at the same time would not involve either ratepayer or private company, who had already spent large sums on their own stations, in any loss, then a general central station for all purposes would be an immense advantage.

(*To be continued.*)

Scientific Research in South Africa.—The Research Grant Board which has been established by the Union Government in South Africa for the encouragement of scientific research, has recently announced its scheme for awarding research scholarships and making grants towards the expenses of scientific research. The scholarships will vary in value from £80 to £250 per annum for one or two years, and may be awarded for a further period. The regulations of the Board may be consulted at the Inquiry Room of the Department of Overseas Trade.—*Board of Trade Journal.*

IN MEMORIAM.

Engineers' Memorial Service at the Abbey.

At Westminster Abbey, on the 18th inst., a Solemn Service was held in memory of the Engineers who gave their lives for their country, 1914-19. The Abbey was well filled, many people standing. Before the service the band of the Royal Engineers, under the direction of Bandmaster Neville Flux, F.R.A.M., played a selection of music appropriate to the occasion, including Chopin's "Marche Funèbre," the overture to Sullivan's "In Memoriam," Tschaikowsky's "Chanson Triste No. 2," &c.

The service commenced with the singing by the congregation of the hymn, "O God our Help in Ages Past."

After the Lord's Prayer and an anthem the following was delivered by the Dean :—

> Let us now praise God for our brethren belonging to the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Naval Architects, the Institution of Electrical Engineers, and the Iron and Steel Institute who have laid down their lives for their King and Country in the great war.
>
> They were men who were drawn from posts of great responsibility and high scientific distinction. They surrendered to the service of their country the gifts of their industrial skill and the riches of their professional experience. In every field of warfare, by sea and land and air, they have won an honourable and immemorial record of great achievement. They were the pride of their homes. They went out in the beauty of their strength and manhood. Their sacrifice has been the price of our country's complete and final triumph. In sure and certain hope of our joyful reunion with them in the day of Resurrection, we now commit the keeping of their souls unto Him who is eternal love and eternal life! May He, through the Holy Ghost the Comforter, strengthen each one of us in the desire faithfully to follow in their steps, that with the same unselfish courage we may strive to do our duty as loyal citizens of our land and as true servants of the Lord Jesus Christ!

The "Doxology" having been sung by all, standing, several prayers were offered by the Dean, the congregation devoutly kneeling, followed by Kipling's "Recessional," the Blessing, the Last Post, the Réveillé, and the National Anthem.

The service, which throughout was simple, impressive, and reverential, was brought to a close with the Grand March "Imperial" (Neville Flux).

The Roll of Honour was composed of several sections setting forth the names of those connected with the different Institutions and Societies representing the engineering profession, who had given their lives for the Great Cause. The following is the list of the losses sustained by the Institution of Electrical Engineers :—

Andrews, G. L.	Capt., R.G.A. (*killed in action*)	M.I.E.E.
Carter, W. L.	Capt., R.E. (*died*)	M.I.E.E.
Casson, W.	Capt., London Regiment (*killed in action*)	M.I.E.E.
Davis, V. O. I.	Lieut., R.E. (*died*)	M.I.E.E.
Damaresq, A. H.	Bt.-Lieut.-Col., R.E. (*died*)	M.I.E.E.
Hammond, R. W.	Lieut.-Col., Royal Fusiliers (*died of wounds*)	M.I.E.E.
Hopkinson, B., C.M.G., F.R.S.	Colonel, R.A.F. (*accidentally killed*)	M.I.E.E.
Sclater, G. L.	Captain, R.N. (*accidentally killed*)	M.I.E.E.
Seligmann-Lui, G. P.	Director, French Military Telegraphs (*died*)	M.I.E.E.
Thorne, G. S.	Capt., R.A.F. (*died of wounds*)	M.I.E.E.
Tild, E. G.	Capt., H.L.I. (*killed in action*)	M.I.E.E.

Alderson, A. R.	Lieut., R.E. (*killed in action*)	A.M.I.E.E.
Algar, H.	2nd Lieut., R.E. (*died*)	A.M.I.E.E.
Andrews, H. G.	Lieut.-Com., R.N.V.R. (*died*)	A.M.I.E.E.
Baldwin, H. R.	Lieut., R.N.D. (*killed in action*)	A.M.I.E.E.
Bates, T. O. H.	2nd Lieut., Indian Infantry (*died of wounds*)	A.M.I.E.E.
Bowker, R. B.	Major, R.E. (*died*)	A.M.I.E.E.
Bradbury, G. S.	Sergt., Manchester Regiment (*died of wounds*)	A.M.I.E.E.
Britton, H. E.	2nd Lieut., R.F.A. (*died of wounds*)	A.M.I.E.E.
Brydon, A. W.	Lieut., Queen's Royal West Surrey Regiment (*killed in action*)	A.M.I.E.E.
Bumpus, B. E.	2nd Lieut., North. Fusiliers (*killed in action*)	A.M.I.E.E.
Cardew, J. H., M.C.	Lieut., R.F.A. (*died of wounds*)	A.M.I.E.E.
Challoner, T., M.C.	Lieut., R.E. (*died of wounds*)	A.M.I.E.E.
Clears, P. J.	Sapper, R.E. (*killed in action*)	A.M.I.E.E.
Cunliffe, J. G., M.C.	Capt., Man. Regiment (*died of wounds*)	A.M.I.E.E.
Davidson, H. J. G.	2nd Lieut., Lancs. Fusiliers (*killed in action*)	A.M.I.E.E.
Doig, A. M., D.C.M.	Private, Man. Regiment (*died of wounds*)	A.M.I.E.E.
Downey, W. E.	Capt., R.A.O.C. (*drowned*)	A.M.I.E.E.
Duesbury, T.	Private, Royal Berks. Regt. (*died*).	A.M.I.E.E.
Dutch, E. J.	2nd Lieut., Royal Fusiliers (*died of wounds*)	A.M.I.E.E.
Dyke, G. B.	Lieut., Royal Garrison Artillery (*killed in action*)	A.M.I.E.E.
Elkins, C. A. I.	Sapper, R.E. (*died*)	A.M.I.E.E.
French, Hon. E. F.	2nd Lieut., R.F.A. (*died*)	A.M.I.E.E.
Gibson, J. S.	2nd Lieut., Bedford Regiment (*died of wounds*)	A.M.I.E.E.
Gilbert, J.	Private, Man. Regiment (*died of wounds*)	A.M.I.E.E.
Gillespie, W.	Major, R.E. (*killed in action*)	A.M.I.E.E.
Handcock, R. H.	Lieut., R.A.O.C. (*died*)	A.M.I.E.E.
Henry, W. J.	Sub.-Lieut., R.N.D. (*killed in action*)	A.M.I.E.E.
Hickie, C. S.	Lieut., R.A.F. (*died of wounds*)	A.M.I.E.E.
Hoggett, F. R.	2nd Lieut., Royal W. Surrey Regt. (*died of wounds*)	A.M.I.E.E.
Hoyle, E.	Lance-Sergeant, H.A.C. (*killed in action*)	A.M.I.E.E.
Hulton, R. P.	Corp., Div. Engineers, R.N.D. (*died of wounds*)	A.M.I.E.E.
Hunstone, W. H.	Major, Embarkation Staff (*died*)	A.M.I.E.E.
Hurlbatt, E. S., M.C.	Lieut.-Col., Lanc. Fusiliers (*killed in action*)	A.M.I.E.E.
Hyde-Thomson, D. H.	Lieut.-Col., R.F.A. (*accidentally killed*)	A.M.I.E.E.
Labour, H.	French Army (*killed in action*)	A.M.I.E.E.
Langdon, W. C. C.	Lieut., R.G.A. (*died of wounds*)	A.M.I.E.E.
Laurie, D. S., O.B.E.	Captain, R.E. (*died*)	A.M.I.E.E.
Lloyd, N. V.	Private, Manchester Regt., (*killed in action*)	A.M.I.E.E.
Marsh, H. H. S.	Major, R.E. (*killed in action*)	A.M.I.E.E.
Middleton, E. J.	Staff-Sergeant, R.E. (*died*)	A.M.I.E.E.
Miller, F. S.	2nd Lieut., R.E. (*died of wounds*)	A.M.I.E.E.
Moffet, J. L.	2nd Lieut., R.S. Fusiliers (*killed in action*)	A.M.I.E.E.
Moore, B. J., M.C.	Captain, R.A.F. (*accidentally killed*)	A.M.I.E.E.
Murray, J. H., D.S.M.	A.-Sergeant, Div. Engineers, R.N.D. (*killed in action*)	A.M.I.E.E.
Newman, V. W.	Captain, Loyal North Lancs. Regt. (*killed in action*)	A.M.I.E.E.
Palmer, J. H.	Lieut., Royal Fusiliers (*killed in action*)	A.M.I.E.E.
Philips, T. F.	Private, Mortar Bat. (*killed in action*)	A.M.I.E.E.
Pink, H. W.	2nd Lieut., R.E. (*died of wounds*)	A.M.I.E.E.
Powell, C., M.C.	Captain, R.E. (*died of wounds*)	A.M.I.E.E.
Read, A. H.	Lance-Corp., Div. Engineers, R.N.D. (*died of wounds*)	A.M.I.E.E.
Russell, G. L. L.	Captain, R.E. (*died*)	A.M.I.E.E.
Rutherford, J. A.	Capt., M.G.C. (*killed in action*)	A.M.I.E.E.
Scrivener, R.	Sergt., Royal Fusiliers (*killed in action*)	A.M.I.E.E.
Solomon, L.	2nd Lieut., K.O.S. Borderers (*killed in action*)	A.M.I.E.E.
Symmes, H. C.	Major, S.A. Infantry (*killed in action*)	A.M.I.E.E.
Turner, H. E.	Capt., R.G.A. (*killed in action*)	A.M.I.E.E.
Tilley, F. E.	Sapper, Divisional Engineers, R.N.D. (*died of wounds*)	A.M.I.E.E.
Ward, C. R.	2nd Lieut., R.E. (*killed in action*)	A.M.I.E.E.
Whitaker, G.	Captain, Indian Army (*died*)	A.M.I.E.E.
Wilson, G. H.	Lieutenant, R.E. (*died*)	A.M.I.E.E.
Winkworth, W.	2nd Lieut., North. Fusiliers (*died of wounds*)	A.M.I.E.E.
Wolstenholme, C. S.	Lieut., Durham L.I. (*killed in action*)	A.M.I.E.E.
Wood, A. L.	Capt., Lancs. Fusiliers (*killed in action*)	A.M.I.E.E.
Wright, C. V. C.	Lieut., R.A.F. (*accidentally killed*)	A.M.I.E.E.
Young, C. R. M.	A.-Major, R.G.A. (*died of wounds*)	A.M.I.E.E.

Downes, H. L.	Lieut., Liverpool Regiment (*killed in action*)	A.I.E.E.
Gardner, A.	Major, R.E. (*killed in action*)	A.I.E.E.
Pilkington, S.	Capt., Leicestershire Regt. (*killed in action*)	A.I.E.E.
Saltren-Willett, A. J.	Lieut.-Colonel, R.G.A. (*killed in action*)	A.I.E.E.

Brown, H. A.	2nd Lieut., Scottish Rifles (*killed in action*)	Grad.I.E.E.
Butler, H.	Lieut., R.A.F. (*killed in action*)	Grad.I.E.E.
Eardley-Wilmot, G. H.	2nd Lieut., M.G.C. (*died of wounds*)	Grad.I.E.E.
Mac-Indoe, G.	Private, New Zealand Signal Section (*killed in action*)	Grad.I.E.E.
Orchiston, G. J.	New Zealand Expeditionary Force (*died of wounds*)	Grad.I.E.E.
Walker, R. B., M.C.	Captain, W. Yorkshire Regt. (*died of wounds*)	Grad.I.E.E.
Warburton, P. A. E.	Sapper, New Zealand Engineers (*died of wounds*)	Grad.I.E.E.

Bannister, E. G.	Captain, R.A.F. (*accidentally killed*)	Stud.I.E.E.
Baker, H. G.	Captain, Gloucester Regt. (*killed in action*)	Stud.I.E.E.
Barlow, L. M., M.C.	Flight Commander, R.A.F. (*accidentally killed*)	Stud.I.E.E.
Barnett, E. J.	2nd Lieut., R.E. (*killed in action*)	Stud.I.E.E.
Bellamy, H. E.	Lieut., R.A.F. (*killed in action*)	Stud.I.E.E.
Bower, H. A.	Flight Lieut., R.N.A.S. (*accidentally killed*)	Stud.I.E.E.
Burleigh, R.	Lieut., R.A.F. (*killed in action*)	Stud.I.E.E.
Burrage, C. J.	Lance-Corporal, R.E. (*died of wounds*)	Stud.I.E.E.
Butler, A. E. W.	Lieut., Loyal Berks. Regt.	Stud.I.E.E.
Byng, H. G.	2nd Lieut., Border Regiment (*killed in action*)	Stud.I.E.E.
Cam, A. M.	2nd Lieut., R.E. (*killed in action*)	Stud.I.E.E.
Castle, R. L.	Private, Royal Warwickshire Regt. (*killed in action*)	Stud.I.E.E.
Cheshire, J.	Private, Manchester Regt. (*died*)	Stud.I.E.E.
Claeys, W. R. E.	Corporal, Belgian Army (*died*)	Stud.I.E.E.
Coombs, C. S.	2nd Lieut., R.W. Kent Regt. (*died of wounds*)	Stud.I.E.E.
Cope, E. L. N	Gunner, R.H.A. (*killed in action*)	Stud.I.E.E.
Corke, H. W.	2nd Lieut., Glos. Regiment (*killed in action*)	Stud.I.E.E.
Cunningham, P. N.	2nd Lieut., H.L.I. (*killed in action*)	Stud.I.E.E.
De Pomeroy, N. R.	2nd Lieut., R.A.F. (*killed in action*)	Stud.I.E.E.
Donald, J. A.	Sapper, Divisional Engineers, R.N.D. (*died*)	Stud.I.E.E.
Douglas, W. A.	Capt., Royal Scots Regiment (*killed in action*)	Stud.I.E.E.
Eaddy, C. T.	2nd Lieut., N. Staff. Regt. (*killed in action*)	Stud.I.E.E.
Eagle, F. W.	Lieut., R.E. (*killed in action*)	Stud.I.E.E.
Edinborough, N. D.	2nd Lieut., Midd. Regiment (*killed in action*)	Stud.I.E.E.
Ferranti, B. Z. de, M.C.	A.-Major, R.G.A. (*died of wounds*)	Stud.I.E.E.
Fisher, D. G.	Sub-Lieut., R.N.V.R. (*died*)	Stud.I.E.E.
Foote, N. V.	Trumpeter, Australian Light Horse (*died*)	Stud.I.E.E.
Forbes, J.	2nd Lieut., R.E. (*killed in action*)	Stud.I.E.E.
Frieake, G. M.	2nd Lieut., Oxford. & Bucks. L.I. (*died of wounds*)	Stud.I.E.E.
Goodwin, J. J.	Gunner, M.G.C. (*killed in action*)	Stud.I.E.E.
Gudgeon, S.	2nd Lieut., Manchester Regt. (*killed in action*)	Stud.I.E.E.
Hill, C. H.	Private, Canadian Infantry (*killed in action*)	Stud.I.E.E.
Hunt, F. E.	Trooper, Sussex Yeomanry (*killed in action*)	Stud.I.E.E.
Kerman, W. H. P.	1st Class A.M., R.N.A.S. (*died*)	Stud.I.E.E.
Killingback, S. G.	Lieut., R.E. (*killed in action*)	Stud.I.E.E.
Linay, R. E.	2nd Class A.M., R.A.F. (*killed in action*)	Stud.I.E.E.
Mahon, A. T.	Private, London Regiment (*killed in action*)	Stud.I.E.E.
Miller, C. W.	Lance-Corporal, Manchester Regiment (*killed in action*)	Stud.I.E.E.
Ogden, A. H.	Sapper, Divisional Engineers, R.N.D. (*died of wounds*)	Stud.I.E.E.
Organ, H. P.	Lieut., Yorkshire and Lancashire Regt. (*killed in action*)	Stud.I.E.E.
Palmer, W. S. H.	2nd Lieut., R.A.F. (*killed in action*)	Stud.I.E.E.
Ponter, H. W. F.	Lieut., London Regiment (*killed in action*)	Stud.I.E.E.
Pullen, W. W.	Sapper, Divisional Engineers, R.N.D. (*died*)	Stud.I.E.E.
Rawson, S. M.	2nd Lieut., Royal Fusiliers (*killed in action*)	Stud.I.E.E.
Reeves-Smith, D.	2nd Lieut., R.E. (*killed in action*)	Stud.I.E.E.
Slater, E. C. H.	Private, Manchester Regt. (*killed in action*)	Stud.I.E.E.
Smith, W. K.	Orderly, Friends' Ambulance Unit (*died*)	Stud.I.E.E.
Snowden, S. J.	Capt., Middlesex Regiment (*killed in action*)	Stud.I.E.E.
Stafford, R.	Lance-Corpl., M.G.C. (*killed in action*)	Stud.I.E.E.
Swinton, E.	2nd Lieut., R.F.A. (*died of wounds*)	Stud.I.E.E.
Taylor, A. T.	Lieut., R.E. (*killed in action*)	Stud.I.E.E.
Thornton, J. M.	Lieut., R.E. (*killed in action*)	Stud I.E.E.
Trouton, D. G.	Capt., R.F.A. (*killed in action*)	Stud.I.E.E.
Turton, T. C.	2nd Lieut., Liverpool Regt. (*killed in action*)	Stud.I.E.E.
Warden, E. A.	Canadian Field Artillery (*accidentally killed*)	Stud.I.E.E.
Wilson, E. W.	2nd Lieut., West Yorkshire Regiment (*killed in action*)	Stud.I.E.E.
Wilson, T. P.	2nd Lieut., Bedford. Regt., (*killed in action*)	Stud.I.E.E.
Winkley, S. H.	Lieut., R.A.F. (*killed in action*)	Stud.I.E.E.
Woodside, H.	Divisional Eng., R.N.D. (*died*)	Stud.I.E.E.
Wormull, C. F.	Lieut., R.A.F. (*killed in action*)	Stud.I.E.E.
Young, A. Y.	2nd Lieut., Royal Scots Fus. (*killed in action*)	Stud.I.E.E.
Young, C.	Lieut., R.A.F. (*killed in action*)	Stud.I.E.E.
Young, H. V.	2nd Lieut., R.A.F. (*died of wounds*)	Stud.I.E.E.

The Institution of Electrical Engineers was represented at the above Service by the following :—

Mr. G. W. Partridge, Vice-President, representing the President (Mr. C. H. Wordingham, C.B.E.), who was unavoidably absent ; Mr. W. M. Mordey, Past President ; Sir John Snell, Past President ; Mr. C. P. Sparks, Past President ; Mr. J. Devonshire, Colonel H. C. Sparks, C.M.G., D.S.O., M.C., and Mr. A. P. Trotter, Members of Council ; Mr. P. F. Rowell, Secretary ; and Mr. R. H. Tree, Chief Clerk.

Automatic Sub-stations.—An article in the *Electric Railway Journal* of March 22nd describes features wherein the automatic sub-station of the Butte Electric Railway differs from others hitherto installed. The maintenance cost for this station is more than 40 per cent. less than estimated, and the company is planning to extend automatic operation. Comparisons are given between the relative characteristics of automatic and manually operated stations containing machines of the same type, style and capacity. A case is cited in which the installation of an automatic sub-station at a centre of load distribution made possible considerable saving in capital and operating costs, compared with the alternative of additional feeder copper. Similar saving could not have been realised by a manually operated sub-station. In the automatic sub-station, containing two rotary converters (500 kw., 60 cycles, 600 volts, 6-phase, full-load rating 834 amp.), the total annual charge for material and maintenance was $355.80, of which $292 was for labour. The automatic sub-station failed only four times during the year, and then for minor reasons; most of these can be eliminated in future. The automatic sub-station has shown its ability to deal with short circuits without flashing. This is due to the use of flash guards and load-limiting resistors which have a cushioning effect. Lightning does less damage in the automatic substation than in a manually controlled sub-station. In the original article equipment is described and illustrated, and useful references are given to other articles on automatic sub-stations.

Flexible Electric Heaters.—A writer in *Elektrische Kraftbetriebe und Bahnen* of March 14th describes the development of flexible electric heaters made by his works for war purposes. The clothing of airmen was at one time heated electrically by A.C. taken from the wireless equipment, but as this was found to impede the reception of acoustic signals, D.C. was substituted by means of dynamos of 200 watts output at 50 volts. The rubber shutters of photographic cameras for use on aircraft were heated by two flexible heaters of 30 watts capacity each, to keep the rubber pliable at low air temperatures, and similar heaters were placed in contact with the clockwork actuating the rolls of films. Boxes lined with flexible electric heaters of about 30 watts capacity were made to enclose the vital parts of machine guns on aircraft The control levers of aeroplanes were heated by flexible cords The heaters of airmen's clothing were composed of a core of asbestos with resistance wire wound in a spiral around it. Illustrations and descriptions are also given in the original article of heated gloves, muffs and boots. In the case of the gloves special heaters were devised for the finger tips.

THE INCORPORATED MUNICIPAL ELECTRICAL ASSOCIATION.

(*Continued from page* 741.)

As we anticipated in our last issue, the Convention of 1919 proved to be in every respect worthy to rank with its most noteworthy forerunners; it was, in fact, a phenomenal success, and we cordially congratulate the President, Mr. F. Ayton, to whom the success was so largely due, and his colleagues and assistants on the happy outcome of their labours. The members present numbered 280, and were accompanied by between 50 and 60 ladies; headquarters was at the Felix Hotel, Felixstowe, but even that roomy building, with the help of the Orwell and Grand Hotels, was unable to accommodate all the visitors, some of whom were provided with rooms elsewhere. In passing, we may put on record the general feeling of appreciation of the successful endeavours of the manager, Mr. P. T. Humphrey, to ensure the comfort of his guests, hampered though he was by the fact that the hotel had been in military occupation until a few months ago, and his staff was necessarily somewhat new to the establishment. Glorious weather prevailed on Wednesday and Thursday, and when the rain came on Friday, the knowledge that it was a godsend to the country went far to mitigate the loss of fair weather to the party.

The proceedings opened on Wednesday morning, at the Public Hall, Ipswich; a special train from Felixstowe and special cars in Ipswich conveyed the members to the rendezvous, where the Mayor of Ipswich, Mr. E. C. Ransome, J.P., chairman of the Electric Supply and Tramways Committee, extended to the visitors a hearty welcome. He considered that the meeting was likely to be one of the most important in the annals of the Association, and expressed gratification at the election to the office of president on that occasion of the electrical engineer and tramway manager, Mr. Ayton, to whose energy and ability he paid a hearty tribute.

Mr. Ayton, having thanked the Mayor on behalf of the Association, then read his address, an abstract of which appeared in our last issue; he remarked that since, the address was written the appointment of Sir J. Snell to the office of Chief Electricity Commissioner had been announced, which would go far to gain the confidence of the municipal undertakings in the policy of the Government.

On the motion of Mr. T. Roles, vice-president, a vote of thanks was awarded to the president for his address, and Mr. Ayton announced that on the occasion of the visit to the seaplane station the Air Ministry would take 10 members for flights: it was agreed that five members of Council and five others should have that privilege, and the result of a ballot was that Messrs. J. H. Bowden, E. E. Hoadley, W. T. Kerr, S. J. Watson, and Colonel A. Sinclair, members of Council, and Messrs. S. Baker, D. L. Connal, S. E. Day, J. F. Magoris, and A. Wilkinson, were the winners.

It was also specially announced that contractors' representatives had not been invited to the meeting, and any present were requested to withdraw.

Alderman W. Walker, A.M.I.E.E., then read his paper, of which an abstract is concluded in this issue.

An interesting and useful discussion followed, which was almost confined to councillors and aldermen, several of whom were working men. The members then dispersed for luncheon, after which local works were visited.

The majority of the members elected to inspect the Corporation electric power station, tramway depôt, repair shops, and electric vehicle garage, whither they were taken in special tramcars. The chief object of interest at the electricity works was a Brush-Ljungstrom 3,750-K.V.A. turbo-alternator, some of the parts of which were awaiting erection. The garage was also a centre of attraction; here provision is made for charging the batteries of five vehicles from motor-generators, as well as two vehicles direct from the mains. There are in Ipswich two vehicles belonging to the Corporation and 14 private electric vehicles, of which six belong to the Great Eastern Railway; they are mostly of 2½ tons capacity, and use the "Ironclad Exide" batteries, which are repaired when necessary by the Corporation staff.

From the power station the party was conveyed by car to the Orwell works of Messrs. Ransomes, Sims & Jefferies, Ltd., where a factory covering 2½ acres, erected in 1917 for the construction of aeroplanes, has been adapted to accommodate the electric vehicle department of the company, of which some particulars are given elsewhere in this issue. Specially interesting features of the Orwell works are the laboratory and test-room, where all the materials used are subjected to physical, chemical and microscopical examination; the machine shop contains a variety of up-to-date tools, of which the helical gear-cutting machines attracted special attention. The substantial construction and high-class workmanship of the chassis and electrical apparatus were particularly noteworthy.

Leaving the works, the party attended a demonstration of pneumatic tools for road-breaking, operated by a Reavell motor-driven air-compressor mounted on an electric truck and fed by a storage battery. The members then proceeded by car to Christchurch Park, where they were the guests of the Mayor at afternoon tea, and visited the Mansion, a fine Elizabethan building which is used as a picture gallery and museum. This part of the day's programme was not the least enjoyable, and the Mayor and Mayoress were cordially thanked on behalf of the visitors by the President. The Ranelagh works of Messrs. Reavell and Co., Ltd., and the Waterside Works of Messrs. Ransomes & Rapier, Ltd., were also open to inspection, the former being noted for the manufacture of electrical and steam-driven air-compressing plant, and the latter for the Stokes gun (in war-time), heavy electric cranes, hydraulic sluices for the Assuan and other dams, &c.

The many historic associations and antiquities of Ipswich would have justified a longer stay, but "according to plan" the party returned to Felixstowe to dine, and spent the evening as their inclination directed. Two important meetings were held, however, at 9 p.m.—a special meeting of Committee members to consider the circular letter and scale of salaries put forward by the Associated Municipal Electrical Engineers, and a meeting of the members of the A.M.E.E. which, we may suppose, was engaged on very similar lines, but viewed the question from a different standpoint.

On Thursday morning the Association met at 10 a.m. in the Spa Pavilion, Felixstowe—an admirable place for the purpose, where the severely technical aspect of the morning's business was off-set by the glorious sunshine and a clear view of the sunlit sea. A discussion on "Electric Transmission Considerations" was opened by a valuable paper read by Mr. S. L. Pearce, M.Sc., C.B.E., chief electrical engineer, Manchester, who pointed out that every case must be considered separately upon its merits, but after traversing the whole field exhaustively, gave a mass of data and estimates which indicated that the economic superiority of overhead transmission as compared with underground cables (on the basis of 60,000 volts) was by no means a deciding factor in the choice of method, while there were strong arguments in favour of the cable. An abstract of the paper will be given in our next issue.

The discussion was noteworthy for the attendance, by invitation of the Council, of several eminent experts in cable manufacture and electric transmission, who made valuable contributions to the debate. Mr. B. Welbourn, by permission of Mr. Wordingham, stated that the I.E.E. Committee on the Heating of Underground Cables had found that for underground transmission the armoured cable laid direct in the ground was undoubtedly the best, carrying over 30 per cent. more current than cables in ducts, other things being equal; the cable laid solid, however, ran the armoured cable very close. Further, an I.E E. Committee had been set up, on the initiative of Mr. Wordingham, to co-ordinate existing regulations for overhead lines, and a Sub-Committee on the subject of safety had drafted a new set of standards which it was hoped would be adopted in place of the present Board of Trade Regulations. Mr. Fedden held that it was cheaper to carry coal than to transmit electricity 30 or 40 miles, and that all main lines would have to be underground. Mr. Beaver agreed that the future lay with underground cables, but Mr. Wordingham held that the case was not proved yet, and Mr. W. Burr supported that view. Mr. Chattock favoured the cable. The paper was generally regarded as one of the best on a technical subject for many years.

A paper on the "Rating of Electric Supply Undertakings," by Bailie W. B. Smith, Glasgow, was then read and discussed. The author pointed out the absurdities of the existing system, based on an Act of Elizabeth, and called for a complete revision of the system of local taxation. In the discussion this demand was strongly supported, and a resolution was passed instructing the Council to take action with a view to impressing upon Parliament the importance of dealing with the question of assessment and valuation of public utilities.

The afternoon was devoted to a visit to the Felixstowe Air (Seaplane) Station and Workshops, the programme having been changed. Two seaplanes were ready for the visitors, and made several flights, carrying the members above named, whose departure and return were watched with keen interest by their less fortunate confrères. The Air Station has been one of the most active of our aviation centres during the war, and has done splendid work in fighting the Hun. A specially interesting machine was a triplane with five engines, which flies daily, and could easily accomplish the trip across the Atlantic if permission were granted by the Government.

In the evening the annual dinner—the first since 1914—was held at the Felix Hotel, Mr. Ayton presiding. The toast list was a lengthy one. After the loyal toasts, Councillor Bruce Lindsay proposed "The Imperial Forces of the Crown," and pointing out that our Army and Navy had bought our liberty at a great price, he urged that we should live worthily of those who had fought and died for us. Rear-Admiral C. F. Thorpe, R.N., Senior Naval Officer, Harwich, in the course of his reply, referred to the part played in the war by the workers at home, and emphasised the importance of electrical power in the manufacture of munitions of war.

Mr. T. Roles proposed "The Ipswich Corporation," and referring to the good work put into the Orwell chassis, urged the importance of publicity in developing the industry. He pointed out also the advantages derived from the election as councillors of engineers such as the Mayor of Ipswich, Councillor E. C. Ransome, who, in reply, remarked that the future prosperity of Ipswich depended upon a cheap supply of electric power, and expressed the hope that the workmen would ask for more power to be provided to increase the productiveness of their labour. There was no likelihood of extensive linking-up in East Anglia, but they were going in for considerable extensions to their electricity works, and had been told that when the national scheme was carried out, Ipswich would be the "electrical mother" of an area of 20 miles' radius.

Mr. L. L. Robinson, who came to the Convention in a sailing yacht, and had a lively experience in entering the River Deven, proposed "The U.D.C. of Felixstowe," and commended the wisdom of the Council in allowing a company to supply the town with electricity, as Felixstowe was famous for sunshine, and had no power load, so that the load factor must be rotten! The chairman, Mr. W. F. Cross, briefly replied.

Mr. C. H. Wordingham, C.B.E., President I.E.E., in proposing "The I.M.E.A.," said that the Association was now at the summit of its influence: profound changes were about to take place, but municipal engineers would retain the distribution of electrical energy, and the Association would continue its career of usefulness. The President, Mr. Ayton, had done splendid work in promoting the use of electric vehicles, and fully realised the undoubted value of publicity; as President of the Association he had conducted the proceedings with conspicuous tact, good humour, and ability.

Mr. Ayton, in reply, agreed that under the new *régime* it would be as necessary as before to have a strong Association capable of voicing the views of municipalities and keeping in order the Electricity Commissioners and the District Boards.

Alderman Walker, in a humorous speech, proposed "Our Guests (including the Ladies)," and Sir Wilfrid Stokes K.B.E., replied with equal wit. He reproached electricity suppliers for surrounding their contracts with so many difficulties and conditions, hindering would-be consumers from taking a supply—they should sweep away all these irksome and repellent conditions.

Mr. Ayton proposed "The Engineering Firms of Ipswich," and Councillor W. Reavell, in reply, stated that his firm 21 years ago adopted electric power throughout, and had never regretted it.

On Friday morning the annual general meeting took place: the annual report and accounts were adopted, and the result of the ballot for new officers and Council was announced as follows:—

President, Mr. T. Roles (Bradford).
Vice-President, Mr. S. T. Allen (Wolverhampton).
Hon. treasurer, Mr. H. Faraday Proctor (Bristol).
Hon. secretary, Mr. A. C. Cramb (Croydon).
Members of Committee:—
Large towns: Mr. S. L. Pearce (Manchester).
  Mr. W. W. Lackie (Glasgow).
  Major H. Richardson (Dundee).
  Colonel W. A. Vignoles (Grimsby).
Small towns: Mr. S. E. Britton (Chester).
Committee members:—
  Councillor Barge.
  Councillor Robinson, M.P.

Miss Lanfear, Electricity Works, Croydon, had been appointed secretary *pro tem.*

Mr. Chattock emphasised the importance of a publicity campaign to develop the use of electric vehicles, and pointed out that the subscriptions received by the Electric Vehicle Committee from municipalities were insignificant compared with those of other bodies. The *Electric Vehicle* would in future be issued monthly instead of quarterly.

In view of the deficit in the accounts for the past year, due to the high cost of printing and stationery, it was agreed that Committee members should be requested to contribute £2 each additional for the coming year.

The resignation of Alderman Pearson, hon. solicitor, was accepted with great regret, and Mr. J. E. Edgecombe was elected an honorary member. The president referred to the splendid work done by Mr. H. Faraday Proctor as a member of the Council from the commencement and hon. secretary for 14 years; at a later stage Mr. T. W. Purse, as one of the more turbulent members, emphasised the indebtedness of the members to Mr. Proctor, and testified to his invariable courtesy, promptitude, and good temper; a resolution expressing the appreciation of the Association of his services was carried with acclamation. Votes of thanks to the President, the local authorities, and others were recorded, and a special meeting was held to adopt various minor alterations in the articles of association. The place of next year's meeting was left to Mr. Roles and the Council.

In the afternoon, in spite of rainy weather, a large party of members was taken in naval motor launches for a cruise of inspection of the war vessels lying in the harbour, and up the Stour estuary to view the German submarines and a German submarine salving ship. Apart from that afternoon, the weather throughout had been all that could be desired, and the Convention was unanimously regarded as exceedingly successful.

The New President.

Mr. Thomas Roles, M.I.E.E., born at Brighton in 1875, commenced electrical work in 1891, and was successively engaged in the electricity supply undertakings at Hove, Aberdeen, Leicester, and Poplar. In 1904 he became chief assistant electrical engineer to the Bradford Corporation, and in 1907 he was appointed chief electrical engineer and manager; in that capacity he carried out the installation of the whole of the three-phase plant, rated at 20,000 kw., and is now erecting two turbo-generators of 15,000 kw. each. The total capital expended on the Bradford electricity undertaking is over £1,200,000, of which more than £700,000 has been spent during Mr. Roles's connection with the department; he has also given special attention to the commercial development of the undertaking, and the annual output during the past two years has exceeded 50 million units.

Mr. Roles has been chairman of the Yorkshire Local Section of the I.E.E., and is now chairman of the Yorkshire Electricity Supply Linking-up Committee; he was a member of the Electric Power Supply Committee of the I.E.E. and of the National Electric Power Supply Joint Committee. For some time during the war he acted as a representative for the Yorkshire district for the Controller of Coal Mines, but was obliged to give up these duties in consequence of a breakdown in health in May, 1918, which rendered it necessary for him to take a complete rest from all business for several months. He has served on the Council of the I.M.E.A. almost continually since 1912, and his genial personality, combined with an inexhaustible fund of humour and sound practical all-round ability, ensures the success of his term in the presidential chair.

Photo. by Mr. Thomas Roles. *Lafayette.*

The Whitley Report and the Electricity Supply Industry.

By. ALD. W. WALKER, A.M.I.E.E.

(*Abstract.*)

(*Concluded from page 741.*)

In June of last year it was decided to submit a draft scheme—drawn up by the engineer and manager and approved by the Electricity Committee—to a mass meeting of the workers of the Manchester Corporation Electricity department. First of all, a printed copy of the proposed scheme was supplied to each employé, then a public hall in the city was hired, and, after an explanatory statement had been made by the writer, questions and suggestions were invited. Afterwards a vote was taken, and by a large majority the following scheme was adopted:—

Scheme Applying the Recommendations Contained in the Whitley Report to the Electricity Department of the Manchester Corporation.

1. *Object.*—To bring forward matters of mutual interest, and those which in the opinion of the men stand in the way of harmonious working. Generally to promote the welfare of the employés and a close feeling between the management and the employés, and to work in conjunction for the mutual benefit of all.

The scheme is in no way intended to interfere with the rights or status of existing trade unions or associations.

The following are cited as matters that could very well come within the purview of the Works Committees:—

(*a*) Co-operation and improved methods of carrying out the work.
(*b*) Conditions of employment.
(*c*) Class of labour employed on certain operations.
(*d*) Co-operation in supervision.
(*e*) Shop troubles.
(*f*) Formation of shop rules.
(*g*) Employment of ex-soldiers.
(*h*) General welfare.

It is hoped that the scheme will not develop into a manufactory of grievances pure and simple, but should rather provide a means for a frank exchange of opinions.

Any general movement of wages, or raising of rates of pay to any class of employés or to any individual would not be a fit subject to be considered by the Works Committees or the Central Works Council, but would be dealt with by means of the existing machinery, viz., the trade unions and the Employers' Federations, or—when formed—the National Industrial Councils.

It is necessary, therefore, to clearly define at its inception the scope of the scheme as broadly set forth above, together with the matters which could be brought before the Committees and Council.

2. *Constitution of the Works Committees.*—So far as practicable, each section of the department—including female employés in that section—should elect an employé representative on the committee, subject to the maximum number of 20 not being exceeded.

Every employé of 21 years of age and over, irrespective of status or grade, shall be eligible for election and to vote.

All elections to be by ballot—after nomination—and it is suggested that the first Committees should be elected for six months only.

The head of the department concerned shall conduct the ballot; two scrutineers to be appointed—one from the management and one from the employés.

Members of the staff would not be eligible for election to the committees as employé representatives, nor would they participate in the ballot.

The management will not be represented by an equal number, but a less number, and four representatives are suggested as being sufficient for any committee. They would be selected by the chief engineer and manager.

The real function of the management representatives would be to exercise a conciliatory and advisory influence over the Works Committees, and to regulate the matters carried forward to the Central Works Council.

The opportunity presented to the management representatives of meeting the workmen's representatives on this committee should be taken advantage of to offer suggestions in regard to directions in which improvements could be effected. In other words, suggestions should not only be brought forward by the workmen, but also by the management.

The question has been raised as to whether it is desirable to constitute the Works Committees on the basis of "occupation" and "grade of workman" or "place of employment."

Bearing in mind that co-ordination will always be secured through the Central Works Council, it appears desirable—and would be a course more likely to stimulate interest and achieve the best results—to have the committees formed according to place of employment, *i.e.*, one for Stuart Street station, one for the city stations, and one for distribution.

Vacancies occurring on the committees would be filled by ballot.

Wherever the term "employé" is used in this scheme the reference is to those outside the staff grade.

The following representation is proposed for the undermentioned respective Works Committees with which to commence the scheme:—

(*a*) Stuart Street Station.

Boiler houses: Operating staff	3
Turbine Room: Operating Staff	2
Building section	1
Shop repairs section: 1 tradesman—mechanical; 1 tradesman—electrical; 1 non-tradesman ...	3
Railway	1
*Women	1
Management	4
Total	15

(*b*) Dickinson Street and Bloom Street Stations.

Boiler houses: Shift men	1
Engine rooms: Shift men—mechanical (1); shift men—electrical (1)	2
Shop repairs section: Tradesman (1); non-tradesman (1)	2
Coaling	1
Building	1
*Women	1
Management	2
Total	10

(*c*) Distribution.

Mains department: 1 jointer; 1 meter fixer; 1 flagger or pavior; 2 non-tradesmen; 1 woman*	6
Sub-stations department: 2 shift attendants; 1 shift assistant; 1 tradesman; 1 non-trades man	5
Testing department: 1 tradesman; 1 non-tradesman	2
Street lighting	1
Management	4
Total	18

* Elected by the vote of female employés only, which shall be additional to their sectional vote.

3. *Works Committees' Procedure.*—The Committees would elect their own chairmen and hon. secretaries from the representatives of the employés.

In connection with the duties of the latter position it will be necessary for the Corporation to arrange for the services of a stenographer and typist, and to supply the necessary stationery and postage, at the Corporation's expense.

Formal notice of meetings to be sent by the hon secretaries to the members of the Works Committees.

The hon. secretary should keep proper minutes of the proceedings, and should also furnish to the Central Works Council, say seven days before the latter's meeting, a statement of the matters it is intended to bring forward, in order that the Council may have an opportunity of getting together all the necessary information in regard to the same in time for the meeting. This is essential so that the Council may be fully prepared to discuss and settle the questions without delay.

For a commencement, at any rate, it is not proposed to confer executive powers upon the Works Committees to deal with any question or group of questions, and therefore each committee must submit to the Central Works Council for approval or otherwise their recommendations and the decisions which have been agreed to by the head of the department concerned.

It is suggested that the committees should have power to call in any employé whose special knowledge of any particular matter would be useful.

4. *Constitution of the Central Works Council.*—The question of having representatives from each of the Works Committees upon the Central Works Council has been carefully considered.

It certainly seems desirable in order to secure a proper co-ordination of interests between the various sub-departments, and to deal with those subject matters which concern all branches of the electricity department, that representation should be accorded to each Works Committee.

On the other hand, it is not necessary for all the delegates to attend, and therefore the following constitution for the Council is put forward:—

Stuart Street Works Committee: Three representatives.—Chairman and hon. secretary and one other employé representative.

Dickinson Street and Bloom Street Works Committee: Two representatives.—Chairman and hon. secretary.

Distribution Works Committee: Three representatives.—Chairman and hon. secretary and one other employé representative.

Management: Seven representatives.—The chairman of the Electricity Committee, the deputy-chairman of the Electricity Committee, the chief engineer and manager, the deputy-chief engineer, the resident engineer, Stuart Street station, the financial superintendent, the mains engineer.

The management would also have the power to call in the head of any department, if necessary, for consultative purposes.

It is also suggested that the committees be allowed, if and when they thought it necessary, to elect and send a delegate, in addition to those referred to above, if it be considered owing to the nature of some particular matter to be brought forward that this additional delegate's knowledge would be helpful.

The chairman of the Central Works Council shall be elected by the members of the Council at the first meeting.

The Electricity Committee will provide the secretary of the Central Works Council.

A copy of the minutes of the Central Works Council shall be sent to each member of such Council one week before the meetings of those committees.

5. *Number and Place of Meetings.*—Each of the Works Committees will meet at their respective locations, viz., Stuart Street, Dickinson Street, and Polygon.

As a commencement, and until actual experience of the scheme has been obtained, it is suggested that the Works Committees meet from 11 a.m. to 12.30 p.m. on the first Wednesday in each month, and the Central Works Council at the same time on the third Wednesday in each month.

In addition, provision might be made authorising the convening of emergency meetings of the committees and council.

6. *Conclusion.*—The proposals contained in this scheme have been drafted for the sole purpose of applying the principles and recommendations of the Whitley Report to the Manchester electricity undertaking.

It is possible, however, that other undertakings in the district may do likewise.

From the several local electricity undertakings, therefore, a District Council could be formed.

To carry the ideas contained in the Whitley Report a stage further, a National Council may eventually be formed out of the various District Councils for the whole of the electrical supply industry of the country.

Obviously, this is a scheme for a large undertaking. Smaller undertakings would not require either three Workshop Committees or a Central Works Council, but would find one committee sufficient. The very small undertakings could with advantage arrange for the election of two or three delegates, who would have the right to meet the management at regular and stated times. At Manchester, the first committees were elected for six months, which period expired in January last. Before balloting for the new committees, meetings were held, of workpeople only, to vote for or against the continuance of the Workshop Committees. Very favourable opinions were expressed on the work of the committees, and the meeting decided that the next election should be for double the period, viz., twelve months. The monthly joint meetings do good. The free exchange of opinions is beneficial to both. It must always be remembered that whilst some of the workers' representatives have had much experience of committee work and procedure in connection with their trade unions, others have not had that advantage, therefore great tact ought to be exercised and every effort made to thoroughly understand the point of view which any member attempts to place before the committee. Many points of both principle and detail are omitted from this paper, and it is hoped that they will be dealt with by contributors to the discussion. Members will see where modifications are necessary to meet their own particular circumstances, and in the opinion of the author, the paper will have justified itself if it leads to a useful discussion of this important matter

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Discussion.

Alderman Walker remarked, in the course of the paper, that the Industrial Council had already held two meetings, and was engaged in defining the functions of the District Councils. It might be found desirable to give the force of law to the decisions of the Industrial Council, but he withdrew the emphasis which he had placed in the paper on the granting of plenary powers to delegates, as he found that it was *ultra vires* for local authorities to give such powers—the acts of a delegation or committee *must* come before the Council for confirmation or otherwise. When agreement had been attained by the Industrial Council, he hoped that the Government would make such agreement compulsory, as it would be necessary to coerce dilatory and backward councils and companies to conform with the views of the industry.

The District Councils ought to play a very important part in the working of the Whitley Report scheme; they would have local knowledge which was not accessible to the Industrial Council, and could arrive at agreements which the chief Council would enforce. As chairman of a small sub-committee he had put forward a scheme for the subdivision of the country into districts as a first step; he had proposed to make those districts coterminous with the electrical areas of the District Boards, but they could not wait for the latter areas to be defined. The London area was already in existence, as defined in the "Award No. 2,772," and was working extremely well. He asked members to advise the sub-committee as to suitable areas, but held that ultimately the Whitley districts should coincide with the electricity districts, to avoid the overlapping of industrial areas in which different regulations operated, in the same electrical district. With regard to the Workshop Committees, he laid great stress on the importance of *regular* meetings; the committees were not to be called together when a grievance had developed—they should anticipate such questions and settle them by discussion, usually a simple matter in the early stages. The workmen's representatives must be elected by ballot, entirely uncontrolled. Women being in a minority in every department, they ought to have a direct representative as well as a vote for the men's representatives.

Colonel Sinclair (Swansea) agreed with the contents of the paper, which he said would become a standard. Since 1901 he had had an agreement with his employés on the lines of the Whitley Report, which had worked extremely well. It was of the first importance to settle any complaint at once by impartial investigation and direct discussion with the men; the management should have wide powers to settle all matters which did not involve principles.

The Mayor (Councillor E. C. Ransome) asked how a works committee should be run in a small town like Ipswich, with a number of different departments each employing a small number of men.

Mr. C. H. Wordingham said that the fate of the country was in the balance; all depended on the attitude of Labour—if the men would not work, the country must go under. The employer had every desire to co-operate, but it was not so certain that the workman desired to co-operate with the employer. He believed the Whitley Report offered the best means yet devised to bring about that co-operation. Nothing could replace the personal touch; they should let the men see what difficulties the employers had to contend with. The paper was a most valuable one, but a body formed for a given purpose should confine itself to that purpose, and he thought that the Whitley Councils should not undertake research, which was in the hands of the Advisory Council. Alderman Walker's proposal to define industrial areas *pro tem.* was entirely practical and useful.

Mr. H. Faraday Proctor said he had received many complaints that the smaller undertakings were not adequately represented on the Joint Industrial Council; the Association had only six representatives, and it was difficult to subdivide them amongst the undertakings. They were nominated by the Council on this occasion for one year only, but should be elected by the whole Association next time.

Alderman Smith said that a strong executive hand was required to reorganise industry, and our educational system should be reformed to develop character.

Alderman Jephcott (Birmingham) as a workman defended our educational system, and urged the members to support the Fisher Act. Poorly paid men could not be expected to increase production or to take broad views of commercial questions. He welcomed the Whitley Report, and declared that if the men were made to feel that they sat on the committees on terms of equality to discuss working conditions. those trifling difference which often became of national importance would not arise. He recognised the difficulty of giving plenary powers to the delegates on Industrial Councils but said that in practice the local authorities would endorse the actions of their representatives The Industrial Councils must eventually have compulsory powers of some sort. They would effect a revolution in shop practice, but would stabilise industry and promote confidence on the part of the workers, who would join hands with the employers in the defence of British trade and industry

Councillor Toppin (Huddersfield), also a workman, raised the question of adequate pensions for men who were past work. The conciliatory methods of the Whitley Report would do far more good than the plan of waiting for a strike and then using "strong executive power." If the education of the workers was a failure, how much greater had been the failure of the educated classes who had only recently awakened to a consideration of the conditions of living of workpeople.

Councillor J. H. Thompson (Wolverhampton) declared that the British working man had more sense than any foreigner —a very important fact, which his experience had demonstrated. What was needed in dealing with him was human sympathy.

Councillor Humphrey (Mexborough), a working man, denied that the employer was more willing to co-operate than the workman. It was too much to hope that the Whitley Councils would abolish strikes, but strikes were not entered upon by workers for the love of striking, and they were anxious to give the system a trial.

Mr. Logan (Rotherham) said that the functions of the trade unions must not be interfered with, or a conflict would be inevitable.

Replying to the discussion, Alderman Walker said that in small industries the workmen could elect two or three representatives who should have the right to approach the management at any time. Departments could not be combined. Economic problems were unknown to the workmen, who should be shown the facts by patient tuition. The Joint Industrial Council had no intention of doing any research work, but would encourage research in the hands of suitable bodies. Pensions were a national question affecting all industries, and could be dealt with by national insurance. No District Councils yet existed, as the areas had not been defined. The Councils could not act in opposition to the Trade Unions, which necessarily constituted half the Councils. The National Industrial Council was not part of the Whitley scheme.

Annual Report.

The report of the Council for the year ending June, 1919, states that the membership of the Association stands at 395, made up as follows:—

Committees (Members)	182
Chief Electrical Engineers (Members)	184
Honorary Members	7
Chief Assistants (Associate Members)	2
Assistants (Associates)	20
	395

There is a net increase of ten in the total membership.

With regard to electric power supply, a general meeting of the Association was held at Birmingham on November 29th, at which a report from the Council was submitted and, subject to certain amendments, was approved and forwarded to the Board of Trade.

On February 14th the Council of the I.M.E.A. passed a resolution objecting to the proposed transfer of the future control of electricity supply from the Board of Trade to the proposed Ministry of Ways and Communications, and the members were invited to take the matter up with their Members of Parliament.

On March 6th, 1919, a communication was circulated to members of the House of Commons and to the members stating that the Association viewed with very grave concern the proposal to transfer the powers. As the consumption of electricity by railways was never likely to exceed, say, 10 per cent. of the national electricity supply in aggregate, it was difficult to see how the interests of the general manufacturing community, who were by far the largest users of electricity, could be adequately protected by the proposed Ministry of Ways and Communications, whose predominating interest would undoubtedly be railways. It was therefore strongly urged that the control of the electricity supply industry should be vested in the Board of Trade.

In a further circular dated April 1st it was stated that it was imperative that the Board of Trade Electricity Supply Bill should be presented to Parliament forthwith; members of the Association and M.P.'s were asked to secure this.

Several members visited the House of Commons on various occasions, interviewing individual Members of Parliament, and were received by the Electricity Committee of the Commercial Committee of the House. As a result of the representations made, all reference to electricity in the Ways and Communications Bill was withdrawn, but reappeared in the long-looked-for Electricity (Supply) Bill. A special general meeting of the Association was held in London on May 16th to consider the Electricity (Supply) Bill; and a circular setting forth the decisions of the meeting was circulated to Members of Parliament and of the Association. (Abstracted in the Electrical Review, May 30th, p. 624.)

Following upon a meeting in Manchester in June, 1918, between representatives of the electric supply industry and the Trade Unions, a committee representative of electric supply undertakings and Trade Unions was set up to draft a constitution for the formation of a Joint Industrial Council for the electric supply industry Several meetings were held and finally an agreed draft constitution was submitted for approval to the Associations representing the employers—both municipal and company—and to the Trade Unions concerned. After considerable delay, approval to the draft was given by each of the constituent bodies concerned and the Council was formally set up. The Council appointed the following as the Association's representatives on the Joint Industrial Council: Councillor Burman, Birmingham; H. Faraday Proctor, Bristol; L. L. Robinson, Hackney; Bailie W. B. Smith, Glasgow; Alderman Vaughan, Maidstone; Alderman Walker, Manchester. Alderman Walker has been appointed chairman of the Council.

The Council of the I.M.E.A. draws the attention of members to the desirability of giving financial support to the work of the British Engineering Standards Association.

The Council has agreed with the B.E.A.M.A. to recommend the members of the I.M.E.A. to act in accordance with the following arrangements in the issue of specifications henceforth:—"A copy of every specification likely to be the subject of tenders by members of the B.E.A.M.A. to be forwarded to the secretary of that Association for deposit at their head office. One copy of specification to be supplied to *bona fide* manufacturers on receipt of a returnable fee (not to exceed £1 on contracts estimated at, say, less than £1,000, and not to exceed £5 in any case). Further copies to be supplied at a nominal charge not exceeding, say, £5. Specifications should as far as practicable be sectionalised in such a manner that the separate sections, tender forms, &c., and general conditions, may be made available at a nominal charge to enable firms having many departments to secure additional copies of particular sections when required for departmental purposes."

Regulations for the constitution of I.M.E.A. centres were approved at a special general meeting held at Birmingham on November 29th, 1918, and are printed in the report. The Council has officially recognised the E.P.E.A. as the body to be conferred with on the subject of the rates of remuneration and conditions of service of the technical staffs of electric supply undertakings. Last December the secretary, Mr. C. McArthur Butler, expressed a wish to be relieved of his duties owing to the many other calls upon his services, and his resignation was accepted with regret. On May 9th, Mr. H. Faraday Proctor tendered his resignation as hon. secretary, a position which he had held since 1904, owing to demands upon his time, and the resignation was accepted with great regret.

At the request of the Council, Mr. A. C. Cramb, past president and hon. treasurer, has accepted nomination as hon. secretary, and Mr. H. Faraday Proctor has consented to nomination as hon. treasurer.

The Standing Conference of Electrical Supply Associations, upon which the I.M.E.A. is represented, has frequently met to consider matters relating to rates of remuneration and conditions of employment in the electric supply industry, and to make recommendations thereon.

The Council is of the opinion, which has been communicated to the Standing Conference, that the Joint Industrial Council having come into existence, the Standing Conference is now redundant to the purpose for which it was set up. At the request of the National Association of Local Government Officers, the Council agreed to support a resolution to the effect that the Departmental Committee on Superannuation should recommend the introduction of a National Superannuation Scheme for the officers employed by local authorities in England, Scotland and Wales on a non-contributory basis, providing similar benefits to those granted to civil servants, and now proposed for teachers, with adequate provision for the present older officers in the service. At a special meeting of the Association held in Birmingham on November 29th the following resolution, proposed by Alderman Walker, of Manchester, and seconded by Alderman Barge, of Poplar, was carried unanimously:—"That in the opinion of this Association the higher officials employed in municipal electrical undertakings should have an increase in salary at least equivalent to the war awards." The engineering members took no part in the discussion or the voting upon this resolution. There appears to be little prospect of developing the use of electricity for agricultural purposes until the State Departments, entrusted with the governing powers relating to electricity supply and agriculture, remove the existing obstructions and encourage progress. The accounts show a deficit for the year of £88.

(*To be continued.*)

BUSINESS NOTES.

Government Sales of Electrical Machinery.—At a sale just conducted at the Anzac Factory, Glasgow, by the Disposal Board of the Ministry of Munitions, £91 was paid for a one-ton electric overhead runway hoist, which cost, when new, £41. A one-ton suspension electric hoist, which cost £57, was sold for £61. For a 10-H.P. shunt-wound D.C. electric motor, 240 volts, 790 revs., £75 was paid, a profit of £24; and for a similar motor, with double the power, which cost £73 10s., the sum of £122 was paid.

German Porcelain Syndicate.—It is reported that about 40 German firms concerned in the ceramic industry have combined, under the title of the Syndicate of German Electrotechnical Porcelain Works, for the mutual protection of their economic interests. All the firms concerned produce mainly insulators and porcelain insulating material for the electrical industry.

Plant for Disposal. Felixstowe and Walton U.D.C. invites offers for two OE size horizontal Stockport gas engines and two 20-KW. generators. For further particulars see our advertisement columns in this issue.

Coal Commission.—At a recent meeting of the Spelter Manufacturers' Association (Swansea), the following resolution was unanimously adopted:—

> That this meeting of spelter manufacturers views with apprehension the suggestions for nationalisation of coal mines, fearing that such action will tend to increase the price of manufacturing coal and seriously affect all smelting industries, and they trust that the Report of the Coal Commission will not be accepted or acted on until sufficient steps have been taken to ascertain the effect of nationalisation of coal on industrial concerns.

The following resolution was adopted by the London Iron and Steel Exchange on June 17th, business being suspended for the purpose of considering the question:—

> That this meeting of the members of the London Iron and Steel Exchange views with apprehension the suggestion for the nationalisation of coal mines, considering that such action will tend to increase the price of coal, and thereby seriously affect manufacturing costs throughout the country.

Dust Bellows.—Bellows suitable for blowing dust out of motors, dynamos, and inaccessible parts of other electrical apparatus have been very difficult to obtain during the war. We are informed that the "Z" Electric Lamp Manufacturing Co., Southfields, London, S.W. 18, is now in a position to supply this class of article. The bellows are made entirely of wood, the risk of shorts occurring being thereby eliminated.

This Year's Machinery Exhibition at Olympia.—The Shipping, Engineering and Machinery Exhibition which was to have been held in the autumn of 1914, but was postponed because of the war, will be opened at Olympia, on September 25th, by Lord Weir of Eastwood. Mr. F. W. Bridges is secretary and organising manager of the Exhibition, which is to remain open for three weeks. An official bulletin and prospectus that has been issued, includes a list of the exhibitors. Quite a number of electrical and allied manufacturers appear therein. We understand that all space on the ground floor has been taken, and the gallery spaces are nearly all occupied. The Exhibition offices are at 124, Holborn, W.C.

Exports to Sweden: Restrictions Withdrawn.—The Board of Trade are officially informed that the Swedish Government have given a general guarantee which has been accepted by the Associated Governments, that goods imported into that country will not be re-exported to enemy destinations. They announce, therefore, that except for goods on Lists A or B, all restrictions on export to Sweden whether by freight or by parcel post have now been removed. It is no longer necessary to consign any goods to importing associations or to official consignees in that country. Applications for licences to export goods on Lists A or B should continue to be made to the Export Licence Department (now situate at 1, Queen Anne's Gate Buildings, Westminster, S.W. 1.).

Exports to Denmark: Restrictions Withdrawn.—The Board of Trade are in receipt of information from the Foreign Office that the Danish Government having now given a general guarantee, which has been accepted by the Associated Governments, that goods imported into that country will not be re-exported to enemy countries. The Board of Trade announce that, except for goods on Lists A or B, all restrictions on export to Denmark, whether by freight or by parcel post, have now been removed. Exporters should, however, satisfy themselves that the goods are not subject to any Danish import prohibition. Applications for licences to export goods on Lists A or B should continue to be made to the Export Licence Department, 4, Central Buildings, Westminster, S.W. 1, but no certificates from the Danish Associations need be produced.

Annual Outing.—The employés of the St. Pancras Borough Council Electricity and Public Lighting Departments held their 25th (Victory) annual outing and dinner on Saturday, June 14th, when Southend was visited. Over 100 sat down to dinner at Garon's Maisonette Café, in the High Street, Southend. The Mayor of St. Pancras (Mr. G. F. Parsons) presided, and he was supported by the following:—Alderman Chas Williams, Councillors T. A. Collins, H. H. Mayes D. Edwards, H. Flight, Mr. C. H. F. Barrett (town clerk), Mr. S. W. Baynes (chief electrical engineer), Mr. A. E. Pycraft (chief clerk), Messrs. W. A. Brown, Albert Blanks, and H. E. Ellis. A most enjoyable day was spent. The arrangements were in the hands of Messrs. W. Layton and W. G. Sutton.

Motor Lorries for Sale.—1,500 unused motor lorries (3 to 4 tons) are being placed on the market as surplus war stock, and they will be sold by private treaty by direction of the Disposal Board of the Ministry of Munitions. The Controller of the Mechanical Transport Department, 1, Grosvenor Place, S.W., will give particulars.

French Import Restrictions Withdrawn.—The *Board of Trade Journal* for June 19th contains preliminary particulars of the French Presidential Decrees published in the *Journal Officiel*, providing for the abolition of import restrictions on a large number of goods imported into France or Algeria, and the increase, by means of *ad valorem* surtaxes, of the rates of Customs duty upon goods imported into those countries. Copies of the decrees in question are on view at the offices of the Department of Overseas Trade, 73, Basinghall Street, E.C. 2, and the full translation will be published in the *Journal* for June 26th.

Sale of Connolly's. At the Thatched House Hotel, Manchester, on Tuesday last week, Messrs. Edward Rushton, Son and Kenyon offered for sale by public auction in one lot, as a going concern, the freehold land and premises known as the Blackley Vale Mill Blackley, near Manchester, together with the machinery and plant for the manufacture of insulated wire and cable, and the motive power plant, utensils, and fixtures therein, together with the goodwill of the business, and the benefit and obligation of pending orders and contracts. The price realised was £35,000. The stock-in-trade and new stores are to be taken over by the purchaser at a valuation to be made by the auctioneers on behalf of both parties.

Patent Restoration.—Application for restoration of Patent No. 28,953 of 1912, granted to P. Marino for "Salicylate electrolytes for use in the electrolytic deposition of metals or metallic alloys," has been made by British Electro-Chemists, Ltd.

The Industrial League.—The June issue of the *Industrial League Journal* contains articles ranging from "International Labour Conditions," by Mr. G. J. Wardle, C.H., M.P. (Parliamentary Secretary, Ministry of Labour); to one on "Workers and Costing," by Lieut. C. Lathan; also a verbatim report of a "Workmen and Shop Stewards' Meeting" addressed by the Right Hon. J. R. Clynes, M.P., and the Right Hon. G. H. Roberts, M.P. An announcement appears of the association of the Industrial League with the Civic Federation of America, an organisation that has very similar objects.

Belgian Agencies Wanted.—The *Board of Trade Journal* states (Reference No. 1,173) that a consulting electrical engineer in Brussels desires to obtain agencies from British manufacturers of electrical material and accessories for central generating stations.

The French Mines: Restoration Schemes.—The *Kölnische Zeitung* in referring to the statement made by Foch to the German Armistice Commission to the effect that the French mines had been flooded and destroyed by Germany according to a definite plan, which must be handed to the Allies in order to facilitate an examination of the shafts, says that the German Government has replied that no such plan exists. The mines were flooded or blown up from time to time as military necessity arose, and the only directions available are some odd notes comprehensible only to an expert familiar with the localties. The Government has offered to send such an expert to meet the French mining authorities and explain the notes. This offer has been accepted.

Trade Risks with Russia: Government Insurance Scheme.—Arrangements have now been made whereby the Board of Trade War Risks Insurance Office, 53, Cornhill, E.C., will be able to give facilities for the insurance of the inland risks upon

(*a*) British goods imported into Russia, and
(*b*) Goods bought by British firms for export from Russia.

The insurance will cover the goods against loss or damage arising from war risks, riots, civil commotions and other risks usually included in an ordinary Lloyd's policy. Full particulars and rates of premium—which will vary according to the localities concerned—can be obtained on personal application to the War Risks Insurance Office, which should be supplied with precise details of the nature and destination, or, in the case of exports, place of purchase of the goods to be insured. Policies will, in the first place, only be issued for the area in South-Eastern Russia and the Northern Caucasus, including the ports of Taganrog, Rostov-on-Don, Novorossisk and Tuapse. Facilities for marine insurance will also be given in cases where this cannot be obtained through the ordinary channels.

It is hoped that one of the more important effects of this provision of insurance facilities will be to enable banks to give advances in the ordinary way of business to traders (1) in respect of shipments from the United Kingdom to Russia, and (2) in respect of goods lying in Russia available for export.

Some of the leading banks are giving special consideration to the question of Russian trade development, and among others the British Trade Corporation, Lloyds Bank, the London County and Westminster and Parr's Bank and the National Provincial and Union Bank of England have intimated that they are prepared to consider applications for advances against goods sent to Russia and insured as above. The banks are also considering the opening up of business in different parts of Russia, and it is hoped that this may lead to methods being found by which the exchange of British and Russian goods will be facilitated.

Whitley Councils for Government Establishments.—There is published as a supplement to the *Labour Gazette* for June a full copy of the Draft Constitutions of the following Whitley Councils and Committees for Government Industrial Establishments :—(1) Departmental Joint Council ; (2) Trade Joint Council ; (3) Shop, Department, Works or Yard, and Trade Committees.

Female Labour.—Another stage in Burnley engineering dispute regarding employment of female labour has been reached Under protest Messrs. Simpson Bros., of Hapton, who are not members of the Employers' Federation, have given the women workers notice to cease electrical work. Should investigations prove satisfactory, the women will be reinstated

The Electrical Wholesalers' Federation, Ltd.—At the last meeting of the Main Committee of this Federation, Mr. W. Donovan, of Messrs. Donovan & Co., Birmingham, was elected chairman of Committee for the ensuing year, and Mr. H. H. Berry, of Messrs. Berry's Electrics, Ltd., vice-chairman. Mr. A. G. Beaver, of the Sun Electrical Co., Ltd., was re-elected honorary secretary. A cordial vote of thanks was accorded the outgoing chairman, Mr. R. W. Smith, for his able services during the past three years.

Copper Mines Shut Down.—The *Times* stated last week that the Mount Morgan Mines, near Brisbane, had closed down, rendering 1,500 workers idle.

The Industrial Tour of Brazilian Delegates.—On Monday last the Brazilian Commercial Delegates who are on a visit to this country, began, in company with a representative delegation from the Federation of British Industries, the business side of their programme. On that day the refrigerating machinery works of Messrs. J. & E. Hall were visited ; Tuesday and Wednesday were devoted to visits to explosives works and docks in London ; yesterday they went to the electric lamp works of the General Electric Co., Ltd. To-day there is a Federation lunch at the Savoy, and to-night a Government dinner at the Carlton Hotel. To morrow there is to be a trip by road to Windsor, followed by the journey on Sunday to Birmingham, which will be their centre for five days, during which the Wolseley Motor Works, and Millward's needle works at Redditch, Willans & Robinson works at Rugby, Kynoch's, and Alldays & Onions's works at Birmingham, will be visited. On Friday, July 4th, the party will proceed to Glasgow, where they will see David Colville's, Beardmore's and Nobel's works. On July 12th they will proceed to Edinburgh and see the North British rubber factories. On Tuesday, July 15th, they will be at Armstrong, Whitworth's at Newcastle ; on the following day at the Parsons marine turbine and North-Eastern Marine Engineering works. Darlington receives them next at various works. The delegates will reach Liverpool in time to visit the British Insulated and Helsby Cables works on July 21st. While at Manchester they will see the Armstrong, Whitworth, British Westinghouse, Crossley Motor, and other works, also the Manchester Ship Canal. On July 28th one section of the party will proceed to Sheffield, and the other to Bradford. Hadfield's, Firth's, and many other factories, are in the programme. Leicester next receives attention, and thereafter movements are dependent upon the Government decisions in regard to Peace celebrations. After these celebrations the tour will be resumed on August 10th, and Bristol and Swansea will exhaust the intentions, if not the energies, of the party. The official programme is, as in the case of a previous tour carried through by the F.B.I., prepared in excellent style, and we have no doubt that the efforts of the Federation will bring in due course ample repayment in the shape of Brazilian business as the result of the very effective demonstration that will be given of British industrial capacity.

Condensing Plant.—Recent orders for Mirrlees condensing equipments, received by the Mirrlees, Watson Co., Ltd., of Glasgow, include seven multiple jet condensing plants with combined rotary and water extracting pumps (Mirrlees, Leblanc system). One of these is for the Steel Co. of Scotland, Hallside Works, to work with Parsons steam turbines, the steam duty being 15,000 lb. of steam per hour. Another is for the Huddersfield Corporation, St. Andrew's Road power station, the steam duty being 72,000 lb. of steam per hour. The Mirrlees multijector air pump is being adopted by large and important power stations. A Mirrlees surface condensing plant for a steam duty of 161,500 lb. of steam per hour has been ordered for the Glasgow Corporation, Dalmarnock power station, and this plant includes eight multijector air pumps (Mirrlees, Leblanc system). The multijectors are arranged in two banks, each bank of four being connected in parallel, so that one or more ejectors in either bank may be operated to deal with the air leakage, thus providing flexible and most economical arrangement.

Scientific Business Management.—This is the title of No. 28 of the series of useful grey pamphlets (2d.), issued by the Ministry of Reconstruction.

Liquidations.—Connolly Bros., Ltd., Blackley Vale.—A petition for the winding up of this company has been presented by Messrs. T. Bolton & Sons, Ltd., and will be heard on July 1st.

Westinghouse Metal-Filament Lamp Co., Ltd.—Winding up voluntarily. Liquidator, Captain M. L. Crandon Gill. Meeting of creditors June 30th, at 2, Norfolk Street, Strand, W.C.

"The Woodville Garage," automobile, electrical and general engineers, Catherine Street, Cardiff.—Mr. E. F. Tompkins and W. Latta have dissolved partnership. Mr. W. Latta will attend to debts.

Catalogues and Lists.—Mr. F. J. Hastings, 57, Albert Road, Aston, Birmingham.—Leaflet giving prices (June) of electric lamps, motors and supplies for theatres and kinemas.

The Electrical Alloy Co., Morristown, New Jersey, U.S.A.—Illustrated circular respecting their nickel and nickel alloy wire and strips.

Plant for Sale.—The Disposal Board of the Ministry of Munitions invites tenders for the purchase of machine tools, plant office and canteen furniture at the "Edith Cavell" projective factory, Glasgow. See our advertisement pages this week.

Book Notices.—"Year Book of Wireless Telegraphy and Telephony" for 1919. Pp. cxvii + 1,160 and map. London : Wireless Press. Price 7s. 6d.

"*Journal* of the Institution of Electrical Engineers." Vol. LVII, No. 282. May, 1919. This issue contains the following papers :—"The Navigational Magnetic Compass," by Mr. M. B. Field ; "Electric Power Supply During the Great War" (Part I), by Mr. A. H. Gridley and Mr. A. H. Human ; and "The Susceptibility of Feebly Magnetic Materials," by Prof. E. Wilson.

"Science Abstracts" (A and B). Vol. XXII, Part 5. No. 257. May 31st, 1919. London : E. & F. N. Spon, Ltd. Price 1s. 6d. each post free.

We have received a copy of *Industry in Parliament* (No. 3), a monthly journal recording the operations of the British Commonwealth Union. A considerable number of additional firms have been elected as members.

Trade Announcements.—Owing to rapid growth of business, the Electrical Accessories Manufacturing Co. have taken larger premises, and their address as from July 14th will be Progress Works, Crossland Street, Holbeck, Leeds.

Mr. C. Orgel, wholesale electrical dealer, has taken larger premises at 111, Great Eastern Street, London, E.C. 2.

Messrs. F. & A. Parkinson, Ltd., of Guiseley, Leeds, announce that their London office has now been changed from Victoria Street to 34, Broadway, Westminster, London, S.W. 1. Telegraphic address and telephone number unchanged : "Octopede, Vic., London" ; "Victoria 3373."

Messrs. Clough, Smith & Co., Ltd., have removed to 36, Victoria Street, London, S.W. 1, where all communications should be sent. Telephone No. : "Victoria 7937" ; telegrams : "Clufmit," Vic., London."

Mr. H. Sloog announces the removal of his offices, as from June 24th, to 45, Great Marlborough Street, London, W 1. Telephone No : "Regent 2460."

Mr. R. S. Goodburn, electrical engineer, has reopened his works at Clarendon Road, Broadstairs.

With reference to their recent change of address to temporary offices at 69, Victoria Street, pending release of premises then in Government occupation, Messrs. Pooley & Austin state that the latter premises have been released earlier than anticipated, and on 24th inst. they moved into their new permanent address at 34, Broadway, Westminster, S.W. 1. Telephone and telegraphic address unaltered.

Messrs. I. Frankenburg & Sons, Ltd., of Salford, have changed the address of their London office from 25, Victoria Street, to 34, Broadway, Westminster, S.W. 1. Telegraphic address and telephone number unchanged.

Titan Electrical Co.—The company is moving into larger premises and establishing a showroom at 20, High Holborn, W.C. 1, where electrical fittings will be displayed. Telephone, Holborn 4687.

The British Electrical and Manufacturing Co., of Newcastle-on-Tyne, have opened an office at 102, Union Street, Glasgow, under the charge of Mr. W. A. B. Ames. They have also re-opened their branch at Athenæum Street, Sunderland, with a comprehensive stock, under the charge of Mr. J. A. Woods.

The Aerial Derby.—In the "Aerial Derby" held at Hendon on Saturday last—"the fastest Aerial Derby on record"—the engines on the machines winning the first and second prizes were equipped with B.T.H. magnetos, the winners being Capt. Gathergood, flying an Airco machine with Napier engine, and Lt. Robert Nisbet, flying a Martynside biplane with Rolls-Royce "Falcon" engine.

Non-Ferrous Metal Industry Act.—The *London Gazette* for June 24th contains a list of further additions to the licences granted under this Act.

LIGHTING AND POWER NOTES.

Ayrshire.—E.L. Scheme.—Kilwinning T.C. is to ascertain from the Kilmarnock Corporation the terms and conditions for lighting the streets and houses in the town. It is understood that energy is being delivered to Largs, while the village of Dundonald is also supplied. The County Council has granted an application for a branch cable from Ardrossan to Dalry.

Bolton.—Fire.—Considerable inconvenience and damage was occasioned by a fire, last week, at the Corporation electricity works. An old water-cooler adjoining the works was being dismantled when the outbreak occurred ; the cause is unknown. Flying embers set fire to the roof of the works. Damage was confined to the engine-house, but the converters had to be stopped. Cars continued running on three routes, current being obtained from Bury and the South Lancashire system, but the full service was not available for the rest of the day, though there was a sufficient supply for lighting in the evening. For two hours, pending the connecting up with the other stations, Bolton was without its accustomed supply of electricity.

Brighton.—Year's Working.—The accounts of the Corporation electricity undertaking for the year ended March 31st last, show total revenue, £144,439, against £119,003; expenditure £100,358, against £76,025; gross profit, £44,080, against £42,977 After deducting sinking fund interest and other charges, the net profit was £3,112, which has been carried forward. During the year the total units sold amounted to 10,144,392, against 10,242,007; the average price of coal per unit sold was 1·11d., against 0·99d. Total works cost per unit sold 1·67d., against 1·40d. 28,442 tons of coal were consumed during the year, the average price paid being 38s. 5½d. per ton, and the consumption per unit sold 5·4 lb., equivalent to an increase of 1·55 per unit sold, 5,000 tons consumed, and an extra £30,000 expenditure over pre-war conditions. The department has now 4,588 h.p. of motors connected, and numerous applications have been received for radiators, cookers, heaters, and other accessories, the original No. 3 1,800-kw. turbo-alternator has been scrapped, and a new 4,000-kw turbo-alternator is due for delivery in the autumn. The total average price obtained per unit was 2·96d., against 2·63d.

Colne.—Year's Working.—The report on the electricity department for the year ended March 31st last, shows that practically no expenditure on capital account was incurred during the year. Capital expenditure was £55,873, and that repaid to date £30,584. The income, £13,242, was the highest reached by the department, being a net increase over the previous year of £707. Cost of generation and distribution was £9,461, against £8,322; gross profit, £3,781, against £4,213; interest and income tax, £1,897; and principal repaid, £2,460. After providing for interest and repayment of principal, there was a loss of £576, against a profit of £5 last year. 1,446,606 B. of T. units were generated, and 1,209,903 were sold during the year. The increase in units supplied for lighting and power was 114,165; traction, 10,660; public lighting, 5,375; or a total increase in units sold of 130,200. The plant capacity was 1,030 kw., and the maximum load, 586 kw., with a load-factor of 23·4 per cent.

Crowle.—E.L. Scheme.—The U.D.C. has declined to adopt an E.L. scheme submitted by Mr. Wroot, who suggested the purchase from the Admiralty of two generating engines which had been used for searchlights. The estimated cost of the scheme is £5,000.

Doncaster.—Proposed New Plant.—It is proposed to put down £40,000 worth of new plant at the electricity works, and application for borrowing powers to this extent is to be made. It is proposed to add a 1,500-kw. turbo-alternator and an additional large water-tube boiler, bringing the capacity of the works up to 4,300 kw.

Dalry. — Overhead Transmission. — Permission has been granted to the Kilmarnock T.C. to carry an overhead main for supplying electricity to Dalry from the existing cable at Ardrossan.

Denny.—Mains Extensions Cancelled.—On account of the cost (£720) the T.C. has decided not to extend the E.L. mains to Anchor Burn, Dunipace.

Dundee.—New Plant.—The Electricity Committee has agreed to the engineer obtaining machinery for the proposed extension of the electricity station, at a cost of £136,019. The engineer, with the view of saving time, has obtained prices from contractors who have done similar work for the Corporation. Two 5,000-kw. Willans turbo-alternators will cost £69,659, and four large B. & W. water-tube boilers, £66,360. The prices do not allow for increases in labour or material. They would be only losing time and gaining nothing by advertising for tenders.

Loan Sanction.—The Secretary for Scotland has sanctioned the borrowing of £250,000 for the purpose of capital works, raising the total sum authorised to be borrowed to £759,000, on condition that the department set aside annually a sinking fund of not less than 4 per cent. on the amount borrowed.

Durham.—Price Increase.—The County of Durham E.P. Distribution Co., Ltd., is to further increase the price of electricity, as from the expiration of the June quarter, by 30 per cent. for lighting and 10 per cent. for heating.

Eccles.—Bulk Supply.—The Corporation is taking a bulk supply of electricity from the Lancashire E.P. Co.

Edinburgh.—Price Increase.—The price of stair lighting is to be raised from 19s. 3d. to an average of 22s. 6d. per lamp.

Ewell.—E.L. Scheme.—The P.C. has asked the South Metropolitan Electricity Co. when it is likely to have electricity supplied to the parish, and has requested the R.D.C. to press the matter forward.

Grimsby.—Year's Working.—The electricity undertaking shows a deficiency of £2,642 on the past year's working.

Heywood. — Loan Sanction. — The Corporation has received the sanction of the L.G.B. to borrow £4,938 and £5,350 for the purposes of the electricity undertaking.

Kirkby-in-Ashfield.—Waterworks Electrification.—The Butterley Co. is about to electrify its waterworks, and will install conductors of sufficient capacity to supply energy to the waterworks of the U.D.C.

Llandyssal (Cardiganshire).—Hydro-Electric Scheme.—Steps are being taken to provide a supply of electricity for the town. It is proposed to utilise water power.

London.—Poplar.—The report on the electricity undertaking for the year ended March 31st shows that units sold increased from 20,505,624 to 21,526,200; net income increased by £25,985 and working expenditure by £20,133; gross profits increased by £5,851. The net profit totalled £8,984, and, after providing for first charges on net profits, a sum of £6,215 is available for distribution under the Council's bonus scheme: of this £2,486 is transferred to general account. Bonus to staff, £1,221 (being 20 per cent. up to £6,000 and 10 per cent. over), and the balance (£2,508) is to go to reduction of assets.

Lytham.—Proposed Loan.—The D.C. is to apply to the L.G.B. for sanction to borrow £35,500 for electric lighting purposes.

Manchester.—Sub-Station Wrecked.—As the result of the collapse of a mill chimney which was being demolished at Ancoats last week, an electric sub-station was wrecked. It supplied a number of firms in the district, and, as a result, these premises were temporarily closed for a few days.

Motherwell.—Bulk Supply.—The T.C. has accepted terms for a supply of electricity from the Clyde Valley E.P. Co.

Penicuik.—Works Electrification.—Messrs. Tait and Co. are introducing electrical power into their works, and the plans for the necessary alterations have been adopted by the T.C.

Portrush.—New Generating Station.—The U.D.C. has agreed to purchase for £1,800 property at Portseadden Bay, at a yearly rental of £10, as a site for an electrical generating station.

Rathmines.—Price Revision.—The U.D.C. has fixed the minimum charge for a supply of electrical energy at 10s. 6d. per quarter for each consumer, this charge to come into operation from September 1st next.

Reigate.—Price Revision.—The T.C. has applied to the B. of T. for consent to increase the price of energy by 1d. beyond the statutory maximum charge of 8d., as from July 1st next.

Rochdale.—Loan Sanction.—The L.G.B. has sanctioned the borrowing of £3,500 overspent on cables, and for various small amounts for new work.

The Corporation Electricity Committee has approved the acceptance of tenders for the supply of cables, switchgear, &c., for the extensions to the D.R. Cotton Mills, amounting in all to about £40,000.

Selkirk.—Street Lighting.—The T.C. has deferred the introduction of street lamp controllers until the comparative cost of gas and electric lighting has been ascertained.

Shanklin (I. of W.).—Public Lighting.—The E.L. Co. has informed the U.D.C. that if the whole of the lighting is undertaken the cost per lamp will be about £2 2s. per annum.

Southmolton.—Expert Advice.—Mr. Stuart, of Ilfracombe, is to advise on the proposed E.L. scheme for the borough.

Southport.—Loan Sanction.—The L.G.B. has sanctioned the application of the Corporation for permission to borrow £130,000 for the new electrical plant and mains extensions. The department has 200 applications for energy, which it cannot grant as the present plant is overloaded. It is estimated that the new plant will effect a saving in fuel of £7,000 a year (£8,400 if the price of coal advances by 4s. 6d. per ton) and it is proposed to carry out the work at once, so as to be ready for next winter.

Sunderland.—Price Increase.—Charges for electricity supply are to be increased as follows:—In place of the present power rate, there is substituted a rental of £4 per k.v.a., plus ·4d. per unit, plus an increment of ·0054d. for each 3d. rise in the cost of coal above the standard price of 8s. 6d. per ton. The present increases in the rates for lighting, domestic use, cooking, and heating are to be advanced to 33⅓ per cent. The effect of the new charges is to bring the increase over pre-war rates up to 53 per cent. in the case of power and 56 per cent. in the case of general supplies. The average price received for supplies works out at 1·09d. per unit.

Tenterden.—Bulk Supply.—The T.C. has decided to support the scheme of the Hastings T.C. to supply electricity in bulk to the borough.

Thornton.—Time Extension.—Application is to be made for the electric lighting order to be extended for a further 12 months. Negotiations are in progress for the amalgamation of the district with the neighbouring county borough of Blackpool.

Tonbridge.—Loan Application.—The T.C. has applied for a loan of £2,500 for mains extensions.

Torquay.—Price Increase.—The T.C. has decided to increase the price of electricity for lighting by ½d. per unit, and heating and power by ¼d. per unit, from the Midsummer meter readings. Meter rentals have been fixed as under:—Up to 10 and including 25-ampere capacity, 1s. 9d. per quarter; meters of larger capacity, 2s. 9d.

Tuam.—E.L. SCHEME.—The gas company has notified the Town Board that it intends applying for a prov. order for power to supply electricity for all purposes in Tuam and district. The Tuam Electric Light and Power Co., recently formed, is also applying for a prov. order for the same purpose, and the former application is to be opposed.

Tunbridge Wells.—RESTRICTED SUPPLY.—Until new machinery has been installed, no further application for connections for lighting or heating can be entertained, except at the discretion of the Committee.

Watford.—LOAN SANCTION.—The U.D.C. has received sanction to loans amounting to £20,540 for electricity purposes.

Warminster.—E.L. SCHEME.—The U.D.C. has been informed that there is no probability of the town being lit by electricity next October as had been hoped, with a supply from a military power station.

Weymouth.—PRICE REVISION.—The price of electricity has been increased as under from July 1st.—Lighting, from 7d. to 8d. per unit, with discount; power, 2½d. net, instead of 3d. for the first 20 units per quarter, and 2d. beyond; fixed price lighting advanced by 10 per cent.

LOAN APPLICATION.—A loan of £2.500 for services has been applied for.

Wolverhampton.—MAINS EXTENSIONS.—The electric mains are to be extended in various districts of the borough and in Buckbury, at an estimated cost of £6,379.

TRAMWAY AND RAILWAY NOTES.

Accrington.—TRACK SUBSIDENCE.—Part of the tramway track in Blackburn Road has been sinking, on account of an old sewer, and the cars incline so much that they are in danger of touching when passing each other. Extensive repairs are now proceeding.

Ardsley.—LINKING-UP.—The U.D.C. has decided to support a scheme for linking-up the Leeds and Dewsbury tramways along the main road passing through the Council's area.

Argentina.—STRIKE.—The tramway services at Buenos Aires have been resumed, and the situation has become more normal.

Birmingham.—ELECTRIC VEHICLES.—The city's order for electric dust-collecting vans was given to Messrs. Edison Accumulators, Ltd.

Brazil.—RAILWAY ELECTRIFICATION.—According to the *Engineer*, proposals are said to be before the Brazilian Government for the electrification of the Estrada de Ferro Central do Brazil—the Central of Brazil—between Rio de Janeiro and Barra do Pirahy, and between Santa Cruz and Piracamby, by a group of English and Italian financiers.

Burnley.—PROPOSED OMNIBUS SERVICE.—The Corporation proposes to ask for power to run a motor-'bus service between its tramway terminus and Rawtenstall tramway terminus at Loveclough.

Chile.—RAILWAY ELECTRIFICATION.—Of the loan recently authorised for carrying out railway improvements $25,000,000 has been assigned for the electrification of the first railway zone, comprising Valparaiso, Los Andes, Santiago.

Continental.—SWITZERLAND.—The introduction of a Bill providing for Federal, Cantonal, and Communal subventions for the electrification of private railways has been approved by the Swiss State Council.

Doncaster.—LOAN APPLICATION.—The T.C. has applied for a loan of £5.500 for a new tramcar shed and for the inside track and pits.

Edinburgh.—There is a doubt as to whether the Corporation undertaking will be able to furnish electricity for the working of the first section of the electrified Corporation tramways by the winter of 1920. Every effort is being made to push on the work of the new power station at Portobello.

Glasgow.—YEAR'S WORKING.—The total revenue of the Corporation tramways for the past year was £1,531,320, an increase of £118,685. Expenditure showed correspondingly larger increase, and the balance carried to net revenue account was £281,331, against £368,452 for the previous year. The total surplus to be handed to the City Common-Good Fund is £14.772, against £177,552.

India.—YEAR'S WORKING.—The net revenue of the Calcutta Tramways Co. for the year 1918 was £151,100. The reserve for depreciation received £25,000, making the total £120,500, and £2,000 was set aside as a reserve for investment depreciation, increasing that account to £4,000. The amount carried forward was increased from £8,400 to £28,600.

London.—L.C.C.—The financial burdens of the L.C.C. tramways were further explained to the Select Committee on London Traffic last week by Sir H. Haward, Comptroller of the Council, who said that the estimated deficiency for the year ending March next, was £158,913. The only way to have kept up the renewals fund would have been to raise the fares in 1912-13, which would have been a very dubious step to take at that time, when there was severe omnibus competition. The likelihood of fares having to be further increased, depended on competition and on expenses. The latter were estimated to rise much further, and he saw no prospect of fares being reduced. Mr. A. L. C. Fell, general manager L.C.C. tramways, said the tramways should be permitted a higher speed, and traffic should be regulated as in New York, by automatic signalling posts at crossings. Mr. Fell denied that the bulk of the passengers were paying double fares, and said there was no intention of having trick sections; over 50 per cent. of the traffic consisted of penny passengers. Omnibus companies ought to be compelled to run workmen's services. The price of new cars was now three times the pre-war cost. Probably in the future a smaller car would be introduced, either with a trailer or a coupled car. Uniformity between cars and trains was difficult on account of the difference in speeds. The Council would be satisfied with a profit of 4d. per car-mile, and he was in favour of the financial burden of the roads being equalised between transport undertakings. He would do away with tramway deadends, and develop the linking up of lines, and he suggested that omnibuses should not operate where the traffic justified the running of tramways. The most congested terminus was Blackfriars, but the pressure there was now somewhat relaxed because the new fares were equalised both ways *via* Blackfriars or Westminster. Victoria was a difficult place to deal with, and until a loop line was obtained the present system was the best. If the Victoria terminus was linked up with Harrow Road, *via* Hyde Park and Edgware Road, it would be a great advantage. Victoria Street was wide enough for a double track, and Birdcage Walk would be an alternative, but less useful route. During the war the Council sold 59 cars of obsolete type to other authorities at the request of the Ministry of Munitions, but the Council had no power to run those cars

IMPROVED TUBE SERVICE.—The Metropolitan Railway Co. is making various improvements throughout its system, giving a more frequent and rapid service. Later trains are also to be run.

From Saturday last 12 stations on the underground railways which have been temporarily closed on Sundays will remain open all day. Also 27 stations, which have been temporarily closed earlier at night, will remain open until the time of the last advertised trains.

L.U.T. TRACK REPAIRS.—The relaying of the whole of the L.U.T. tramway track in the Chiswick High Road has commenced. Traffic is being maintained over one line.

TELEGRAPH AND TELEPHONE NOTES.

Automatic Telephones.—A regrettable error crept into our note under this heading last week. The new Huddersfield telephone exchange is of the central-battery manual type—not automatic—the full equipment for which was supplied and erected by the Peel-Conner Telephone Co., Ltd.

Cable Delays.—Further representations are, we understand, to be made immediately by merchants to the authorities on the subject of the serious cable delays. Since much business is normally conducted on a c.i.f. basis, business under present conditions of delay is often quite impracticable. The continued refusal of the authorities to permit the use of private codes is undoubtedly responsible for much of the delay.—*The Times.*

It is officially announced that, owing to an interruption of the cable between the Azores and St. Vincent, on May 22nd, the West African full-rate traffic was delayed from one to three days, and that, in the case of deferred telegrams at half rates, the delay was as long as eight or nine days. On June 10th the cable was restored.

From New Zealand comes the news that a deputation of the Associated Chambers of Commerce waited on the P.M.G. and protested against the delays on commercial cables. The Minister held out no hope of an immediate improvement.

Constantinople Telephone System.—The financial Press states that the general manager of the Constantinople Telephone Co., now on a visit to London, reports that the plant was taken over finally from the Turkish authorities as from April 1st last, and the service is now being conducted by the company.

New Marconi Invention.—At the general meeting of the Marconi International Marine Communication Co., held last week, Mr. G. C. Isaacs stated that the number of stations installed and worked by the company at the end of the year was 2,549, and now stood at 2,638. They had every reason to hope that telegraph stations on board ships would be more freely used in the future than they were in the past. They thought it probable, too, that an additional source of revenue to the company would arise from the more general use on board ships of direction-finding apparatus. To an even greater extent it was thought that the latest invention of Senator Marconi would be adopted on board ships. This new discovery provided means whereby a ship in the densest fog might discern the approach of another ship, provided that that ship be also fitted with the apparatus, and, at the same time, giving an approximate idea of the distance of the approaching ship. At present commercial shape was being given to this new apparatus, and its value on board ship would be shortly demonstrated.

P.O. War Work.—According to Mr. Pike Pease, the telegraph business at the front was magnificently organised, and at headquarters alone over 7,000 telegrams have been dealt with in one day. The P.O. supplied 40,000 miles of cable for use in the trenches, and 200,000 miles of overhead wire, the insulators used numbering five millions.

Secret Wireless Stations.—During the examination of spies arrested by the Finns, it was found that the "Reds" had a wireless station at Helsingfors, which it is hoped will shortly be discovered. Further, it is probable, says the *Times*, that a similar station exists in England.

United States.—The House of Representatives has adopted the Bill passed by the Senate providing for the return of the telegraphs and telephones to private control.

CONTRACTS OPEN AND CLOSED.

(*The date given in parentheses at the end of the paragraph indicates the issue of the* ELECTRICAL REVIEW *in which the "Official Notice" appeared.*)

OPEN.

Australia.—SYDNEY.—August 27th. N.S.W. Railways and Tramways Department. Three-phase induction motors. Chief Electrical Engineer, 61, Hunter Street, Sydney.—*Tenders.*

Bedford.—July 14th. Electricity Committee. One 1,500-KW. 1-phase turbo-alternator and condensing plant, boilers, superheaters, mechanical stokers and induced draught plant, E.H.T. switchgear, water softener. feed-water heater and storage tanks, water-measuring apparatus, feed pumps. (June 20th.)

July 21st. Electricity Committee. Buildings, electric motors, &c., coal conveyor, runaway and chutes. (See this issue.)

Belfast.—June 30th. Harbour Commissioners. Three or five electric travelling gantry cranes. Mr. T. S. Gilbert, Harbour Engineer, Harbour Office, Belfast.

Birkenhead.—July 28th. B. of G. Installation of internal telephones. (June 6th.)

Colne.—July 4th. Electricity Department. Supply, drawing-in and jointing of approximately 2,200 yd. ·05 sq. in., 3,300-volt, 3-core cable. (June 20th.)

Darlington.—July 11th. Electricity Department. Rotary converter, cooling tower, water-tube boiler, economiser, and induced draught fan. (June 20th.)

Gravesend.—July 12th. Electricity Department. One 2,000-KW. turbine with 6,000/6,600-volt 3-phase alternator. condenser with motor-driven air and circulating pumps. (June 20th.)

Kirkcaldy.—June 30th. T.C. One 7-B.H.P. electric motor and equipment for the organ at the Adam Smith Halls. Specification from the Burgh Electrical Engineer, Electricity Works.

Paris.—July 10th. Administration des Postes et Télégraphes. Supply of multiple commutator switchboards. Particulars from Direction de l'Exploitation Téléphonique, 4, Bureau, 103, Rue de Grenelle, Paris.

Portsmouth.—July 3rd. Electricity Department. Water-tube boiler, steam capacity 20,000 lb. per hour (June 20th.)

Salford.—June 30th. B. of G. Repairs to telephone apparatus at Eccles New Road Institution. Mr. E. H. Inchley, Clerk, Poor Law Offices, Eccles New Road.

July 7th. Electricity Department. Steel cinder bunker at the power station, Frederick Road, Pendleton. Borough Electrical Engineer.

Tasmania.—LAUNCESTON.—July 28th. City Council. Sub-station equipment, battery, reversible booster, switchgear, &c. City Electrical Engineer.

West Ham.—July 1st. T.C. 20 single-truck electric tramcar bodies, with roof covers. Mr. L. Slattery. General Manager. Greengate Street. Plaistow, E. 13.

CLOSED.

Australia.—P.M.G.'s Department, Queensland :—

1,000 telephones, magneto wall pattern, £4,650.—J. Paton & Co.—*Tenders.*

Burnley.—Health Committee. Edison electric 3½-ton vehicle, with tipping body, &c., £1,814.

Coventry.—The City Council has been recommended to accept tenders amounting to £10,908, for five new tramcars.

Glasgow.—Tramways Committee. Recommended :—

Car motor equipment.—British Westinghouse E. & M. Co., Ltd.
Car motor controllers.—British Thomson-Houston Co., Ltd.
Armature coils.—Manchester Armature Repair Co.
Scrap brake blocks.—Miller & Co.

Special track work :—

Edgar Allan & Co. (delivery 10 weeks)	£5,653
Hadfields, Ltd. (3 to 4 months)	5,624
U.S. Steel Products Co., Ltd. (Loraine Steel Co.) (8 to 10 weeks; 6 to 9 weeks if order cabled) .. (recom.) ..	**5,184**

Government Contracts.—The following Government contracts were placed during May, 1919 :—

CROWN AGENTS FOR THE COLONIES.

Electric turret clock.—Gent & Co., Ltd.
W.P. insulators.—Bullers, Ltd.

WAR OFFICE.

Motor converters.—Bruce Peebles, Ltd.
Transformers.—Foster Engineering Co., Ltd.

INDIA OFFICE—STORE DEPARTMENT.

Wireless apparatus.—Marconi's Wireless Telegraph Co., Ltd.
Cable.—Macintosh Cable Co., Ltd.; Siemens Bros. & Co., Ltd.; General Electric Co., Ltd.
Cells.—J. C. Fuller & Son, Ltd.; D.P. Battery Co., Ltd
Copper wire.—F. Smith & Co., Ltd.
Crucibles.—Morgan Crucible Co., Ltd.
Train lighting materials.—J. Stone & Co.

POST OFFICE

Telegraph apparatus.—Automatic Telephone Manufacturing Co., Ltd.
Telephone apparatus.—British L.M. Ericsson Manufacturing Co., Ltd.; India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.; London Electric Wire Co. & Smiths, Ltd.; Park Royal Engineering Works, Ltd.
Battery boxes.—W. D. Tucker & Sons, Ltd.
Telegraph & telephone cable.—British Insulated & Helsby Cables, Ltd General Electric Co., Ltd.; Hackbridge Cable Co Ltd Union Cable Co., Ltd.
Insulators.—Taylor, Tunnicliffe & Co.
Sheet & strip lead.—Grey & Martin, Ltd
Troughing & cover.—Doulton & Co., Ltd.
Troughing.—A. Bruce & Co.; Burt, Boulton & Haywood.
Bronze insulated wire.—Siemens Bros. & Co., Ltd.
Soft strand copper wire.—T. Bolton & Sons.
G.I. strand wire.—Rylands Bros., Ltd.; Whitecross Co., Ltd
V.I.R. wire.—W. Geipel & Co.
Laying conduits.—Kingston-Portsmouth Road: Grounds & Newton; London-Stanmore corner (manholes): J. Mowlem & Co., Ltd.
Manufacturing, supplying, drawing-in and jointing cables.—Manchester-Rochdale, W. T. Glover & Co., Ltd.; Leeds-Wakefield, Johnson & Phillips, Ltd.
Extension of Telephone Exchange equipment at Derby.—Western Electric Co., Ltd.
Supplying and erection of pick-up carrier at Manchester Head Post Office.—Lamson Pneumatic Tube Co.
Overhaul & repair of recovered submarine cables.—India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.
Overhaul and repair of H.M. T.S. "Monarch."—R. & H Green & Lilley Weir

H.M. OFFICE OF WORKS.

Engineering works—Electric Wiring Kew Insurance Offices Lund Bros & Co

PUBLIC WORKS, IRELAND

Electrical works & supplies, Belfast district—A. Stevenson

Hull.—Corporation. Telephones Committee. New district automatic exchange. Tender of £19,800 accepted.

Preston.—The Corporation Cleansing Committee recommends the acceptance of a tender for two electric vehicles for that department, at a cost of £2,664.

Richmond-on-Tees.—T.C. :—

E.L. installation at the public baths.—Beard & Co., £57 10s.

Two electric dust vans :—

General Vehicle Co., Ltd. ..	(accepted) ..	**£1,295**	each
Ransomes, Sims & Jefferies, Ltd.		1,300	,,
Edison Accumulators, Ltd.		1,427	,,

Stirling.—T.C. :—

Condensing plant.—Edward, Dean & Beal, Ltd., £4,124.

Taunton.—T.C. :—

75-KW. transformer.—British Electric Transformer Co., £131.
Cable for a year.—Pirelli-General Electric Co.

FORTHCOMING EVENTS.

Institution of Electrical Engineers (Students' Section).—Saturday, June 28th. Visit to National Physical Laboratory, Teddington.

Monday, June 30th. At 6 p.m. At the Institution of Civil Engineers, Gt. George Street, S.W. Paper on "The Oscillatory Valve Relay: a Thermionic Device," by Capt. L. B. Turner.

Industrial Reconstruction Council.—Tuesday, July 1st. At 1 p.m. At the Institute of Journalists, Tudor Street, E.C. Conference on "Health Work for Whitley Councils," to be opened by Dr. E. Halford Ross.

British Scientific Products Exhibition, Central Hall, Westminster.—Thursday, July 3rd, to Friday, August 5th.

NOTES.

The "Electrical Review" Index.—As it is still necessary to effect every possible economy in paper consumption, the Index to Vol. LXXXIV of the ELECTRICAL REVIEW, which will shortly be printed, will be supplied only to those who, through the post, specially apply for it. To such it will be supplied for 3d. post free. Any reader or advertiser at Home or Abroad who requires a copy for binding or other purposes is asked to make early application therefor to the Publisher, ELECTRICAL REVIEW, 4, Ludgate Hill, E.C. 4.

Burnley Technical Institute.—Messrs. Siemens Bros. and Co., Ltd., and Messrs. Jones & Shipman, of Leicester, have made gifts of engineering and other apparatus to Burnley Technical Institute.

Peace Celebrations.—The Electrical Development Association has called a preliminary meeting for Tuesday, July 1st, to consider the provision of lamps for Peace illuminations; the provision of strip devices and other material; the rates to be charged by electricity supply undertakings; and the provision of additional or heavier service connections where required. If necessary, further meetings will be arranged.

The British Science Guild.—At the annual general meeting of the Guild on Tuesday last week, the report of the Executive Committee was submitted. Amongst the subjects dealt with were University and Higher Technical Education, the Optical Industry and the British Scientific Products Exhibition, which opens next Thursday. The Guild has drawn the attention of the Government to the urgent necessity of securing a strong optical industry in this country, and of protecting it against unfair competition. The accounts show receipts £883 and expenditure £533. A memorandum by the Education Committee, and a report by the Metric System Committee on the subject of decimal coinage, are appended to the report.

Irish Water Power.—The Board of Trade Committee on the Water Power Resources of Ireland will begin its sittings at Belfast on July 4th. On July 3rd the Committee will make a tour of the lower Bann, between Toome and Coleraine, and it will also visit Strangford Lough. Sir John Griffiths is the chairman of the Committee, and Prof. H. H. Jeffcoat, Royal College of Science, Dublin, is the secretary.

Battery Standardisation.—The Electrical Equipment Division of the Standards Committee of the American Society of Automobile Engineers has lately appointed a special sub-committee to study a standard form of rating for the accumulator batteries of farm electric lighting sets.

James Watt Centenary Commemoration.—A movement has been inaugurated in Glasgow to found a James Watt Chair of Engineering at the University. Birmingham engineers decided some time ago that a similarly named Chair should be installed in the University of their City, besides holding a Centenary Commemoration and erecting an international memorial to the three great pioneers, Watt, Boulton, and Murdock. The commemoration in Birmingham will take place on September 16th, 17th and 18th. London, Glasgow and Greenock, and, indeed, all parts of the country are heartily co-operating, and, with very few exceptions, the Universities and scientific societies, together with many manufacturers and individual eminent men, are associating themselves with the scheme. In the South Kensington Science Museum steps are being taken to arrange a comprehensive exhibition of Watt relics. In Birmingham the Watt relics, which have been preserved by the forethought of Mr. Geo. Tangye and a few years back were presented to the City, will be completely re-arranged and displayed, with many additions. Two pumping engines made by Boulton and Watt will be seen; one, the first sold by the makers in 1776, will be actually under steam and raising water.

A Memorial Service will be held in the Parish Church of Handsworth, where the three contemporaries are buried. A garden party will be held in the park at Heathfield Hall, where the garret workshop still remains as Watt left it. Lectures will be delivered by eminent men, and a centenary dinner will be held.

According to the *Times* a meeting convened by the Institution of Engineers and Shipbuilders in Scotland, held in Glasgow, has decided to raise a fund to commemorate the centenary of the death of James Watt by the further endowment of the engineering department of Glasgow University. Of the £50,000 required, about £6,000 is already subscribed.

Daylight Saving in U.S.—The House of Representatives has decided by 233 votes to 122 to repeal the Daylight Saving Law next October. The farmers object to the continuation of the law now that the war is over. The Senate has also voted by 56 votes to 6 in favour of the repeal of the Daylight Saving Law at the close of the present season.

Disabled Soldiers' and Sailors' Electrical Engineering Classes.—At the Royal Horticultural Society's Show, on Wednesday last, the Croydon Polytechnic had a number of exhibits of work done by disabled men, including wiring in casing; a complete "charging board," wired and fitted throughout, by a disabled man, for use in a country house or other installation for the owner to charge up motor-car or other batteries from his own electric lighting plant; a "Henley" joint-box, with a paper lead-covered and armoured cable led in and connections made between this and two V.I.R. tails; a specimen exercise in pipe bending; a piece of armoured cable, one end of which has been sealed with a lead cap, while the other end has a cable socket sweated on (the disablement of the man who executed this piece of work consists of amputation of two fingers and thumb on right hand, amputation of thumb on left hand and left eye removed); and test papers showing the practical character of the instruction given.

Fatality.—Whilst riding on the front of one of the Blackpool-Fleetwood tramcars, near Cleveleys, on the 18th inst., Frank Butterworth (44), an inspector in the employ of the company, was thrown from the car and seriously injured. He died two hours later.

Proposed Canadian I.E.E.—There is more than usual interest attaching, at the moment, to the question whether the electrical engineers in Canada shall form themselves into a Canadian Institute of Electrical Engineers, or whether they shall merge their identity in the organisation which until recently has been known as the Canadian Society of Civil Engineers, and is now called the Engineering Institute of Canada. According to the *Electrical News*, beyond the new name there is little evidence that the personnel of the Institute is different from that of the former Society, which view is borne out by the fact that a number of organisations have not looked upon the proposition of becoming part of the new Institute with favour, although the new name would indicate the intention that all branches of engineering should be included in one large comprehensive organisation.

Illuminating Engineering Society, U.S.A.—The election of the following officers of the Council for the fiscal year 1919-20 was confirmed by the Council on June 12th, 1919. These officers were elected to fill vacancies due to expiration of terms:—President: S. E. Doane. Vice-President: Wm. J. Clark. General Secretary: Clarence L. Law. Treasurer: L. B. Marks. Directors: E. C. Crittenden, F. E. Cady, R. B. Ely.

The E.T.U. and Disabled Men.—Mr. James Currie, Controller of Training, Ministry of Labour, gave evidence before the Select Committee of the House of Commons appointed to inquire into the working of the Pension Acts. He put in a list relating to Trade Advisory Committees, and, according to the *Daily Telegraph*, the statement regarding the electrical trade was as follows:—

"In certain branches of the electrical trade there was a fair opening for disabled men, but the Electrical Trades Union was extremely cautious in sanctioning the training of any considerable number."

The Electrical Development Association.—We understand that Mr. J. W. Beauchamp, director of the Electrical Development Association, has now commenced operations at Hampden House, 84, Kingsway, London, W.C. 2 (telephone: Holborn, 253), and will be glad to receive communications from readers associated with the housing schemes in connection with reconstruction. It is hoped in a few days to issue a preliminary pamphlet which has been prepared in connection with the work and objects of the Association.

The Conjoint Board of Scientific Societies.—The report of the Board for 1918 has just been issued. It states that the number of constituent societies is now 54; their contributions to the funds amounted to £190, and the expenditure to £520. With other items, there is a credit balance for the year of £27, and a sum of £47 is recoverable from the Ministry of Munitions. The Committee on the Application of Science to Agriculture, of which Sir John Snell has been appointed Acting-Convener, recommended the Board of Agriculture to grant funds for designing, constructing, and testing an electrical tractor and other agricultural machines; a deputation interviewed the Permanent Secretary, Sir Daniell Hall, on December 13th, 1917, and explained the Committee's views with regard to the application of engineering to operations on the land, and to the big electrical developments that were expected in the supply of motors for homestead purposes as well as on the land, but Sir Daniell Hall thought the time inopportune to deflect labour and material to the said purpose.

A report was submitted by Sir John Snell on an investigation made through Mr. Nugent Harris in the Bridlington district, with regard to a scheme for the supply of electrical power to the farms of a district containing 1,177 holdings.

The Watching Committee on Education has pointed out certain defects in the Report of the Commission on Civil Service Examinations, Class I, militating against the study of science, and has submitted a report on the scientific needs of the Civil Service.

The Metric System Committee has completed its report, which is under consideration.

The Iron Ore Committee has completed certain magnetic surveys, and finds that magnetic disturbances may be of use in determining the boundaries of ore fields, but are also caused by faults, &c., in other formations.

The Committee on the Water Power of the Empire has issued a report, which was abstracted in the ELECTRICAL REVIEW of August 16th and 23rd, 1918.

Inquiries.—Makers of fireclay bars for electric heating elements are asked for.

Appointments Vacant.—Director of research (£1,250) for the British Cotton Industry Research Association; electrical mechanic (£250 + £50) for the Government of Somaliland; jointer for the Borough of Bacup Electricity Department; electrical foreman (£323), chief draughtsman (£277), for the Royal Siamese State Railways: sub-station attendant (88s. 3d.) for the Hackney B.C. Electricity Department. See our advertisement pages to-day.

The Incorporated Municipal Electrical Association in Scotland.—At a meeting at Edinburgh, the constitution of the newly-formed Scottish Centre of the Incorporated Municipal Electrical Association was adjusted, and the following office bearers were appointed:—Chairman: Councillor Bruce Lindsay, Edinburgh. Vice-Chairman: Mr. W. W. Lackie, Glasgow. Hon. Secretary: Mr. D. Robertson, Depute Town Clerk, Edinburgh. Engineer Members of Committee: Messrs. Bell, Aberdeen; Hughes, Falkirk; Newington, Edinburgh; Smith, Paisley; and Richardson, Dundee. Municipal Members: Bailie Willock, Glasgow; Bailie M'Callum, Greenock; Bailie Coull, Leith; and Councillor Smith, Hamilton.

Qualities of Amorphous Carbon Electrodes. — The following values for the physical and chemical qualities of amorphous carbon electrodes are given by the *Mechanical World* from a German source: Specific weight, 1.5-1.55; specific resistance at cross sections of from 25 to 3,000 sq. cm., 45-100 ohms; electrical coefficient of temperature at from 25 to 900 deg. C., 0.000318; specific heat at 100 deg. C., 0.18-0.22; compressive strength, 230-410 kg. per sq. cm.; bending strength, 51-81 kg. per sq. cm.; heat extension from 0-700 deg., 0.26 per cent. of the initial value; heat conductivity for a cube of 1 cu. cm. at temperature falls from 130-20 deg. C., 0.24 heat units per hour; ash content, 2.5-3 per cent.; phosphorus, 0.45-0.53 per cent.; sulphur, 0.91-1.1 per cent.

The Association of Consulting Engineers.—The annual general meeting of this Association was held on May 30th, 1919, at Caxton Hall, Westminster, Mr. Frank Gill (chairman of the committee) presiding, who, in moving the adoption of the report of the committee for the year ended April 30th, 1919, mentioned the deaths of two members, Lieut. W. Llewellyn Preece and Mr. E. H. Stevenson. The report stated that during the year the work of the committee had been of a routine character. In September the Association was invited by the Institution of Electrical Engineers to nominate a representative to serve on a committee appointed by the Council of the Institution to consider and report on the "Report of the Board of Trade Electric Power Supply Committee," and the hon. secretary (Mr. A. H. Dykes) was selected to represent the Association. Subsequently a memorandum setting out the opinion of the Association was duly prepared and transmitted to the committee; a copy was afterwards sent to the President of the Board of Trade. During the year the British Standards Committee had on more than one occasion invited the Association to nominate some of its members to serve on panels. Mr. John May was nominated to a panel dealing with electrical power plugs and Mr. A. P. Trotter and Mr. A. H. Dykes to represent the Association at a joint conference of the Standards Committee and lamp makers on the grading and marking of metallic filament lamps. Recently the Association had been asked by the Board of Trade, Foreign Department, to assist the Government of India in selecting consulting engineers to advise on the utilisation of water power in that country. It had also asked for assistance relative to the position of consulting engineering work in Canada, and the Association had correspondence with the American and Swiss Associations of Consulting Engineers. With regard to the Institution of Electrical Engineers' agreement with the B.E.A.M.A. that the clause dealing with payments in the Institution's "Model Form of General Conditions" should be amended, the committee had informed the Institution that the Association had been unable to recommend its members to adopt these "General Conditions" and that this alteration was against the established practice of the majority of the members of the Association, particularly of the civil engineering members. The committee felt that a final reserve of 5 per cent. was insufficient and that the amount retained until the end of the maintenance period should continue to be 10 per cent.

The committee would be glad to have the views of members on this point before arriving at a final conclusion. Six new members had been elected, and it had been considered desirable to amend the official scale of fees on the time basis, those on the percentage basis remaining as before.

Mr. G. Midgley Taylor, in seconding the report, said that the increased recognition of the Association was a healthy sign, and he hoped that in the future they would elect all consulting engineers. After some discussion as to the revised scale of fees, the report was adopted unanimously.

The Threatened Electrical Lock-out: the Dispute Ended.—We have received the following official statement from Mr. Leonard G. Tate, general secretary of the National Federated Electrical Association:—

"I have been instructed to hand you the following statement:—

"*Subject.*—Dispute between the London Section of the National Federated Electrical Association and the London Section of the Electrical Trades Union, owing to the withdrawal of union labour from Messrs. Rashleigh, Phipps & Co., Oxford Street, thus leading to a threatened lockout of the members of the Electrical Trades Union in London. The committee appointed to investigate have reported as follows:—

"That in the opinion of the committee the position of Messrs. Rashleigh, Phipps & Co. in respect to the employment of union and non-union labour was seriously prejudiced by a letter written by them to the Electrical Trades Union dated July 3rd, 1914, as a result of which, acting on the advice of the committee, the members of the National Federated Electrical Association could not carry on the dispute on behalf of Messrs. Rashleigh, Phipps & Co., consequently the immediate difference between the National Federated Electrical Association and the Electrical Trades Union has for the moment disappeared."

Faraday House Dinner.—It was recently decided, in order to afford old Faradians from overseas an opportunity of meeting before returning home, to revive the activities of the Faraday House Old Students' Association, and accordingly the eleventh annual dinner was held at the Holborn Restaurant on Friday last, Col. Hubert C. Sparks, C.M.G., D.S.O., M.C., Croix de Guerre (avec Palme), president, in the chair. Several old Faradians who had come from abroad to take their part in the war were present, and the large attendance as well as the fact that this was the first dinner since 1914 afforded a unique opportunity of renewing old friendships, about 120 guests being present. The speeches were brief, and referred chiefly to Faraday House and its present and old students and their achievements, both as engineers and as members of H.M. Forces. During the dinner Miss Thenia Wrainch Walter's Harmonic Quartette played a selection of music, and after the toasts a musical entertainment was given by the following artists: Miss Gladys Vaile (comedienne), Mr. Lawrence Folker (baritone), Mr. Herbert Collings (conjurer), and Mr. Finlay Dunn (entertainer at the piano)

Transport Questions.—Meetings will be held at the Caxton Hall, Westminster, S.W. 1, on Monday, June 30th, at 8.30 p.m., to consider Mr. A. W. Gattie's "System of Cheap Transport," and on Monday, July 7th, at 8.30 p.m., to discuss the "Transport Bill and Housing Bill."

Sheffield and District Wireless Society.—A very enthusiastic meeting was held in the Council Room of the Sheffield Literary and Philosophical Society, on June 20th, when a permanently organised wireless society for Sheffield and the surrounding district was formed. Mr. H. E. Yerbury, M.Inst.C.E., M.I.E.E., who presided over the meeting, was elected as president for the ensuing year. It is proposed to secure premises in the centre of the city, if possible, where members may meet to read and discuss papers, and where eventually it is hoped, by arrangement with the Postmaster-General, to install an aerial and the necessary instruments for experimental work. The hon. secretary is Mr. L. H. Crowther, 156, Meadow Head, Norton Woodseats, to whom applications for membership should be sent.

Improvements in Electric Cables.—According to French Patent No. 487,577 of P. H. Chase, electric cables may be improved by winding around the insulating covering a strip of insulating material covered with a strip of metal with oblique slits cut in it. The slits are cut at such an angle that when the strip has been wound spirally round the cable the slits lie perpendicularly to the axis of the cable. This system reduces the dielectric losses and also the eddy current losses, and improves the thermic conductivity of the cable. Furthermore, the covering is an effective protection, and moderates the electrostatic strains.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station and Tramway Officials.—Halifax T.C. is recommended to grant increases of salary to Mr. W. M. Rogerson, electrical engineer, from £800 to £900; Mr. J. D. Caird, tramways traffic manager, £425 to £475; and Mr. J. W. Galloway, tramways engineer, from £375 to £425.

Mr. A. W. Sweetinburgh, assistant distribution engineer to Bury Corporation electricity department, is leaving after twelve years' service to take up a position as engineer representative with Messrs. Halwains, Ltd., Electrical Power Plant Specialists, of Bury.

General.—At the Woolwich works of Messrs. Siemens Brothers & Co., Ltd., on Tuesday last in the presence of a crowd of Mr. W. Cullum's fellow employés, Mr. Chauvin, the managing director, presented to him a jubilee gift of £50 in commemoration of his having completed 50 years' service with the firm. Mr. Chauvin mentioned that Mr. Cullum was the second of the same family to be such a recipient, his late brother three years ago having fulfilled a similar length of service. Mr. W. Cullum started as a boy in the line department, but was soon transferred to the cable department, where he witnessed the starting of the first two cable machines, and was engaged in various cable expeditions. Mention was made of many exciting escapes experienced by Mr. Cullum in the course of his duties. He was transferred to the lead cable shop on its inception, and has risen to the position of a foreman therein. On behalf of Mr. Cullum's fellow workmen Mr. Chauvin presented a testimonial in the form of a clock and umbrella and an envelope containing a sum of money for Mr. and Mrs. Cullum.

It is announced in the Press that Signor Marconi is to be one of the new Italian Delegation to the Paris Conference.

According to the *Times* the Council of the Institution of Mining Engineers decided to present the medals of the Institution this year to Dr. Auguste Rateau, of France, and to M. Watteyne, of Belgium, in recognition of their work in the interests of mining, and as a tribute to two of our Allies in the war. In their absence, the medals were presented by the president to Professor Louis on behalf of Dr. Rateau, and to Sir William Garford for M. Watteyne on Monday last.

Mr. A. Henderson has resigned the post of electrical manager of Messrs. Scotts' Shipbuilding and Engineering Co., Ltd., Greenock, to accept an appointment with the Thermotank Company, 55, West Regent Street, Glasgow. He is succeeded by Mr. E. T. Caparn, formerly assistant electrical manager to Messrs. John Brown & Co., Ltd., Clydebank.

Messrs. Murray Coombs & Richards have opened offices as advisory and inspecting engineers at 25, Victoria Street, S.W.1. Telephone: Victoria 5488.

Major G. A. Bruce, T.D., M.I.E.E., Tyne Electrical Engineers, has been restored to the establishment of the R.E. (Territorial Force) of which he was a supernumerary officer whilst employed with the R.E. during the war. He recently had the Territorial decoration conferred on him.

Lieutenant E. E. Walker, London Electrical Engineers, has been restored to the establishment of the R.E. (Territorial Force). Lieutenant Walker was commissioned in the corps in No. 4 Searchlight Company, London, in September, 1915, got his second star in April, 1916, and was seconded whilst employed with the R.E.

Lieutenant and Acting Captain A. M. Robertson, Renfrew Fortress Engineers, has relinquished the acting rank of captain on ceasing to be employed with effect from the 24th ult. He was commissioned in the Searchlight Company of the regiment in April, 1915, and subsequently given an acting captaincy whilst attached to a line unit.

Mr. James Settle, staff officer in the secretary's department at the General Post Office, is retiring at the end of June after 48 years' service.

Mr. R. Millett, who was recently engaged for some years with Messrs. Siemens Brothers Dynamo Works, Ltd., Manchester, has been appointed by the Electric Construction Co., Ltd., of Wolverhampton, as their sole Lancashire agent. Mr. Millett has opened offices at 30, Cross Street, Manchester. Telephone: No. 7772 City.

Mr. Donald Sinclair, A.M.I.E.E., for over 13 years resident engineer, General Electric Company (Glasgow branch), has been presented by the staff with a case of cutlery and a mahogany clock, &c., on the occasion of his marriage. The presentation was made by Mr. P. G. Sims, the manager.

According to the *Times* a marriage will shortly take place between Captain Vincent Ziani de Ferranti, eldest surviving son of Dr. Ferranti, and Dorothy, only child of Mr. and Mrs. Reginald P. Wilson.

Roll of Honour.—Sapper E. R. Sutton, R.E., who was previously with the Altrincham Electrical Supply Co., Ltd., has been awarded the Meritorions Service Medal for work in connection with the Third Army Signal Dumps.

Obituary.—We are pleased to learn from authoritative information that has now reached this country that the newspaper reports to which we referred last week were incorrect in so far as they related to any of the Messrs. Pirelli being on board the *Citta di Milano* at the time of the disaster. We, however, regret to learn that Commendatore Jona was lost. By the death of a gentleman of such high capabilities Messrs Pirelli have suffered a heavy loss.

The death has occurred at Ballybough, Dublin, of Mr. Joseph Dowdall, electrical engineer, a contractor to the Corporation. He was 52 years of age.

Will.—The late Dr. Henry Wilde, F.R.S., bequeathed his books, papers, and scientific instruments to Oxford University.

NEW COMPANIES REGISTERED.

R. B. Hand & Co., Ltd. (156,193).—Private company. Registered June 18th. Capital, £1,000 in £1 shares. Electrical and mechanical engineers, agents, factors, merchants, manufacturers, etc. The subscribers (each with one share) are: S. Grundy, The Datcha, Teddington, electrical engineer; R. B. Hand, 35, Kashgar Road, S.E.18, electircal engineer. The first directors are R. B. Hand and S. Grundy. Registered office: 63, High Holborn, W.C.

Vactite Wire Co. (1919), Ltd. (156,012).—Private company. Registered June 12th. Capital, £25,000 in £1 shares. To acquire the business of a manufacturer and supplier of accessories to the incandescent electric lamp industry carried on by a company of similar name at 20, Copthall Avenue, at Bollo Lane, Aston, and at Lower Walsall Street, Wolverhampton. The subscribers (each with one share) are: A. C. Hyde, Perivale Lodge, Perivale, W.13, electro chemist; Mabel J. L. Ferrar, 29, Eaton Park Road, Palmers Green, N.13, accountant's clerk; L. Beman, 20, Copthall Avenue, E.C.2; C.A. Solicitors: Smith, Goss, King & Gregory, 62, London Wall, W.C.

Anglo-Norwegian Electro Chemical & Finance Co., Ltd. (155,968).—Private company. Registered June 12th. Capital, £20,000 in £1 shares. To carry on the business as indicated by the title. The subscribers (each with one share) are: V. Vogt (Norwegian), Briarcourt, Hampton Hill, merchant; G. Christensen, 101, Leadenhall Street, E.C.3, merchant. Directors: V. Vogt, G. Hartmann, W. C. Eger and G. A. Jebson, all Norwegians, of 1, Bygdo Alli, Christiania. Registered office: 6, Great St. Helens, E.C.

Prideaux & Co., Ltd. (156,071).—Private company. Registered June 14th. Capital, £2,000 in £1 shares. To take over the business of gas and electric fittings manufacturers and brassfounders carried on at 7-8, Macdonald Street, Birmingham, as "Prideaux & Co.," and at Bracebridge Street, Birmingham as "Lea & Perrins." The subscribers (each with one share) are: T. Phillips, 7-8, Macdonald Street, Birmingham, fittings manufacturer; J. W. Lea, Bracebridge Street, Birmingham, fittings manufacturer. First directors: T. Phillips (permanent director and chairman) and J. W. Lea. Registered office: 107, Macdonald Street, Birmingham.

Suplyawl, Ltd. (156,109).—Private company. Registered June 16th. Capital, £3,000 in £1 shares. Electrical, hydraulic and mechanical engineers, metal workers, hardwaremen, shipowners, carriers, wharf, pier and dock owners, &c. The subscribers (each with one share) are: E. S. Thomas, 15, Wetherby Mansions, Earl's Court, S.W.5, merchant; G. M. I. Blackburne, 5, Margaret Street, Cavendish Square, W., merchant. First directors to be appointed by the subscribers. Registered office: Rooms 506-7, Bank Chambers, 329, Holborn, W.C.1.

Metal Industries, Ltd. (156,191).—Private company. Registered June 18th. Capital, £39,000 in 20,000 preference and 18,000 ordinary shares of £1 each and 10,000 deferred shares of 2s. each. Mechanical and electrical engineers, iron, brass and metal founders and workers, steel platers, metallurgists, &c. The subscribers are: B. Peters, 15, Dean Street, S.W.1; C. H. Dade, 17, The Avenue, Beckenham; J. E. Spagnoletti, 14, St. James's Place, S.W.; P. D. Ionides, 76, Piccadilly, W.; W. Stokes, 32, Victoria Street, S.W. The first directors are to be appointed by the subscribers. Qualification, £500 shares. Solicitor: S. Morse, 79, Queen Street, E.C.4. Registered office: Manchester Hotel, Aldersgate Street, E.C.1.

Feuerheerd's Motors, Ltd. (155,697).—Private company. Registered June 2nd. Capital £20,000 in £1 shares. To acquire an invention relating to improvements in turbines, rotary pumps, air compressors, and the like, and to adopt an agreement between E. Feuerheerd of the first part, C. F. Quack of the second part, and R. G. Layton (for this company) of the third part. The subscribers (each with 100 shares) are: P. Layton, 7, Tithebarn Street, Liverpool, cotton merchant; A. Greaves, Gorseinun, Dudley Road, New Brighton, timber agent. First directors: E. Feuerheerd, Walton, 50, Lower Oldfield Park, Bath, and C. F. Quack, 12, Hackins Hey, Liverpool. Solicitor: R. G. Layton, 9, Fenwick Street, Liverpool.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Rushmores, Ltd. (formerly Rushmore Lamps, Ltd.).—Satisfaction registered May 21st, 1919, of £2,500, part of amount registered December, 1917.

Alderley & Wilmslow Electric Supply, Ltd. (47,663).—Return dated May 13th, 1919. Capital, £30,000 in £1 shares (20,000 ordinary and 10,000 preference). 15,009 ordinary shares taken up. £15,009 paid. Mortgages and charges, £15,000.

Bromley (Kent) Electric Light & Power Co., Ltd. (54,127). Return dated April 28th, 1919. Capital, £100,000 in £5 shares. 15,000 shares taken up. £75,000 paid. Mortgages and charges, £64,063.

Mather & Platt, Ltd. (60,387).—Capital, £1,000,000 in 40,000 preference shares of £10 each and 600,000 ordinary shares of £1 each. Return dated March 14th, 1919. All shares taken up. £317,000 paid on 29,200 preference and 25,000 ordinary. £683,000 considered as paid on the remainder. Mortgages and charges, nil.

London Electric Warehouse Co., Ltd. (67,568).—Capital, £1,000 in £1 shares. Return dated December 31st, 1918 (filed June 4th, 1919). Eight shares issued. £10 paid, leaving £80 in arrears. Mortgages and charges, nil.

Midland Electric Wire Co., Ltd. (104,571).—Capital, £5,000 in £1 shares. Return dated April 14th, 1919. All shares taken up. £5,000 paid. Mortgages and charges, nil.

CITY NOTES.

Marconi International Marine Communication Co., Ltd.

Mr. Godfrey Isaacs presided at the annual meeting on June 20th. He said that Mr. Marconi had been called by his Government to Italy on important business. The profit for the year showed a slight reduction due to providing and training a large number of operators in a very short time. The number of stations installed and worked by the company at the end of the year was 2,549, and it stood now at 2,638. Taking into consideration the large number of ships that had been lost during the war, they had every reason to be satisfied with their position. They looked forward to the benefit of their telegraphic receipts of which they had been deprived during the last 4½ years. Having regard to the very much larger number of vessels now fitted with wireless telegraph stations, the great increase in costal stations, and, above all, the greater acquaintance which the world at large had now of wireless telegraphy, they had every reason to hope that their telegraph stations on board ships would be more freely used in the future than they were in the past. He would not prophesy what might be the development of wireless telegraphy upon ships as a result of the navigation of the air. They looked for an additional source of revenue to the more general use on board ships of the direction finder, which had now been so very materially improved that it gave promise of proving of considerable value to navigators. That, together with Mr. Marconi's latest invention, promised to be a great boon to navigation. This new discovery provided a means whereby a ship in the densest fog might discern the approach of another ship if fitted with the apparatus, and ascertain the distance. They were at present engaged in giving a commercial shape to the new apparatus, and as soon as possible its value on board ship would be demonstrated. The speaker went on to refer to the great services rendered by their operators during the war, and to the men who had lost their lives. The company now employed upwards of 5,000 wireless operators; a large number of inspectors in all parts of the world; and a very considerable clerical staff. They proposed to reserve for and issue from time to time in all 100,000 of the 300,000 unissued shares, to those employed in the company who desired to interest themselves in it.

United Electric Tramways of Montevideo, Ltd.

The report to March 31st, 1919, states that the tramway system operated with the following results during the year ended October, 1918: Gross receipts, $1,787,412, an increase of $96,195; operating expenses $1,386,244, an increase of $149,251; net receipts $401,168, a decrease of $53,054, which at exchange of $4.7 to the £ is £11,289. The passengers carried were 47,928,606, an increase of 3,045,086; car miles run 7,038,427, a decrease of 473,456. Percentage of operating expenses to gross receipts 77.56, an increase of 4.42. The gross traffic receipts continue to improve. Operating expenses, however, are still high, mainly due to the excessive cost of fuel and freights during the whole year. In consequence of these abnormal costs there is a decrease in net receipts of £11,289. The effect of all the economies made by the company has been more than counterbalanced by increases in expenditure due to causes beyond the company's control. The increased cost of fuel alone has exceeded the decrease in the net receipts. The cost of all materials for maintenance is still very high, and wages have increased in Monte Video as elsewhere. It is hoped, however, that a reduction of shipping freights during the current year may show a considerable improvement in the cost of fuel, which is the company's largest item of expenditure. The amount receivable from La Sociedad Commercial de Monte-Video in respect of revenue was £82.404. The profit and loss account for the year, after providing for administration expenses and charging £48,039 for debenture interest, shows a credit balance of £55,582. plus £13,296 brought forward. There is put to debenture redemption £4,461; to preference and ordinary share redemption, £2,500; to renewals and contingencies, £20,000; 6 per cent., less tax, on the cumulative preference shares, in satisfaction of arrears for the half year to September 30th, 1917, £11.250; carried forward, £10,669.

British Electric Traction Co., Ltd. The gross profit for the year ended March, 1919, was £250.214, against £237,906 for the previous year. After deducting the general expenses and the amount written off sundry assets, £36,890, £213,324 remains, plus £112,116 brought forward. Debenture stock interest is £90,449; there is put to reserve £21.486; 6 per cent. is paid on the cumualtive participating preference stock, 3 per cent. dividend is recommended on the ordinary stock, leaving £130,952 to be carried forward. The net profit shows an increase of £4,102. The aggregate receipts of the associated companies continue to show an increase, but it is to a great extent counterbalanced by the increased cost of operation, due in a large measure to the continued rise in wages. The associated companies are pursuing the policy of setting aside larger provisions for future repairs and maintenance. The reserve will now stand at £475,000. The investments now stand at £4,283,736, and they yielded a revenue of £217,863, representing an average of 5.08 per cent. for the past year on the amount at which they appear in the balance sheet, as compared with 4.93 per cent. for the preceding year.

With regard to fares, the Statutory Undertakings (Temporary Increase of Charges) Act was passed in August, 1918 The Act does not, however, authorise any increase of fares which would be more than sufficient to enable three-quarters of the pre-war rate of dividend to be paid by the operating Company

The Ministry of Ways and Communications Bill and the Electricity (Supply) Bill, if passed into law in their present form, may have a far-reaching effect on the interests of shareholders in tramway and electric supply undertakings. Efforts are being made by the representative Associations to obtain amendments, and the directors recommend shareholders to give the Bills their close attention.

Lancashire Power Construction Co., Ltd.—The report for the year ended March, 1919, shows that the trading profit of the Lancashire Electric Power Co. for 1918 was £48.014, plus £78 interest on hire-purchase plants, &c., making £48,092 compared with £42.031 for 1917. £5,721 was brought forward. Debenture interest absorbs £4,500; reserve fund £15,000; 6 per cent. dividend on shares, £30,000; carrying forward £4,313. The development of the Parliamentary company's business for two years is shown in the following:—

	1916	1917	1918
Units generated	40,842,652	43,744.919	49,181,893
Max load in KW.	11,900	13,300	11,000
H.P. connected . .	30,600	34,000	35,510
Receipts .. .	£97,964	£115,131	£136,745
Expenditure ..	£59.251	£73.583	£88,731
Profit on trading ..	£38,710	£41,518	£48.014

The revenue account of the Lancashire Electric Power Construction Co., Ltd., shows that the total interest, dividend, and other receipts for the year ended March, 1919, were £34,703. Debenture interest, trustees' fees, and general charges, £17,639; dividends 7 per cent., less tax, on the preference shares, and 6 per cent. on the ordinary, leaving £8,441 to be carried forward. In order to meet further capital requirements of the Parliamentary Co., an issue of 50,000 7 per cent. cumulative participating preference shares was made in December last.

Imperial Tramways Co., Ltd.—The gross receipts of the Middlesbrough, Stockton, and Thornaby Electric Tramways were £106.524, an increase of £23.736. Passengers carried 13,972,274, an increase of 753,127. Net profit of £18,966, against £16,540 for 1917. The substantial increase in traffic receipts has been almost wholly absorbed in additional expenditure for wages and materials. An agreement has been arrived at with the three Corporations (Middlesbrough, Stockton, and Thornaby) settling the procedure to be adopted for carrying out the transfer of the undertaking of the company within their respective boroughs. The report of the London and Suburban Traction Co., Ltd., intimating inability to recommend any preference dividend is referred to by the directors. The Imperial Co. holds 125,000 5 per cent. cumulative preference shares of £1 each and 122,120 ordinary of £1 each in that company. The available balance of the Imperial Co. is £23,917, and after payment of interest on the debenture stock, 6 per cent. on the preference shares, less tax, and 4 per cent. on the ordinary, less tax, £48 is carried forward.

Eastern Telegraph Co., Ltd.—Dividend at the rate of 3½ per cent. per annum, less tax, on the preference stock for the June quarter, and a quarterly interim dividend of 1¼ per cent. on the ordinary stock, free of tax.

Rangoon Electric Tramway & Supply Co., Ltd.—The report for 1918 states that the cars travelled 1,494,544 miles, a decrease of 63,112 miles, and carried 21.202,591 passengers, an increase of 5,468,389, or of 34.75 per cent. Total receipts Rs10,79,573, an increase or Rs1,67,427, or 18.35 per cent. The directors have arranged for a considerable extension of the present tramway system. In the private lighting and power department gross receipts for current supplied amounted to Rs9,71,733, an increase of 5.28 per cent. Gross receipts of the house wiring and supply department amounted to Rs1,24,527, the profit realised being Rs20,173, as compared with Rs19,778. A revised agreement with the Rangoon Municipal Committee for public lighting of the city and suburbs has been signed for twelve years on mutually favourable terms. The gross profits were £77,661, which added to transfer fees and interest on deposits and investments in London, £2,912, makes £80,573. Net profit £24,039. The directors recommend a dividend on the Ordinary shares of 5 per cent. for the year, free of income tax, carrying forward £4,447.

Shropshire, Worcestershire & Staffordshire Electric Power Co.—Mr. W. L. Madgen presided on Monday at the annual meeting. He said that the demand upon their power stations had fallen off considerably since the armistice. The varied industries had received plenty of orders, but remedies had not been found for the shortage of labour and raw material. The result was that for the first half of the year this company experienced a reduction of output, and the plant was not so fully occupied as it would be when the district returned to ordinary peace conditions. Under the new conditions that were developing, more and more electrically-driven machinery would become essential to the purposes of increased production. The speaker went on to refer to the Electricity Supply Bill, and the amendments which might be effected to make it a really practical and useful measure.

Adelaide Electric Supply Co., Ltd.—The "Financial Times" states that extraordinary general meetings will be held on July 1st to consider a resolution providing for the increase of capital to £1,000,000 by the creation of 250,000 shares of £1 each to be called "A" Preference shares, and to be entitled to a cumulative dividend of 5 per cent., free of British income tax. The shares will be repayable at par on a distribution of assets and on a winding up, and will rank *pari passu* (both in respect of dividend and on a distribution of assets) with the 6 per cent. cumulative preference shares, and be entitled to one vote in respect of each five shares.

J. G. White & Co., Ltd.—Net profit for the year ended February 28th, £17,292. The investment account has been reduced from £393.323 to £219,198 by the recent liquidation of certain securities on advantageous terms enabling loans to be repaid. Balance at credit of profit and loss (including £43,041 brought forward) £60,333. Preference dividend 6 per cent. for the year, less tax; 6 per cent., less tax, on the ordinary; £16,000 to reserve; carrying forward £33,333. Reserve fund £200,000, out of which £30,000 has been appropriated for bonus in preference shares.

Electro-Bleach & By-Products, Ltd.—The profit for 1918, after deducting repairs, standing charges, depreciation, deferred repairs, bonus to employés, directors' additional remuneration, and excess profits duty, was £24,498, plus £1,670 brought forward. After meeting debenture charges, paying 7 per cent. on the preference shares, and 12½ per cent. on the ordinary, £4,000 is put to reserve (making it £10,000), and £394 is to be carried forward. The Inland Revenue department has allowed the company to appropriate out of the revenue, £10,000 for deferred repairs.

Crompton & Co., Ltd.—The "Times" City column for June 21st says: "We understand that Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd., are now in negotiation for the acquisition of a substantial interest in the well-known electrical manufacturing firm of Crompton & Co., Ltd. From such information as is at present available, it seems probable that the terms may be communicated to shareholders in the latter company in about a week from now."

New General Traction Co., Ltd.—For the year ended March, 1919, the revenue was £17,697, and expenditure, including debenture interest and income tax, £8,028. Profit £9,668, plus £8,630 brought forward. Dividend 1 per cent (less income tax). Carry forward £7,818. A dividend of 2 per cent. was paid by the Norwich Electric Tramways Co. for the year ended June 30th, 1918. The Douglas Southern Electric Tramways system has remained closed down during the year, but it is hoped to reopen for traffic during this season.

Stock Exchange Notices.—The following are to be officially quoted:—

General Electric Co., Ltd.—46,500 ordinary shares of £10 each, fully paid (Nos. 57,501 to 90,000 and 106,001 to 120,000).

Siemens Brothers & Co., Ltd.—120,000 shares of £5 each, fully paid (Nos. 1 to 120,000); 80,000 shares of £5 each, fully paid (Nos. 120,001 to 200,000); and £500,000 4½ per cent. debenture stock.

Waygood-Otis, Ltd.—For the year ended March 31st the profit was £27,253; balance brought in, £17,405; £6,000 to reserve. According to the *Financier* the directors propose to pay 12 months' dividend on preference, which includes all arrears, and a dividend of 2½ per cent. on ordinary, leaving £3,405 forward.

Globe Telegraph & Trust Co., Ltd.—Net revenue for the year ended May 31st, 1919, after deducting expenses £227,421, plus £1,180 brought forward. £6,000 has been transferred to reserve for contingencies; 6 per cent., less tax, has been paid on the preference shares; 8 per cent., free of tax, on the ordinary; £1,629 is to be carried forward.

Victoria Falls & Transvaal Power Co.—Final dividend on the preference shares of 4 per cent., less tax (making 10 per cent.) for the year 1918; a dividend of 3 per cent., less tax, on account of the year ending December 31st, 1919; and a dividend on the ordinary shares of 5 per cent., less tax, in respect of 1918.

Montreal Light, Heat & Power Co.—Year ended April 30th: Surplus earnings, $1,042,890. Provision for depreciation amounts to $6,268,801, which will in due course be required for replacement of worn-out and obsolete plant. Regular quarterly dividends have been paid at the rate of 4 per cent. per annum.

Aluminium Corporation, Ltd.—The accounts for 1918 cannot yet be submitted as excess profits liabilities are not settled. They will be ready by the autumn, but the results of the year's trading are such as to justify the payment of the preference dividend for 1918.

Blackpool & Fleetwood Tramroad Co., Ltd.—A special meeting of shareholders will be held in Manchester on July 1st for their formal consent to be given to the transfer of the undertaking to the Blackpool Corporation.

W. & T. Avery, Ltd.—Final dividend of 10 per cent., making 15 per cent., less tax, for the year, on the ordinary shares.

India-Rubber, Gutta-Percha & Telegraph Works Co., Ltd.—Interim dividend of 2½ per cent., (5s. per share), free of tax, on ordinary shares.

Provincial Tramways Co.—Interim dividend of 8d. per share on the ordinary shares.

Coventry Chain Co., Ltd.—Interim dividend of 6 per cent. per annum on the ordinary shares.

Callender's Cable & Construction Co., Ltd.—Dividend of 12½ per cent., less tax, on the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

The German consent to sign the Peace Treaty has had little effect in the Stock Exchange markets. That the final result was assured, sooner or later, had been felt for some time past, and the twelfth hour wriggles of the enemy fell flat as a market factor. Nor has the Loan campaign entirely dried up the fount of ordinary business. New issues are permitted to appear, although an official hint is given as to their restriction. An interesting one is the offer of £200,000 in 10s. shares by the Metropolitan Railway Country Estates. Three properties, covering in all 627 acres, have been acquired in Hertfordshire and Middlesex, in the district served by the Metropolitan Railway and the Metropolitan Great Central Joint Line. The land is to be laid out to meet the requirements of all classes of residents, and we believe this is the first company of its kind that has been issued since the war. The Board is a good one, and the venture will appeal to a wide circle of speculative investors. It appears to have very fair prospects of success. Sound management will naturally form an essential part of the new company's success.

The Adelaide Electric Supply Company is taking powers to increase its capital to a million pounds sterling by the creation of 250,000 "A" cumulative preference shares of £1 each to be entitled to a 5 per cent. dividend free of British income tax. It is said that the underwriting commission is 3 per cent. Considering the financial strength of the company, a welcome to its new shares can be regarded as assured.

London Labour Party leaders deem very unsatisfactory the provisions of the Government's Electricity Supply Bill. They stamp the Bill as an incentive to "privateering." The authorities to be set up they—the London Labour Party Executive—declare to resemble on a national scale "the corrupt chaos of Boards and Commissioners for special services existing in London prior to the Metropolis Management Act of 1855." The statement lacks little of pungency and picturesqueness.

Immediately following this several of the companies themselves have circularised their shareholders with a memorandum which capitulates "the chief objections to the Bill, and they urge you," to quote the covering letter of the Kensington and Knightsbridge Electric Lighting Company, "to request your Parliamentary representative to support such amendments as will protect the existing rights and legitimate interests of shareholders."

In these circumstances it is not surprising that electricity supply shares should be dull and heavy. Westminsters have gone back sharply to 5½. County of London ordinary are obtainable at 9 11-16. Chelseas and Charing Cross have both given way. The manufacturing group is rather easier. Electric Constructions are 1-16 lower. British Westinghouse preference eased off to 2¾. Telegraph manufacturing issues keep up well. Callenders have gained 7s. 6d. British Aluminium at 35s. have improved.

British Electric Traction ordinary stock weakened to 44 on the appearance of the report. Net profits increased about £2,500 to nearly £123,000, and the dividend is maintained at 3 per cent. This rate has now been paid for the four successive years 1916-1919 since the capital account was reorganised in 1915. Some had hoped for 4 per cent. this time, and the slight disappointment caused the decline in the price of the stock. Underground Electric "A" shares are a shade lower at 10s. 3d., and the other issues are also easier. Metropolitan Railway Stock is better at 26½ in sympathy with a general advance in home railways, brought about, rather mysteriously, by the reports of the Coal Commission.

Cable issues are again somewhat easier on sales by holders who want to transfer into the new Loan. Eastern ordinary, Globes and other members of this group have come to market during the past few days. It is further suggested that the successful spanning of the Atlantic by the aeroplane is another reason why proprietors of cable stocks are deeming it wise to exchange into the new Loan. To-day (Tuesday) a harder tone supervened, and part of the previous decline was recovered. Marconis keep steady. Canadians have been up to 19s., but are now 18s. 3d. Marconi Marines at 3 7-16 are ⅛ below the recent best, and American Marconis went back a little to 30s. 9d.

Brazilian Tractions spurted to 62½, and held their rise. Mexicans are merely marking time. Rubber shares have recovered, on a rally of twopence, to 1s. 10¼d. per lb., in the raw produce. Armament issues are firmer, and the coal and iron division derived a little support from the reports of the Coal Commission. Bombay Electric ordinary has risen 5 points to 50. Madras Electric ordinary advanced to 16s. 6d., Rangoon Electric to 1⅛ and Calcuttas to 7¾.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend		Price June 24,		Yield
	1917.	1918.	1919.	Rise or fall.	p.c.
Home Electricity Companies					
Brompton Ordinary	10	8	6¾	—	£5 8 16
Charing Cross Ordinary	4	4	8	— ½	6 18 4
do. do. do. 4½ Pref.	4½	4½	8¼	—	6 18 4
Chelsea	5	8	6½	— ⅛	4 12 4
City of London	8	8	11⅞	—	8 14 6
do. do. 6 per cent. Pref.	8	8	10	—	6 0 0
County of London	7	7	9⅞	— ¼	7 1 9
do. do. 6 per cent. Pref.	8	6	10	—	6 0 0
Kensington Ordinary	7	8	5¾	—	5 4
London Electric	Nil	Nil	1⅜	—	Nil
do. do. 6 per cent. Pref.	5	8	8⅞	—	7 14 10
Metropolitan	4	6	8⅛	—	8 0 0
do. 4½ per cent. Pref.	4½	4½	8¼	—	6 18 8
St. James' and Pall Mall	9	10	7⅛	—	7 0 4
South London	5	5	2¾	—	7 5 6
South Metropolitan Pref.	7	7	20/6	—	6 18 7
Westminster Ordinary	9	8	5½	— ⅜	7 5 6
Telegraphs and Telephones.					
Anglo-Am. Tel. Pref.	6	6	98½	—1½	6 1 6
do. Def.	1½	33/6	22¼	—	7 8 0
Chile Telephone	8	8	7	—	5 14 4
Cuba Sub. Ord.	7	7	11	—	*6 4 5
Eastern Extension	8	8	16	— ⅛	*5 0 0
Eastern Tel. Ord.	8	8	161½	— ½	*4 19 1
Globe Tel. and T. Ord.	7	6	16	—	*5 0 0
do. do. Pref.	6	6	10¾	+ ⅛	6 11 7
Great Northern Tel.	22	22	82	—	6 17 6
Indo-European	13	13	55	—	5 18 2
Marconi	20	20	6¼	+ 1/16	3 4 0
Oriental Telephone Ord.	10	15	2 1/16	—	6 9 0
United R. Plate Tel.	8	8	6⅛	—	*4 18 8
West India and Panama	1/3	1/8	1 7/16	—	*4 6 4
Western Telegraph	6	8	17	—	*4 14 2
Home Rails.					
Central London Ord. Assented	4	4	63¾	—	6 6 0
Metropolitan	1	1¼	26½	+ ½	4 16 0
do. District	Nil	Nil	24⅛	—	Nil
Underground Electric Ordinary	Nil	Nil	8¾	— ⅛	Nil
do. do. "A"	Nil	Nil	10/3	—3d.	Nil
do. do. Income	4	5	95	— ½	*5 5 8
Foreign Trams, &c.					
Adelaide Sup. 6 per cent. Pref.	6	6	4¾	+ ⅛	6 6 4
Anglo-Arg. Trams. First Pref.	5½	Nil	3 3/16	+ 3/16	—
do. do. 2nd Pref.	—	—	3¼	—	—
do. do. 5 Deb.	5	5	68¾	—	7 6 5
Brazil Tractions	—	—	62½	+2½	—
Bombay Electric Pref.	6	6	11¾	—	5 11 7
British Columbia Elec. Rly. Pfce.	5	5	62½	—	7 18 6
do. do. Preferred	Nil	2½	49½	+1	5 8 1
do. do. Deferred	Nil	Nil	44½	—	Nil
do. do. Deb.	4½	4½	61½	—	6 17 10
Mexico Trams 5 per cent. Bonds	Nil	Nil	62½	—	Nil
do. 6 per cent. Bonds	Nil	Nil	50½	—	Nil
Mexican Light Common	Nil	Nil	87	—	Nil
do. Pref.	Nil	Nil	51	—	Nil
do. 1st Bonds	Nil	Nil	66	—1	—
Manufacturing Companies.					
Babcock & Wilcox	15	15	3 15/16	—	8 16 0
British Aluminium Ord.	10	10	1¾	+ 1/16	5 14 5
British Insulated Ord.	25	12½	2 1/16	—	5 11 1
British Westinghouse Pref.	7½	8	2¾	—	5 16 5
Callenders	25	25	10⅝	+ ⅜	5 17 8
do. 6½ Pref.	5	6½	5¼	+ ⅛	6 8 10
Castner-Kellner	25	20	2¾	— ½	7 5 6
Edison-Swan, "A"	—	—	1¼	—	6 0 0
do. do. 5 per cent. Deb.	4	5	75½	—	6 12 8
Electric Construction	10	10	1 3/16	— 1/16	8 8 5
Gen. Elec. Pref.	6	6½	10⅛	— ⅛	8 5 4
do. Ord.	10	10	22	+	*4 11 0
Henley	25	25	2½	—	5 2 6
do. 4½ Pref.	4½	4½	3¾	—	6 0 0
India-Rubber	10	10	17¾	—	*5 12 8
Siemens Ord.	—	10	6 15/16	—	*7 4 0
Telegraph Con	20	20	25½	—	4 18 6

*Dividends paid free of Income Tax.

TARIFFS ON IMPORTED MANUFACTURED GOODS.

By C. R. BELLING.

Some friends have suggested that I should explain my views a little more on the above question, having referred to it in our advertisements at different times.

The reasons why I am convinced that it is impossible for me to compete with the American manufacturers of heating and cooking appliances, unless we do have an import tariff, are as follows :—

1. At the present time the home American market for these appliances is the biggest market in the world. It is probably five times as big as the rest of the world put together.

This home market they keep entirely to themselves by imposing an import tariff of 65 per cent. on any foreign-made goods.

2. Owing to this big home demand, and to the knowledge that this home market is secure, the American is enabled to install plant to manufacture on a very large scale.

3. The fact of being able to manufacture in large quantities reduces his labour cost per article to a lower figure than could be reached in this country, notwithstanding that the labour rates in this country may be slightly lower than in America.

4. On top of this, however, the labour rates in this country have gone up to such an extent recently that they are now not far below the American.

5. American industry has received a tremendous impetus during the war, as she has been supplying practically all the world. Whilst we have been making war material, her factories have practically never been disorganised.

6. No question of better brains, better training, greater ingenuity, better methods of production, is necessarily involved.

That is, we should still be unable to compete with America, even if we produced an exact duplicate of an American article, both as regards appearance, efficiency, and finish, and produced it by exactly the same method of manufacture—*because* we shall never be in the position to produce the same large quantity, not having the same markets available to sell them in.

They have their own vast market, *plus* the rest of the world. We have the rest of the world only.

Hence my conclusion that it is obviously impossible for me to compete with the American, who is in a position to make far bigger quantities *and* at a lower labour cost each.

Result :—Unless we have a tariff on heating and cooking appliances, I shall have to close down, except on the heavier class of cast-iron articles.

But it is not just the fact of my being closed down that counts ; unfortunately, every skilled and relatively skilled trade is open to the same competition, owing to exactly the same facts and conditions—that is a protected home market giving the manufacturers a larger total market—reducing the labour cost per article, and, perhaps, most valuable of all, giving the manufacturer confidence.

This country before the war was undoubtedly losing all its high-class work, and importing this class of goods instead, paying for them in the main by goods produced by unskilled sweated labour, or by raw materials, or getting the goods on credit (which must be happening at the present time, our imports being about three times the value of our exports), or by services rendered which are always relatively unskilled, and therefore badly remunerated.

The question is whether it is good for this country for its skilled industries to be closed down, even if, temporarily, prices should be slightly higher for home-made goods ?

Of course, the Free Trader will immediately say, "Why should the consumer not be able to buy in the cheapest market ?"

This question opens up the whole and the broadest discussion of fiscal policy, on fundamental grounds.

Perhaps the broadest reply is : Why have America, Germany, and Japan, all tariff-walled countries, so rapidly built up new industries, gradually, but surely, forcing us to close them down here ?

This practically applies to all highly skilled trades. Take watches, typewriters, lenses, electrical ware, gloves, dye-stuffs, cutlery, automatic machinery, small tools, motor-cycles, motor-cars, tires, pianos, magnetos, and,—well the list is endless. Shipbuilding is, perhaps, the most recent industry attacked.

If we take it that goods are paid for by goods—which they must be ultimately—as credit or cash is merely the equivalent of a promise to pay in goods, it follows that all goods we import are eventually paid for by goods we export (or by service), and therefore they must be equal in exchange value.

The crucial point, and the point on which the well-being and prosperity of the nation depend—is the nature of the goods (or services) given in exchange.

If we give goods which require the labour of 100 men for a given time, in exchange for goods which have only taken the labour of 50 men the same time, we are the losers, because obviously with 100 men (such as we employed), the other country would have either time to spare for leisure, or to produce double the value of goods.

As an example, take the case of steel ingots, which mean mostly man handling. We export these and receive in exchange, say, finished needles. To send us the equivalent exchange value in needles demands the labour of far fewer, these being produced by skilled brain-work combined with automatic machinery.

Obviously the country making the needles has, at once, the advantage ; as, in addition to having a balance of needles over, they employ fewer men for an equivalent exchange value, and do not use up their irreplaceable raw material.

Hence, it will be seen that the most prosperous country is the one which skilfully produces the finished articles, and wastes least irreplaceable raw material.

Now, it must be obvious that the country adopting protective tariffs is able to determine and to foster the highly-skilled, highly-paid wealth-producing industries, and that country must, as a whole, be better off, wealthier, and its population able to live under more congenial conditions.

Now, to return to the Free Trader's original question —"Why should not the consumer be able to buy in the cheapest market ?"

The answer is that if the article in question is one which is made in a tariff-walled country, he is obviously still more strengthening the position of that country—in that he is increasing the production in that country, to the detriment of production in his own country, of the particular article he purchased ; and such article is invariably of the highly-skilled, high-wage paying class.

Now the value of currency has a definite relation to goods produced ; therefore, the more goods produced in any country, the greater the purchasing power of the unit of currency in that country.

This is why the tariff-walled country is strengthened by the increased production in its highly-paid trades, and how all classes of its community are benefited, and why their conditions of living are better.

The present value of the English sovereign is low because our production is low.

Our production in the highly-skilled, wealth-producing trades cannot be recovered or even maintained, whilst some nations adopt tariffs and we Free Trade.

To return once more to "buying the cheaper article." It is agreed that eventually any article brought from a foreign country has to be paid for in goods or service by this country ; but, as before explained, tariff-walled countries are enabled by their tariff to discriminate in the particular trades which they will foster, and they naturally choose the trades which make the biggest profits.

They thus eventually compel the Free Trade country to pay for the highly-skilled, highly-paid goods which they import into it, by taking in return raw materials—such as coal and iron (on which our future and very existence depends), or manufactured goods on which the lowest grade of unskilled labour is employed—or else manual service of some kind, also unskilled.

In time this means either the entire depopulation of the Free Trade country in question, or, at any rate, its degradation to the position of becoming general labourers, that is, doing the digging, mining, labouring, navvying, portering, carrying, and all the other hard demoralising unskilled work for the rest of the world.

All these unskilled trades mean low wages, unemployment, discontent, and probably revolution or Bolshevism.

Therefore, the man who buys the low-price foreign-made article is helping to eventually cut the ground away from under his own feet, or his son's feet, unless he is anxious to become a labourer or an unskilled man, instead of a highly-paid skilled artisan, like the workers in America, who now have their motor-cars.

The whole question can, of course, only be finally decided politically.

That is, the matter will have to go before the country—be fought out in the old way, the Free Traders voting for such M.P.'s as promise to support Free Trade, and the Tariff Reformers *vice versa*.

The biggest vote lies with the working classes. The catch phrase, "Your bread will cost you more" (coupled with the big funds behind Free Trade propaganda), has, up to the present, carried the day.

The first step necessary to alter the present fiscal policy of this country is to teach the working classes the true position; to carry out propaganda work amongst them, and to convince them that their present wages and future prosperity depend on increased production in the highly skilled, highly-paid trades, which can only be achieved by Tariff Reform.

Every manufacturer should tackle his own employés at once.

The next general election (very soon) will probably be settled wholely and solely on this issue.

Why not get ready for it?

It may appear that any efforts made by manufacturers to convert the policy of the country are selfish ones, but, on the other hand, what are the efforts of the Free Trade party but purely selfish and personal ones?

The Free Trade party, although the smallest actually, have just been the cleverest, and enlisted the vote of a larger body of workers in this country by their ("Your food will cost you more") propaganda, and thus carried the day.

Manufacturers must risk what motives are assigned to them, and must now take steps to protect their industries and those they employ, by acting individually in their efforts to convert, first of all, their own employés, and then combining in further efforts to convert the fiscal policy of the whole country—generally.

I would suggest that your columns should be opened out for discussion of both sides of the fiscal question, as far as the electrical industry is concerned.

THE TROUBLE MAN'S "TROUBLE."

By C. SYLVESTER, A.M.I.E.E.

I HAVE been a "trouble man" myself, and I understand to no small degree the difficulties with which they are beset.

Their trouble does not commence with travelling long railway journeys, or waiting for hours on railway station platforms, or tramping miles across country in the rain or snow. It commences when they are actually on the site of their "trouble," and it is usually not confined to *this* trouble alone.

I remember a case where a man was sent to a large power station to see to a newly-erected rotary converter; there was something wrong with the over-speed device. He had not been on the job an hour when the engineer-in-charge came along and inquired how long it would be before the machine was running. When the trouble man told him he did not know, the engineer immediately got on the 'phone to the works, and complained that the "trouble man" did not understand the job.

Now, this was hardly fair or reasonable: because it is almost impossible for anyone to locate even small troubles in an hour or so. As a general rule, the trouble men of leading electrical manufacturers are experts in their own particular class of work. A rotary converter trouble man is a rotary converter expert, and his firm would not think of sending him on a job, say, to look at the carbon packing rings of a Curtis turbine. Yet, as soon as he arrives upon a job where trouble exists he is expected to perform the proverbial "miracle."

Another case that I remember quite well, because I was connected with it, was where a trouble man was sent to see to the exciter of a 6,000-KW. turbo-generator. Here the exciter had been changed, and it was necessary to test it up to 25 per cent. overload for a certain period. To test this exciter it was not considered desirable to impress the exciter voltage across the rotor slip-rings, since to test the machine efficiently the load had to be more or less flexible—that is, from 25 per cent. of full load to 25 per cent. overload.

The only obvious thing to do was to obtain some wooden barrels or a wooden tank, use a solution of caustic soda, and with iron or steel plates to place the desired load on the machine.

In this case, the trouble man knew what to do, but could not very well do it, because when he requested the loan of two empty wooden oil barrels he was told they could not be spared. This meant that he had to roam about the town, where he eventually borrowed a suitable receptacle to hold his solution. It would not have mattered a great deal had the matter ended here. It did not. The station superintendent wrote a letter to the man's firm complaining of the delay, with the result that the man experienced "trouble" when he returned to the works.

That there is need for greater sympathy and co-operation between the engineer and the trouble man there is not the slightest doubt. If an engineer can assist the trouble man, then he should do so by hook or by crook. He should realise that the trouble man's object in life is to overcome difficulties. He should understand that the trouble man never meets the "satisfied" customers. He should give a little thought to the fact that when one commences to overcome difficulties it is not known what one may have to contend with. It is this, the trouble man's "unknown quantity," that makes him appear to be a nuisance to everyone. It is this that makes him scratch his head when he finds that he will have to borrow tools or material which he has not brought with him. Some trouble men would rather go into the street to buy a file or a roll of Blackley tape than ask for it at the power house store, where the storekeeper appears to have a continual grudge against "them contractors."

Even here the trouble man's "trouble" is not ended. On one occasion, I remember a man going outside the works to which he was sent to grind the commutator of an exciter. The reason he went out was to purchase a carborundum stick; the only tool that will efficiently grind a commutator on site. He had not left the power house five minutes when the station engineer telephoned to the man's firm and complained that "their man had arrived, but, after a look round, he had gone for a stroll down the street."

And so I could go on quoting cases where the trouble man meets trouble other than that which he sets out to meet. To a certain extent, however, the trouble men protect themselves against engineers who have a greater use for the pen than they have patience. Each firm's trouble men have a black list, and when they meet an engineer who is on their black list they mind their P's and Q's more than they would do if they met a more genial engineer.

I do not wish to create the impression that all engineers, power house or otherwise, are always on the track of the trouble man. This is not so. Every engineer desires to see his plant in as perfect a working condition as is possible. He does not wish to see any portion of his plant broken down, or waiting for, or under, repairs. When this happens, he is robbed, so to speak, of a certain amount of spare power. This he can ill afford to lose, especially at the times of peak load in the winter, when a large lighting load is being carried by the machines. It is only natural that he should be anxious, and it is probable that his anxiety, at times, overcomes his knowledge of the fact that the trouble man is doing his best.

I do not hold a brief for all trouble men, because they are not all as good and conscientious as they might be. An engineer has a perfect right to complain, and to have men removed from the works at once who show slackness.

It may be said, however, that trouble men are specially selected by their employers. In addition to ability they must possess tact. They must be able to turn a complaint into a compliment; they have the reputation of their firm at stake, and if they smooth the path between a dissatisfied customer and their employer they are rendering their firm a valuable service.

It is true that some trouble men make mistakes. They should not forget that they are not the only persons who understand the machine they have been sent to rectify. They are not sent to teach, but to rectify a defect. I think that if trouble men were to observe rules similar to those set out below, there would be a much better understanding between them and the engineer-in-charge :—

1. Report immediately upon arrival on site.
2. Never leave the job without leaving word where you are going to.
3. Give all the information you can concerning a defect, at the same time studying the manufacturer's interest.
4. Give all information willingly. Do not assume a mysterious attitude when conversing with the engineer concerning the behaviour or efficiency of a machine.
5. Always point out the good features of a machine, and never refer to defects which have developed in other machines. Defects make themselves known quite clearly when they develop.

On the other hand, the engineer should do all he can to assist the trouble man. He should place his workshop and stores at his disposal. He should lend him additional labour, if it is required. Every bit of assistance that the trouble man is given means that the job will be got running much quicker. Before making a complaint to the manufacturer, if the trouble man is on the spot, he should be consulted. Small mistakes and misunderstandings can be easily overcome by candid conversation. When an engineer goes on a job he should be pleasant. He should talk to the trouble man, and if he thinks the job is not being tackled correctly he should say so.

A complaining or dissatisfied customer is a liability with an ever increasing ability to do the manufacturer harm. A complimenting or pleased customer is an asset, the value of which is continually increasing. In order that any business may succeed, its assets must at least equal its liabilities. If a manufacturer does not liquidate his liabilities in the form of complaint and dissatisfied customers, he will soon go into bankruptcy. A customer who cheerfully admits that a defect has been tackled with skill and speed is no longer a liability. As a matter of fact, complaining customers can often be handled in such a way that they become good boosters—or, in other words, good assets.

A good many firms have as their motto—"The customer is always right." This is really the attitude which should be taken by every firm. It is an axiom, however, which should not be regarded lightly. It is the foundation on which complaints of any nature should be handled. Regardless of whether the manufacturer or customer thinks himself in the right, every complaint should be heard in full, and the matter concluded in such a manner that the customer is completely satisfied.

It sometimes happens that the customer himself is to blame for a defect. Even so, he must not be told this. It is something he can find out for himself if the complaint is handled properly.

No matter how or where the blame is placed, it must be remembered that the trouble man is the medium through which the defect is rectified, and both manufacturer and customer are satisfied. So let the engineer and trouble man work together in harmony, and the rectification of defects will become a pleasure on both sides, instead of a nuisance.

VACUUM-VALVE AMPLIFIERS.

The first important technical problem which the Army faced in expanding its wireless development work was that of obtaining suitable vacuum valves. The success with which this need was met may be judged from the fact that at the cessation of hostilities the production rate in America was in excess of 1,000,000 per year, and large reserve stocks had been accumulated.

In recent issues of the *Electrical World* interesting articles recited briefly the story of this remarkable war-time development. In July, 1917, the valves marketed in the States were too unstable, critical, non-uniform, and required careful adjustment for successful operation. The U.S. Signal Corps, therefore, decided to develop two types, one suitable for receiving and the other for transmitting, so balanced in their adaptabilities that they would serve, either separately or in combination, for any uses contemplated. All apparatus was to be designed to employ one or both of the standard types. The receiving valve had to operate as a detector of damped oscillations, as an oscillating detector of continuous oscillations by the heterodyne method, and as an amplifier of telephonic—and telegraphic—frequency alternating currents. The power valve had to be an efficient oscillator for the production of wireless-frequency A.C. power, and serve as a modulator of such power for wireless telephony. Furthermore, adjustments of both types had to be reduced to the absolute minimum.

Specifically, the valves must show uniform operation over ranges of 20 per cent. variation of filament and plate voltages, since no rheostats or potentiometers were to be allowed, and the valves must automatically adjust themselves over the range of voltage (initial to discharge) impressed by the fixed storage and dry batteries or dynamotors used in the circuits. This requirement was a radical departure from ordinary practice. All valves were to possess a high degree of electrical and mechanical ruggedness, a reasonably long useful life, and also to have and retain a high vacuum.

The ideal condition desired was that it should be practicable to replace any valve operating in any set by any other valve of the same type without affecting the operation or requiring any readjustment of the set. The first type of U.S. Signal Corps amplifier built, and the one used most successfully and in the largest quantities, was entirely devoid of adjustments of any kind. A box contained the transformers, wiring, dry battery units and valves, and was provided on the outside with two binding posts for direct connecting to a 4-volt storage battery, with two binding posts for the input current to be amplified, and a jack for the insertion of the plug of the standard telephone head-set. There were no knobs, switches, or rheostats whatever. With power valves the conditions are more severe, and in some cases a filament rheostat has been used. However, this is only to compensate for gradual battery voltage drop due to discharge and the frequency of its adjustment is measured in hours. The receiving valve which was finally adopted by the U.S. Signal Corps was the coated-filament type VT-1, illustrated in figs. 1 A and B, developed and manufactured by the Western Electric Co. As shown, the corrugated plates, punched from sheet steel, form a cylinder at the bottom which fits tightly around the glass stem. At the top they join again, and are clamped about a small square plinth of special insulating material. The grid, also punched from sheet steel, is supported at the bottom by the lead-in wires, and at the top by bracing wires embedded in the plinth. The V-shaped filament of twisted platinum strip coated with thermionically-active compounds is held taut by an insulated spring support at the top. Thus the whole structure is rigidly tied together and clamped tightly to the stem. The base consists of a metal shell with a phenol-fibre diaphragm at the bottom which carries the connecting studs. In assembly the base is fitted over the bottom of the tube, the leads are soldered to the contact studs, and the whole is inverted and poured full of insulating wax. The ends of the contact studs are capped with a non-corroding alloy, as are also the faces of the connecting springs in the sockets. This ensures dependable contact under all climatic conditions.

The normal filament current of this valve is 1.1 amp. The filament circuit requires a 4-volt storage battery, while the plate circuit operates from a 15-cell dry battery unit. When provided with the proper input transformer the average valve will give a power amplification of 200, *i.e.*, a two-stage amplifier composed of two of the valves in cascade will give out 40,000 times the A.C. power fed to its input terminals. The average life of the valve is in excess of 500 hours. The ordinary characteristic curves of the VT-1 are given in fig. 2. Several excellent valves of the tungsten-filament type were developed to the same specifications and standards as the VT-1, but none of these combined the necessary features. Some of them excelled in certain respects, but were deficient in other important respects.

The development of power valves proceeded more slowly than that of receiving valves, and the difficulties to be overcome were greater. The valve finally adopted for U.S. Signal Corps use was a coated-filament type developed and manufactured by the Western Electric Co., known as type VT-2, illustrated in fig. 1c, and its characteristic curves are given in fig. 3. The normal filament supply is 1.36 amp. at 7 volts. The plate voltage is normally between 250 and 350 volts. The normal high-frequency power output is 3 watts, but over 5 watts may be obtained without exceeding the safe limit of operation. While its output-input ratio as an amplifier is

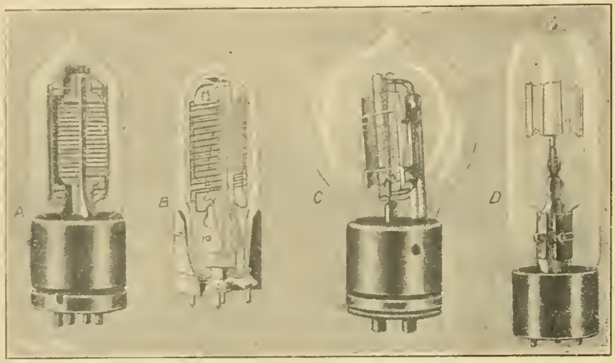


FIG. 1.—U.S. SIGNAL CORPS VACUUM VALVES.

not much greater than that of the VT-1, it is capable of handling considerably more power, and has thus been used. One or two types of tungsten-filament valves were developed along with the VT-2, but although they possessed desirable characteristics, they were not able to maintain the same standard of performance and efficiency.

These are by no means looked upon as the final solution of the problem, and other very promising lines of development are under way.

Two main improvements are required in the receiving valve—a considerable decrease in the power necessary to heat the filament so that storage-battery equipment can be reduced, and a decrease in the electrostatic capacity which will improve operation as a radio-frequency amplifier, particularly for short waves. The VT-3 valve which has been developed and manufactured on an experimental basis by the Western Electric Co. has these two improvements in view. Its filament requires only 0.2 amp. at 2 volts. The filament power input is thus less than 0.5 watt, as compared with 4 watts for the VT-1.

The possibilities of the tungsten-filament tube when designed to use the larger filament input and higher plate voltage to which it is inherently better suited are illustrated by the VT-5 type (fig. 1D), developed by the General Electric Co. (U.S.A.). It requires a filament current of 6.5 am. at 10 volts and operates at a plate potential of 700 volts to 800 volts, is capable of giving an output of 30 watts high-frequency power, and its characteristics make it well suited to use as a modulator. Its characteristic curves are given in fig. 4. The valve is considerably more powerful than is required for the average equipment, but for certain higher-power equipment gives more satisfactory results than the combination of several low-power tubes in parallel.

The "Type P" "Pliotron" made by the General Electric Co. is a vacuum tube capable of producing 100 watts of high-frequency power. It takes a filament current of 3.5 amp. at 25 volts; approximately 0.2 amp. at 1,500 volts is required by the plate. The valve is rather expensive, and as now constructed is fragile. Nevertheless, from the electrical standpoint it is fairly reliable, and a limited use has been made of it. Valves have been constructed similar in form to the type P, which can successfully deliver a quarter kilowatt of high-frequency power. Such tubes usually require 2,000 volts or 3,000 volts potential on the plate electrode.

Preliminary to the standardisation of the valves themselves a standard design of base and socket was made. The four-contact bayonet type was selected, and the bases for receiving and transmitting tubes were made identical except for the angular position of the locking pin. In the bottom of each socket was placed an insulating shield pierced by four holes, which allowed the base contact studs to project through and touch the contact springs beneath. This shield and the angularly displaced locking pins precluded the possibility of a valve being placed in the socket improperly or in the wrong socket.

Aside from measuring instruments and storage batteries, a testing set consists of three parts—the amplifier test set, the detector test set, and the oscillator test set. In the amplifier test set the valve to be tested amplifies an 800-cycle alternating current. A double-throw switch allows of cutting the telephone head-set into either the input or the output side of the valve. The output side is provided with a variable shunt of the constant impedance type. The shunt is adjusted until the shunted output gives a signal of the same loudness as the direct input. The reading of the shunt is then a measure of the power amplification given by the valve. In order to pass inspection a valve must give more than a certain ratio of power output to power input. For the VT-1 type this ratio is 121. In the detector test set the valve is compared as a detector of modulated radio-frequency oscillations with a calibrated standard valve, and must show equivalent or better signal response. In the oscillator test set the valve is connected to a standard circuit, in which it must cause continuous oscillations if it is to be passed as a satisfactory oscillator. The tests are carried out at two filament and plate voltages corresponding respectively to the upper and lower variation limits of these factors under severe conditions.

The sets are conveniently arranged so that other necessary measurements can be made in connection with those mentioned. The resistance of the filament circuit is measured, and must fall within certain specified limits so that the tubes will operate properly in series or in parallel without losing their interchangeability. The plate current is measured and is held to a certain maximum limit, so as to reduce the drain on the small dry battery which in service supplies the current. A measurement of grid current is made under conditions such that it is indicative of the amount of gas in the tube, which must be within a limiting value. A determination of the insulation resistance between the various electrodes is made, and the limit of this resistance is specified.

The sockets in the testing sets are ground accurately to size, and form automatic limit gauges which indicate defective valve bases as inserted for test. A careful visual inspection for bent electrodes, broken welds, cracked glass, loose or broken contact studs, and similar defects is carried out. In the amplifier test the valve is jarred to detect noise due to excessive vibration of electrodes or any tendency of adjacent electrodes to strike together and short-circuit. A certain percentage selected at random are forwarded to the National Bureau of Standards for life and mechanically destructive tests.

For power valves the requirements of mechanical perfection were the same as for receiving valves. Similarly, equivalent tests for gas, insulation resistance, ruggedness, life, and filament resistance were applied. Tests for operation as oscillators were made in a standard circuit. Specified power outputs were required for varying conditions of filament and plate voltage. An overload test was made in which the valve was operated a short time at excessive input. A test was applied which caused the rejection of valves unsuitable for operation as modulators.

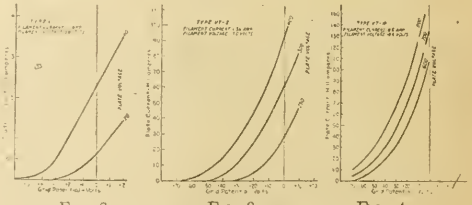


FIG. 2. FIG. 3. FIG. 4.

CHARACTERISTIC CURVES OF VALVES.

Two other evacuated valve devices have been classed with vacuum valves in their development. These are the regulator valve and the ballast lamp. The former consists of a hot cathode and single, cold anode, similar in general arrangement to the Fleming valve rectifier. The latter is merely an iron-wire filament normally operating near its recalescence temperature, and maintained in a low-pressure hydrogen atmosphere. These two tubes are used in the aeroplane wireless telephone set for automatically regulating the voltage of the fan-driven generator.

An interesting article in the *Journal of Electricity* deals with the manufacture of vacuum valves as carried out in a San Francisco factory under the supervision of Capt. R. W. Brewer, of the British Army, who has taken an important part in the development of vacuum valves.

The British Service has used wireless telephone sets for more than two and a half years past, and the vacuum valves in connection therewith have been worked out to a degree of nicety by engineers in England. They are based on the invention of Mr. O. B. Moorhead, of San Francisco, who holds an American patent for the cylindrical anode. The Moorhead valve, in addition to having the cylindrical anode, has a spiral grid and a central filament, making a completely concentric arrangement so that the distance between each of the elements is the same in all directions.

In the modern device great care and ingenuity are displayed in eliminating all traces of gases from the inside of the valve, and a most severe test is imposed to ensure that there shall be no blue glow when a high voltage is impressed on the anode and a specified dissipation is taking place inside the valve.

Not the least interesting feature of the Moorhead valve is the mechanical construction thereof, it being the only valve which is not truly hand-made. Valves are being produced which are absolutely uniform and mechanically sound.

The bulbs in the rough must first have their stems shortened to the required length and be tubulated for pumping. The tubulating is performed in a machine having two heads, one of which fuses the glass where the pip is formed, this being blown out by a small internal air pressure. In the meantime the tube is heated under another gas flame, and the bulb is transferred to the carrier holding the tube, and the two parts are fused together. It is then taken to a head having a ring of flames which play upon the stem, the surplus metal falls by gravity and the end of the stem is blown out and broken off, thus leaving a bell mouth for sealing in the elements. Two machines are employed for sealing the element support wires into their stems, each machine having four heads, and two more machines each with four heads seal the completed elements into the bulbs. After each sealing-in process the glass members are immediately placed in rotary annealers to eliminate cracking. After inspection the valves then pass to the pumps for evacuation; each oven for pumping is fitted with a Langmuir mercury-vapour pump, and holds 50 valves at once. The degree of vacuum requisite to ensure a reasonable length of life is far in excess of anything that has previously been attained commercially. The rate of pumping exceeds 1,000 valves a day, with only about half the ovens in operation. Some of the machines which have been produced to ensure uniformity and accuracy in the manufacture of the elements deserve particular attention.

The tungsten filament, which is of exceedingly fine diameter, must be very accurate in respect to its electrical resistance, and it also has to withstand a considerable degree of overload in testing. The tungsten wire is first crimped in a motor-driven rolling mill, long lengths of wire being treated at one time. After the supporting wires have been sealed into their glass stem they are cut off to exact length in a combined machine; the first operation of the lever shears off the surplus metal, the stem is then placed in another position, and a small hook is formed in the short wire which supports the lower end of the filament. The end of the hook forms the locating point for future operations.

The grid consists of a spiral coil which is wound in two-foot lengths from a spool of nickel wire. Each gird is cut off to exact length, and is welded to its supporting wire in exact place by an electric spot welder. The anode cylinders are first stamped out from nickel strips and rolled into form in a specially constructed mill having three power-driven rollers; they are then welded on to the supporting angle piece by an electric spot welder.

This system of spot welding has required a great deal of care in attaining its present state of perfection, as the work has to be done most accurately, and the shapes and sizes of the material worked upon are very awkward.

After these elements have been centralised, the top supporting wire for the filament is placed under a drop hammer which flattens it at the bend, and gives it the necessary amount of spring to take up the expansion of the tungsten filament when heated. To fix the filament to the supporting wires it is riveted in place in a machine with two heads, which gauges off the exact length of filament every time. The surplus metal is cut away by hand.

The valve bases are cemented in place on a machine which is motor-driven and has six double heads. In the first carrier the valve is brought opposite a gas jet which dries out the cement while the valve itself rotates, and upon touching a trigger the head rotates through half a revolution, and the valve is brought opposite to an air stream which cools it down.

The remarkable uniformity of the product is evidence of the perfection of this system of manufacture.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "G.E.C. "Buoy" Hand-lamp.

Recognising that some of the electric hand lamps which have been put on the market in the past have lacked certain qualities which make for convenience and long life, the General Electric Co., Ltd., Queen Victoria Street, London, E.C. 4, has developed a new hand lamp for industrial purposes which is known as the G.E.C. "Buoy" hand lamp, and has been very thoroughly tried and tested. It is illustrated in fig. 1. The base, of black insulating material, weighs approximately 1¾ lb. The guard is of strong tinned steel wire of light weight; the base, owing to its curvature and weight, will keep the lamp upright, however it is first placed. It will stand also on a gently sloping surface, and can be used without any greater care than is commonly accorded material by unskilled labour in heavy industrial work. It is very compact, measuring only 8½ in. long by 4½ in. diameter, is provided with both a side and top hook, is easily grasped, and as it can be hung or stood anywhere *both hands are left free.* It complies with the Home Office regulations with regard to hand lamps for use in factories, and will be found invaluable in all industrial situations.

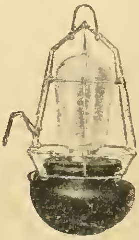


Fig. 1.—G.E.C. "Buoy" Hand Lamp.

Colliery Transformers.

A new type of colliery transformer, for use actually in the pit, has been designed by the British Westinghouse E. and M. Co., Ltd., of Trafford Park, Manchester, and recently placed upon the market. The illustration, fig. 2, shows a typical 3-phase, 50 periods, 300-K.V.A., 2,200/500-volt colliery transformer recently installed. The type generally has been developed with a low overall height, making it suitable for passage in the pit. It is mounted on wheels fitted to run on any gauge of track to be encountered in mining work. The underframe is constructed to act as a buffer from either end to protect the cooling tubes from possible damage, and is so designed as to permit of couplings being attached at each end. Mechanical robustness and safety from risk of explosion and fire have been the primary factors in design. The tanks are of boiler iron fitted with external tubes to give the requisite cooling surface, and the cable terminals, &c., are constructed so that no soldering need be done in the pit. Trifurcating or bifurcating boxes for armoured cables are fitted; these comply with the Home Office regulations for fiery mines. So far this type of colliery transformer has been made up to 300 K.V.A., 3,300 volts, at 50 periods, 3 phase

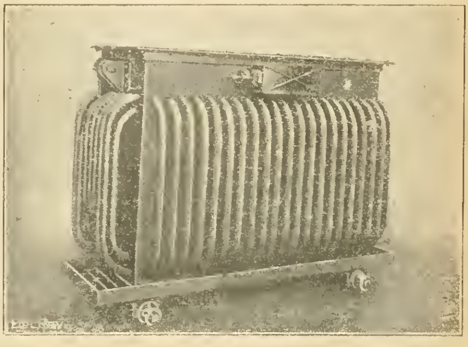


Fig 2.—Westinghouse Colliery Transformer

ORWELL ELECTRIC VEHICLES.

On the occasion of the visit of the Incorporated Municipal Electrical Association to Ipswich last week, the electric vehicle department of the Orwell Works of Messrs. Ransomes, Sims and Jefferies, Ltd., was thrown open to inspection. The works was founded in 1789 to manufacture the ploughs for which the firm is famed, and now employs over 3,500 men in shops covering 30 acres. The products of the works include railway material, agricultural machinery and portable engines, lawn mowers, and, during the war, enormous quantities of munitions of very diversified character. New shops covering 2½ acres were erected for building aeroplanes, and on the cessation of hostilities the electric vehicle department, which was inaugurated during the war, was transferred to these shops, which will be devoted entirely to the manufacture of Orwell electric vehicles. It is interesting to note that the company has built self-propelled vehicles since 1842, and claims the credit of being the first British manufacturing firm to place battery-propelled commercial vehicles on the market.

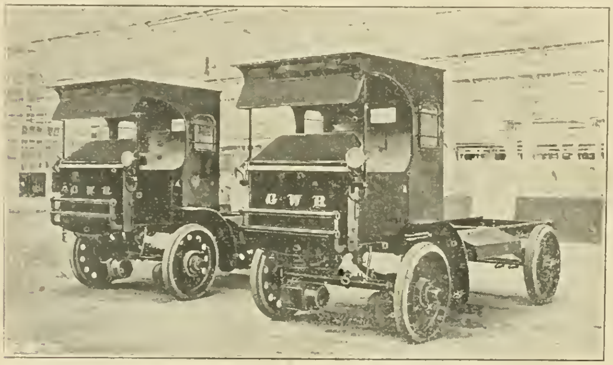


Fig. 1.—Orwell 2½-Ton Vehicles.

We have on previous occasions published particulars of Orwell vehicles; they are fitted with "Ironclad Exide" batteries, for which a service of 25,000 miles is claimed without dismantling the battery for repairs, and are driven by two motors on each vehicle, thus dispensing with mechanical differential gear and the usual transmission. For 2½ tons capacity the vehicles have a front-wheel drive, the motor pinion meshing with an internal gear attached to the wheel; a 3½-ton size is made, with a rear-wheel drive, and several types of industrial trucks are also manufactured, carrying 3 000 lb each.

The electric vehicle department is well-equipped with all kinds of machine tools, including drills, combination and capstan lathes, milling and grinding machines, and helical gear-cutting machines, which are all electrically driven; gauges and jigs are made on the premises, and all components are inspected at various stages of manufacture to ensure their interchangeability and quality. Physical, chemical, and microscopic tests are applied to all the materials used, in a laboratory well supplied with up-to-date apparatus. The order of manufacture is controlled by a Progress Department, and the system of manufacture is highly organised to facilitate assembly. Heavy forgings, castings, and woodwork for the electric vehicles are produced in the adjoining engineering workshops and foundry.

Figs. 1 and 2 show respectively two 2½-ton trucks which form part of a fleet of four supplied to the Great Western Railway, and a 2-ton tipping wagon supplied to the City of Edinburgh for refuse collection; both types are fitted with the firm's patent two-motor front-wheel drive, and the tipping wagon is operated by an independent electric motor. The Orwell vehicles are designed on the Mossay system; two batteries are used, slung under the chassis, the controller is fixed under the driver's seat and is actuated by a pedal and lever, the standard charging socket of the E V C. is provided, and two independent expanding brakes act on each of the rear wheels. The frame consists of pressed steel girders, and the wheels are of wrought-steel with cast-steel hubs.

The visitors were impressed by the excellence of the workmanship and the substantial construction of these vehicles, which, combined with the simplicity characteristic of electric propulsion, go far to explain the comparative immunity of the vehicles from the need for repairs over long periods.

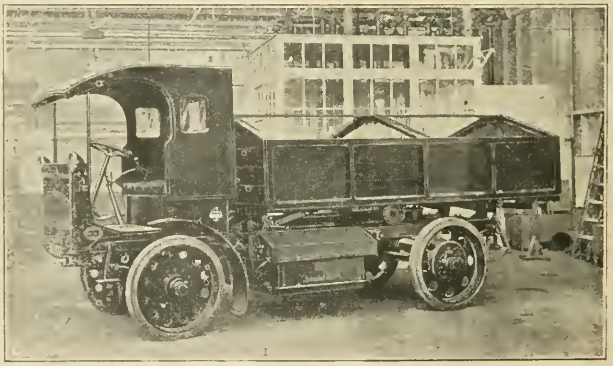


Fig. 2.—Orwell 2-Ton Tipping Wagon.

LEGAL.

Braulik *v.* Davis.

In the City of London Court, on June 20th, before his Honour Judge Atherley-Jones, K.C., an action was brought by Mr. George Braulik, electrical fittings manufacturer, 8, Lambeth Hill, E.C., against Mr. J. Davis, traveller in electrical fittings, Hornsey, to recover £38 13s. 6d., moneys collected from his customers. Defendant counter-claimed £34 6s. 4d. for commission due to him, the claim being practically admitted. Mr. Cairns appeared for the plaintiff and Mr. H. H. Trusted for the defendant.

Mr. Cairns said that the defendant was engaged as the plaintiff's traveller in 1915 when all the plaintiff's travellers—four or five in number—had gone to the war. Defendant had paid himself the commission in dispute by collecting accounts from plaintiff's customers. He had paid £4 into Court, to balance the claim and counter-claim. Plaintiff engaged another traveller named Rodda to deal with the Northern counties of England, and had paid him the commission for which the defendant was now counter-claiming. Defendant was engaged to travel the whole of England as far as he could. He had at start £2 a week and 5s. expenses while travelling in London, and when in the country the expenses were increased. Defendant also had a commission of 2½ per cent. on approved orders accepted and executed by the plaintiff. The terms to customers were that cash was to be paid on or before delivery. In December, 1916, defendant gave a month's notice to leave the plaintiff's employment. Then, in January, 1917, he was re-engaged as the London and country representative. Plaintiff was anxious that defendant should visit all customers at least three times a year. Plaintiff wrote in October, 1917, and told the defendant that a man named Rodda, who lived in Manchester, was to see him with a view to becoming a traveller for the plaintiff. Defendant was told to see Rodda, which he did. On November 3rd, 1917, defendant saw Rodda and engaged him to take over Ireland, Scotland, and the North of England, Rodda saying that he had a connection in the electrical trade. Rodda worked Lancashire and Yorkshire and the Northern Counties. Defendant said that Yorkshire and Lancashire were not northern counties, but the plaintiff maintained that they were. Defendant claimed to be entitled to travel in Yorkshire and Lancashire to the exclusion of Rodda

Judge Atherley-Jones did not know that Lancashire and Yorkshire were northern counties. The northern counties used to apply to Westmoreland, Cumberland, Northumberland, and Durham.

Mr. Cairns, continuing, said that the defendant sent a circular to the plaintiff's customers telling them not to have anything more to do with Rodda, who was travelling for the plaintiff. In spite of that fact, the defendant was now claiming commission for the business which came in during the six weeks after he ceased to act for the plaintiff. The defendant wrote to the plaintiff's customers urging them not to give orders to Rodda, and adding that "it was the old story of the scrap of paper." One customer wrote and said that Braulik was always doing the same sort of thing, and that he never bought of Braulik what he could get anywhere else. The Yorkshire Electrical Wiring Co., of Sheffield, promised to send the defendant their orders direct. The defendant had since given an undertaking not to circularise plaintiff's customers, because it was a distinct breach of the agreement. Defendant was now asking for commission for orders which had come from customers whom he had never interviewed. It was impudence on the defendant's part to say "give me commission on orders which I have not been able to intercept," for that was what he was doing. It was impossible for one man to cover the whole of England and Ireland and Scotland, as defendant seemed to think he was entitled to do. Plaintiff had never given him, since Rodda was appointed, the exclusive right to the whole of the country. Surely the plaintiff could employ as many travellers as he liked. No electrical business or any other could grow properly if one man were allowed to represent it over the whole country. Furthermore, it would be against public policy. When a Continental company employed a man as sole agent he, in his turn, employed sub-agents in this country. For a firm to be told that they must employ one traveller was absurd. All the customers involved were the plaintiff's old customers, and not new ones brought in by the defendant.

Judge ATHERLEY-JONES said that would certainly make a great difference.

Mr. CAIRNS further said defendant was claiming commission for orders obtained in Scotland, although he had never been there. He was claiming to be entitled to commission on orders taken by Rodda.

Mr. GEORGE BRAULIK, the plaintiff, was called, and said he had never promised the defendant commission on orders taken in Scotland and Ireland. The defendant was not entitled to an over-riding commission in any sense, Rodda was employed to extend the business, and defendant was directed to engage him, which he did. But the idea of both of them being entitled to commission was absurd. He had paid Rodda commission for the orders he had taken, and now defendant was demanding commission as well. He always treated defendant liberally. On one occasion he paid the defendant a sum for commission to which he was not entitled, but he gave it him as a bonus to end squabbling which ensued. It was untrue that he had trouble with other travellers.

Mr. DAVIS, the defendant, said his relationship with the plaintiff was very difficult, speaking generally. He entered his service in 1909 and left him, but returned in 1915. Generally speaking, he had done very good business for the plaintiff. He was to have an over-riding commission for Scotland and Ireland to the same amount that Rodda had. Plaintiff told him to insert an advertisement in the ELECTRICAL REVIEW which he did, and so got into communication with Rodda, whom he engaged. Plaintiff was to have nothing to do with Rodda, who was to work entirely under witness's jurisdiction. It was distinctly understood that he was to have a commission on all business which Rodda did. That was absolutely definite.

Defendant further said that he did not fix the remuneration for Rodda, as that was determined by Braulik. He had no recollection of receiving a letter of October 31st, and he would almost swear that he had not had it.

Judge ATHERLEY-JONES thought after the defendant's reply of November 3rd to the letter of October 31st it was scarcely worth pursuing the matter. In commission claims one always endeavoured to be as liberal as possible in one's interpretation of contract in favour of the man who had rendered service. That seemed to him to be a very wholesome rule for a Court to observe, and no doubt in a very large proportion of cases the agent who served in return for commission was very much at the mercy of the principal. A principal having got perhaps a connection from an agent who had entered into an improvident contract then discharged the agent from his service, and reaped the fruit of, perhaps, many years' labour in aggregating or in piling up a goodwill. But that was not the present case. The defendant's function was merely that of visiting plaintiff's customers who had belonged to the plaintiff and obtaining orders from them. The defendant had not presented any case which was worthy of consideration, and he found judgment for the plaintiff for £36 19s. 10d. on the claim and counterclaim.

BATTERY MAKERS FINED.

AT Ashton-under-Lyne County Police Court, last week, Messrs. Oldham & Sons, electric accumulator lamp manufacturers, of Denton, were summoned for failing to comply with the regulations governing works engaged in the manufacture of electric accumulators, by not having at least 500 cubic feet of air space for each person engaged in the casting room, and for not providing one lavatory basin for every five persons employed.

Mr. D. WALMSLEY, H.M. Inspector of Factories, said that the defendants manufactured electric accumulator lamps used in collieries and on ships. Some time ago they commenced to make electric accumulators themselves, and they were charged with overcrowding the casting shop, and having insufficient washing-bowl accommodation for the whole of the works. It was very necessary that the regulations should be carried out, in order to prevent the men getting lead poisoning.

Mr. W. F. CHAMBERS, for the defendants, submitted it was a purely technical offence. The business had been carried on for half a century, and during the whole of that period there had never been a complaint against the firm for contravening any Act. The firm had not committed the offences wittingly. Owing to the war, the heads of the firm had been working at a great strain, and Mr. Oldham, the head of the firm, and one of his sons, had broken down. The firm had been called upon to manufacture a large number of accumulators; they had extensive contracts with the Navy and with different collieries in Yorkshire. They had been compelled to manufacture the accumulators themselves, with the result that although the premises had been much extended they proved to be somewhat inadequate. The firm had endeavoured manfully to complete its contracts, and in one case if the goods had not been delivered within a certain time there would have been a strike at a colliery which would have involved 5,000 men. Mr. Chambers submitted the firm had been endeavouring to benefit the nation by supplying the articles which prevented a strike.

The magistrates imposed a fine of £5 5s. in each case.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Working Speeds in Radio-Telegraphy.

My words in your issue of the 6th inst., and referred to by Mr. Godfrey C. Isaacs in the ELECTRICAL REVIEW of June 20th as having appeared "under the heading of 'Working Speeds in Radio-Telegraphy'" were headed by me "An Appeal for Information."

You, Sir, doubtless with the best of motives, but to my regret, altered my title.

I would not venture to write on radio-telegraphic commercial working speeds in up-to-date long-distance practice—a subject outside my present personal experience and knowledge.

It was only in view of the apparently conflicting nature of the statements quoted by me (ELEC. REV., June 6th) that I made "an appeal for information." This information Mr. Godfrey C. Isaacs, managing director of Marconi's Wireless Telegraph Co., Ltd., has kindly vouchsafed in your current issue, under the form of an interesting explanation of Madrid-London wireless working conditions.

Among my most cherished souvenirs is a radio-telegram over eleven years ago—by an old friend and oft-time shipmate—sent to me at Wimbledon from Montreal, Canada, and received by me "*via* Marconi," with a total delay of 15½ hours; not a bad performance in those days considering the landline connections, &c.

Years ago there were rumours that a goodly proportion of "wireless" traffic really passed over the cables. Personally, the writer kept an open mind. Mr. Godfrey Isaacs's recently reported statements, however, have caused me to fear that my souvenir Marconigram of eleven years ago, after all, may have pulsed through an Atlantic cable. He has informed us that "the wireless traffic has grown beyond the company's capacity to handle. They had to advise customers that they could not accept traffic, and they had to cable thousands of words which could not be handled by wireless."

In this case, therefore, wireless conditions seem to have increased congestion of the cables. It is pleasant, however, to read, in Mr. Isaacs's ELECTRICAL REVIEW letter, that, in the Madrid-London instance, the "wireless service" has greatly relieved the congestion of the cables.

Finally, one must not forget that Mr. Godfrey Isaacs has said his contention all along has been that the wireless does not take away from the cable traffic, but creates additional traffic by offering lower rates.

E. Raymond-Barker.

London, *June 23rd*, 1919.

[Our choice of titles for correspondence is guided solely by the consideration that the title should indicate, as clearly as possible in brief, the subject of the letter, a condition which we think was fulfilled in this case; an "appeal for information" conveys no information to the reader, but the word "radio-telegraphy" at once attracts the attention of anyone interested in that subject—Mr. Godfrey Isaacs, for instance. Mr. Raymond-Barker's present letter was headed "Radio-Telegraphs"; that would have served very well in the first instance, but if the title were now changed the letters would probably be indexed under separate headings. In the body of the first letter it was clearly stated that the letter was "an open and sincere appeal for exact information," which was duly forthcoming.—EDS. ELEC. REV.]

Resettlement.

During the past week I had a visit from a member of the E.T.U. He came to ask what he should do, when he got his demobilisation through, about finding a job. I, bearing in mind all that has been said about resettlement, finding jobs for our "Boys," and making England a "fit place for heroes" to live in, advised him to visit his former employers, who would no doubt be able to fix him up. This he did. But with what result? Sad to say not the expected result. Oh yes, they were quite prepared to fix him up, but at what a wage? £1 18s. per week—this to a man 27 years of age.

Now, who do you think were the philanthropic people who were prepared to pay such a princely sum? Hold your breath . . . Messrs. ——— & Co., of London.* When it is pointed out that the district rate for an assistant is now about £3 11s. 6d., it is quite easy to see how generous (?) these people are. No wonder the discharged man is saying: What did I fight for, and who? A word before closing to "H. A. Harding," a correspondent in this week's issue, he draws, I think, the only conclusion possible from the case he quotes *re* the grants. That is, that the E.T.U. is *the* organisation for the electrical worker. In closing I would ask him to seriously consider the position before going so far as to assist in yet another Association being formed; I think he will agree that the main trouble at the moment in the industrial world is that there are by far too many Associations, each trying to score a point one against the other, with what result we can all see. My advice is: take the E.P.E.A. and the E.T.U., put one against the other, judge for yourself which is *the* one, then join that one. Remember inside you can do a lot, but outside your hands are tied.

Robert J. Thompson, Local Secretary, E.T.U.

Walthamstow, *June 23rd*, 1917.

[* Without inquiry, we think it inadvisable to give the name.—Eds. Elec. Rev.]

A Colossal Blunder.

If attention has not already been drawn to the following extract, it may prove of interest to your readers, as illustrating how even so reliable a publication as the "Encyclopædia Britannica" may occasionally give somewhat misleading information. The "howler" referred to is to be found in the American reprint of the 9th edition (published *circa* 1895), Vol. XVII., Addenda, under the heading "Motors, Electric." As the newspapers say, "comment is superfluous":—

". . . Many people fail to understand how it is that an electric motor furnishes power. . . . The principle of the motor's operation is the application of the current through the wires or brushes to the commutator, which may be termed the axle of the motor. This commutator is made up of a great number of sheets of brass, spreading out radially and separated by insulating material. These commutator bars cause the alternating currents produced in the armature to flow in the same direction externally, on what may be unscientifically called the "hub." A repellant action is produced between these commutator bars and the brushes, an action similar to that of the magnetic needle. This repellant action of the current from the brushes produces a pushing result on the commutator (or axle), and causes it to turn around rapidly, in connection with an armature mounted between large field magnets. This rotation is directly applied by means of a belt or the like to the machinery. Where motors are applied to street cars . . . the motor (or motors) is usually placed beneath the car, while resistance-boxes, by means of which the motor-man controls it, are on either platform, and are operated by handles, much after the manner of a brake."

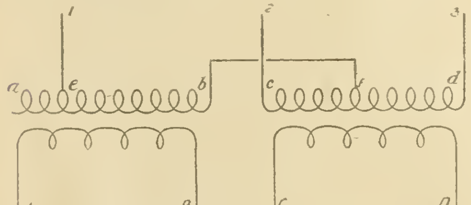
F. A. Swann, A.C.G.I., B.Sc., D.I.C.

London, S.E., *June 20th*, 1919.

Scott-connected Transformers.

Referring to the note on p. 731 of your last issue, Scott connections if properly made, and if great care is taken during balancing will operate most successfully. I have had considerable experience during my research on electrothermal chemistry in the conversion of three-phase to two-phase currents. I found I could get a very good balance, and the temperature rise in either of the transformers was nothing much to observe; however, I noticed the temperature rise highest in transformer *ab*.

I found the best load to operate at was 90 per cent. of the full rated load of the combined transformers. The following are my connections:



a b c d are the high-tension windings, and A B C D the low-tension windings of two equal transformers giving the desired voltage ratio between the three-phase supply 1, 2, 3, and the two-phase currents to be produced. The transformer *a b* has a tap *e*, so that *e b* is 87 per cent. of *a b*, assuming that *f* is a tap at the middle of the H.T. windings. When the connections are made as above A B, C D, will have a phase difference of one-quarter period, and be of equal voltage. It is sometimes convenient to use transformers single phase with the 87 per cent. tap *e*. The above very seldom goes out of balance, and the temperature remains constant if 90 per cent. load is taken from it.

J. D. Doyle, B.Sc., B.Eng., *Professor.*

Ballybrach, co. Dublin, *June 21st*, 1919.

NEW PATENTS APPLIED FOR, 1918.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs Sefton-Jones, O'Dell and Stephens (successors to W. P. Thompson & Co., of London), Chartered Patent Agents, 285, High Holborn, London, W.C. 1

14,578. "Methods of determining directions of signals in wireless telegraphy." J. G. Stewart. June 10th.

14,598. "Electro-therapeutic appliances." A. H. Hewitt. June 10th.

14,600. "Signalling apparatus." J. Goodyear & W. A. Goodyear. June 10th.

14,608. "Shade carriers for electric lampholders." V. Hope. June 10th.

14,614. "Electric lampholders." V. Hope. June 10th.

14,617. "Combined motor and dynamo with dual field control for starting and lighting sets for automobiles." F. J. Hawkins. June 10th.

14,618. "Electric switch-device for securing railway-carriage doors." L. Coleman. June 10th.

14,632. "Switches for automatic and semi-automatic telephone systems." L. C. Bygrave. June 10th.

14,635. "Automatic and semi-automatic telephone systems." L. C. Bygrave. June 10th.

14,668. "Dynamo electric machines and means for controlling operation thereof." L. J. Stevenson. June 10th. (U.S.A., June 20th, 1918.)

14,675. "Electric insulators." F. W. Le Tall. (Westinghouse Electric and Manufacturing Co.) June 10th.

14,678. "Sparking-plugs for internal-combustion engines." L. Morel. June 10th. (France, June 10th, 1918.)

14,680. "Electric switches." R. L. Murray & Telephone Manufacturing Co. June 10th.

14,682-3. "Apparatus for transforming electrical energy." J. E. Calverley & W. E. Highfield. June 10th.

14,684. "Electrical engine-starting device." S. T. Henn & Rushmores, Ltd. June 10th.

14,707. "Ignition and lighting current generators for internal-combustion engines." R. L. Aspden. June 11th.

14,731. "Device for locking steering-gear and switching off electric current from magnetos of motor cars, boats, aeroplanes, &c." G. Cummuskey. June 11th.

14,732. "Electric theft or burglar alarm apparatus, &c." W. L. Ellis. June 11th.

14,734. "Junction boxes for electrical conduits." A. W. Sclater. June 11th.

14,757. "Electric circuit connecting devices." J. Glasson. June 11th.

14,758. "Oscillating-apparatus for submarine signalling, &c." Submarine Signal Co. June 11th.

14,760. "Electric insulators." H. Lutz. June 11th.

14,761. "Suspension insulators." H. Lutz. June 11th.

14,762. "Container for secondary cells." E. G. Lind. June 11th.

14,776. "Electrically heated laundry irons." F. Angell & H. Angell. June 11th.

14,782. "Means for preventing manipulation of electric motor-vehicles." H. Crochat. June 11th.

14,790-17,791. Magneto-electric machines." C. Olivetti. June 11th.

14,792. "Distributors for ignition apparatus." C. Olivetti. June 11th.

14,797. "Signalling devices." H. Ashworth, J. J. Ashworth & R. R. Ashworth. June 12th.

14,808. "Interlocking-devices for combined tumbler switches and sockets." J. H. Collie. June 12th.

14,809. "Fixing frame for securing electric meters switches, fuses, &c., to walls, &c." E. A. Welch. June 12th.

14,818. "Sparking-plugs for internal-combustion engines." J. S. Foley. June 12th.

14,825. "Aerial systems for wireless telegraphy." C. T. Wilkinson. June 12th.

14,842. "Rotary rectifier of alternating current. A. D. Macropoulos (Macropulos). June 12th.

14,877. "Process for production of plates and sheets by electro-deposition." S. O. Cowper-Coles. June 12th.

14,879. "Electric furnaces." E. P. Barfield & L. W. Wild. June 12th.

14,909. "Trolley heads for overhead wire systems of electric traction." Brecknell, Munro & Rogers & A. M. Willis. June 13th.

14,913. "Methods of converting supply of direct current from one voltage to another." Automatic Telephone Manufacturing Co. June 13th.

14,919. "Air-cooled sparking plugs." L. Pineschi. June 13th.

14,934. "Holders, contacts and sockets for wireless or vacuum tubes." W. J. Polyblank. June 13th.

14,940. "Magnetic or electromagnetic measuring, indicating, recording, &c., apparatus." L. R. Gleason. June 13th.

14,941. "Sparking plugs." A. Watkins. June 13th.

14,948. "Electric switches." R. P. Myers. June 13th.

14,956. "Safety device or belt trap for electric lighting of trams." W. Wood (Wood). June 13th.

14,963. "Distributors for ignition systems of internal-combustion engines." D. A. V. Rist. June 13th.

14,991-2. "Automatic telephone system." Relay Automatic Telephone Manufacturing Co. & F. M. Ward. June 13th.

14,993. "Automatic telephone systems." B. B. Johnson & Relay Automatic Telephone Manufacturing Co. June 13th

14,994. "Receivers of wireless signals." E. E. Frankis. June 13th

15,036. "Electric, &c., change letter signs." J. S. Powell & R. V. Willesford. June 14th.

15,047. "Induction coils." F. Weatherill. June 14th.

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The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1916.

2,598. Devices for coupling circuits in wireless telegraphy and telephony so as to produce oscillations having a strictly single frequency. E. Bellini. February 21st, 1916. (126,978.)

1917.

1,460. Wireless telephony.—Soc. Francaise Radio-Electrique. February 15th, 1916. (127,008.)

2,591. Electric driving gear particularly for motor cars. E. Crochat. December 15th, 1916. (Patent of addition not granted. (127,012.)

2,656. Receiving apparatus for wireless telegraphy. L. N. Brilluoin & G. A. Beauvais. March 27th, 1916. (127,103.)

2,657. Telephone installations particularly for wireless telegraphy. L. N. Birlluoin & C. A. Beauvais. November 7th, 1916. (127,014.)

4,083. Processes of producing metallised brushes for electric machines. Compagnie Générale Electrique. May 27th, 1910. (127,030.)

4,288. Apparatus for the electric driving of ships such as submarines. E. C. R. Marks. (Volta Soc. Anon.) March 24th, 1917. (127,042.)

19,368. Grinding and other machines having magnetic work-holders. W. Alter. December 31st, 1917. (127,061.)

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